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Front Cover

The photograph is that of a female Green Turtle,
Chelonia mydas.

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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

In looking over the *Quarterly's* in volume 36, I observed that most of the articles, notes and photo essays concerned the general subject matter of biology or geology. This is as it should be since generally the creation/evolution controversy centers about those disciplines.

Therefore let us consider the coverage of these areas in this *Quarterly*. First I note the geology offerings. Peter Klevberg finishes his series on sequence stratigraphy discussing the usefulness of the technique for the Flood model. His series should be compared with other articles by creationists on this topic. Carl Froede examines a location of fossil trees in Tennessee. He compares the uniformitarian model of deposition within a prograding delta with that of a higher energy environment of deposition during the Flood. Hurricane Danny, in 1997, caused catastrophic damage to Dauphin Island, Alabama. Froede catalogues the geologic effects and details the evidence within the context of a Flood model. Particularly, he comments on possible rapid canyon formation during catastrophic events. I had the pleasure of writing a brief photo essay on a beautiful location in Arizona. I compare the granitic pluton being described to one in Georgia (Panola Mountain), previously noted in the *Quarterly*, from a creationist viewpoint.

Changing the subject to consider the biological material contained in this *Quarterly*, our feature article is an introduction to baraminology by Wayne Frair. This rapidly-developing creationist discipline may be somewhat of a puzzle to you since there has been the introduction of many terms possibly unfamiliar to you. Carefully reading

Dr. Frair's introductory explanation should help in understanding the subject matter. Those of you who enjoy the work of classifying living organisms should follow baraminology studies carefully, and this article is a good starting point. Jerry Bergman follows the rise and fall of Haeckel's biogenetic law. This is one of the not-too-proud examples of fraud perpetrated in science to aid in the acceptance of the theory of evolution. Unfortunately some educators still employ Haeckel's fraudulent drawings as "proof" of recapitulation. Wayne Frair recently wrote on this subject for the *Quarterly* also. These articles by both creationists show the willingness of some life scientists to continually misrepresent the case for macroevolution. If you appreciate electron microscopy as I do, you will enjoy the lengthy photo essay on parasitism. The microscopy is fantastic! Mark Armitage and the late Dick Lumsden did a great job on the subject matter. The title, Parasitism by Design, is intriguing. Why would parasitism be a product of design? I hope we will receive more papers from Armitage on this challenging topic. Two letters by Colin Brown on biological subjects may interest you.

Likewise it is my hope that you will find the book and field trip reports interesting. I would appreciate your comments on any of the subject matter. Detailed exchanges on various topics generally offer salient points not covered in position papers. I look forward to hearing from you.

Emmett L. Williams
Editor

Book Review

Biblical Weather by Alfred F. Davies

Essence Publishing, Belleville, Ontario, Canada. 1999, 388 pages, \$18.

Meteorologist Davies is retired from a career in aviation weather forecasting in eastern Canada. He also has a continuing pastoral ministry. The book condenses Davies' lifetime of weather experience, and could serve as a class text. There is a unique continual interaction with Biblical references. Davies takes practically every Bible verse which mentions clouds, precipitation, wind, etc. and then ex-

plains the weather context. Also included is a thorough discussion of Holy Land geography. The book concludes with a bibliography, subject index, and glossary.

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Invited Paper

Baraminology—Classification of Created Organisms

Wayne Frair*

Abstract

For decades creationists have been using the word “kind,” “type,” or “group” for their envisioned categories of genetically unrelated organisms including all those formed by the Creator during Creation Week. Within each of these categories the various species, subspecies, and varieties were conceived to have diversified from common ancestral stock. However, until recent years there has not been a serious comprehensive methodology of classification

focusing on characterizing each original category, which is separated by genetic gaps from all other categories. Now baraminology (with discontinuity systematics) has developed into a fruitful approach to classification within the creation model. Terminology and methodology have been developed, and the first scientific baraminology conference was held in the summer of 1999. An aggressive future program is envisaged.

Introduction

Basic human attributes include classification and identification. People do these so constantly that the practices are essential to our way of living. Individuals have learned the classification of thoughts and things, and as they interact with their environments they persistently identify cognitions as smells, sights (sky, food, animal, plant, etc.), sounds (honk of horn, bark of dog, music, etc.), savors (sweet, sour, etc.), and other sensations such as rough and smooth. The complexity of all this is astounding.

Interestingly, the Bible includes an account of God’s bringing to Adam all the terrestrial animals and birds (Genesis 2:19) so that Adam could observe and name them. This story may have a deeper significance than a cursory reading would reveal. In the process of naming the creatures Adam learned something about himself. He realized his capacity to perceive and to discover patterns. Some critters wore scales and others hair or feathers.

In addition, Adam would learn something about God—the Designer. There in the creation was an expression of the Lord’s handiwork. After Adam discovered nature he never would be the same again. The stars, the animals, the plants—all were part of God’s creation. The stage now was set, and subsequently billions of science students would play their part upon the stage of life and

during that time sense the excitement of discovering God’s message in nature (Psalm 19:1; Romans 1:19,20; and see ReMine, 1993).

Taxonomy and Systematics

Pondering these matters makes it easier for us to realize the basic importance of classification in biological studies of extinct and extant forms of life. *Taxonomy* is the term used for the science of classifying living things according to their natural groupings. Essentially, scientists of today utilize a taxonomic system introduced by the Swedish botanist, Linnaeus, about 250 years ago.

However, there are different approaches used by scientists for studying patterns of life and for classification. These are called *systems* of taxonomy and they lie under the general heading of *systematics*. For studies of nature’s patterns ReMine (1993, p. 444) has compared the diverse procedures to the functions of different types of film (infrared, ultraviolet, and x-ray film). For example there is *phyletic* or evolutionary systematics (or Darwinian systematics) in which macroevolution (involving large changes) is assumed. See Figure 1.

Systematic schemes which place less stress upon evolution may be termed *phenetic* because they are based upon appearances of features of the organisms and not necessarily their possible large scale evolutionary relationships.

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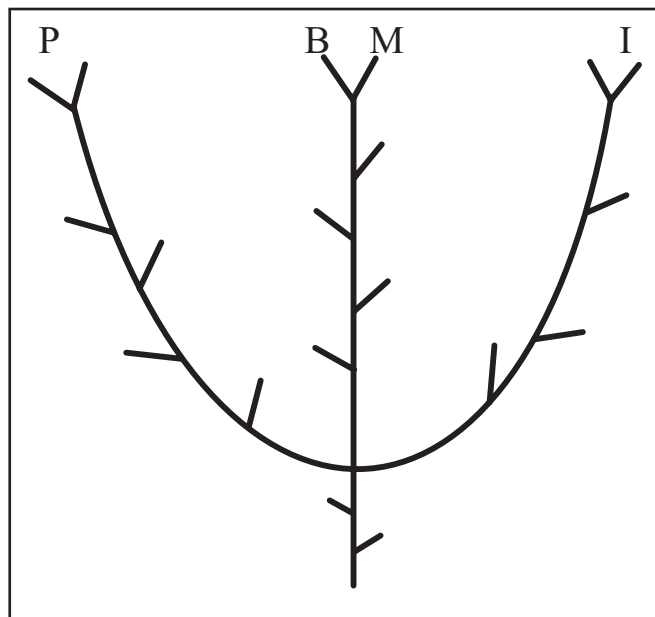


Figure 1. Generalized diagram representing a macroevolutionary understanding of the relationships of all forms of life. Plants(P) would be on the branch to the left, birds (B) and mammals (M) at the pinnacle of the middle branch, and insects (I) at top of the large right branch.

Also there is the *cladistic* approach which focuses on common or so-called “shared/derived” characters. Most importantly, popular methodology in phyletic, phenetic and cladistic procedures *all* have been adapted to macroevolutionary theorizing.

The earliest methods were phenetic which conferred the distinct advantage of being objectively observable and most verifiable. Critics of basic phenetics feel that its simplicity does not encourage adequate consideration of historical causation. Nevertheless, those who employ baraminology (with discontinuity systematics) as presented in this paper, can be agnostic regarding popular phenetic and cladistic methodology, but at least they do employ some phenetic methodology as one of their tools.

Discontinuity Systematics and Baraminology

Scientists who have preferred something other than a macroevolutionary framework recently have developed what they believe to be a more realistic systematics based upon the discontinuities or typology found in nature. This methodology appropriately has been termed *discontinuity systematics* (formally presented by Walter J. ReMine, 1990), or when combined with Biblical revelation, *baraminology* (a term introduced by Kurt P. Wise, 1990). Baraminology may be defined as a taxonomy based upon the created kinds (see Bartz, 1991; Frair, 1991; 1999; and Figure 2). The word “baramin” was conceived by Frank L. Marsh and first published in 1941; it is derived from the Hebrew verb *bara*, create and *min*, kind (also see Marsh, 1969; Williams, 1997).

Since classification underlies all biological investigations, it is quite significant that creationists now have an active focus on this topic. Substantial progress has been made since 1990, and baraminologists have developed their own terminology which at this time appears to be quite practical for those doing systematic research. The major purpose of baraminology is to determine which organisms share common ancestry.

Marsh employed the term *baramin* in an inclusive way for an entire group of known, unknown, and possibly inferred organisms sharing genetic relationship. But now the focus is more specific, and only those specimens which can be studied as living or extinct (including fossil) specimens may be included in the current four main baraminic groups. The terms employed as the four primary baraminic categories are *holobaramin*, *monobaramin*, *apobaramin*, and *polybaramin*.

Holobaramins

In baraminology the primary term is *holobaramin* from the Greek *holos* for whole. The holobaramin is all and only

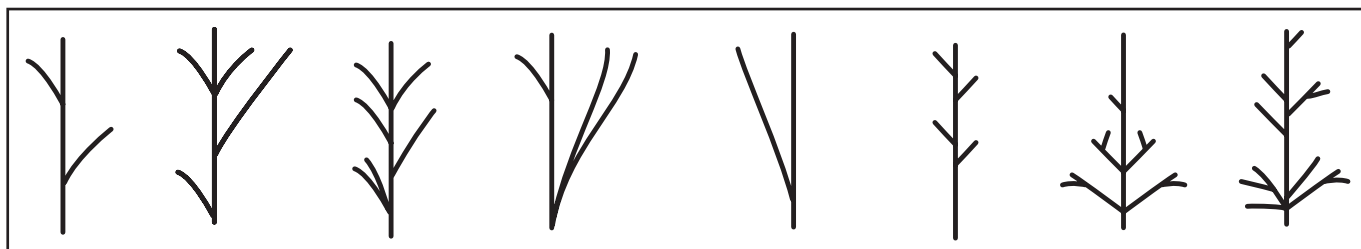


Figure 2. “Neo-creationist orchard” (Wise, 1990). Each tree has its own trunk, and there are no roots connecting one tree to another. Every one of the rootless trees represents a created kind or baramin. The holobaramin at any time constitutes all that is known about the trunk and branches resulting from all diversification which has occurred since the original creation. Compared to Figure 1 the changes (“growth”) of the trees in time is small, or microevolutionary.

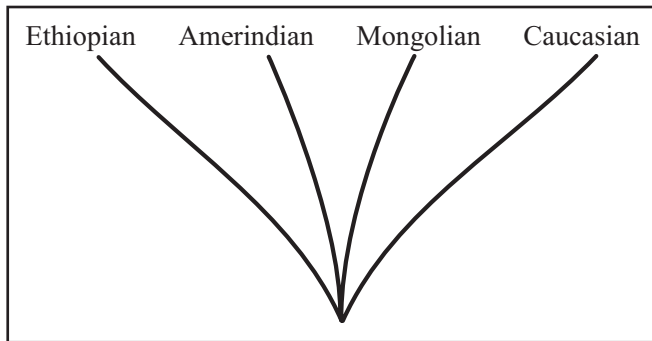


Figure 3. Condensed diagram of a human (*Homo sapiens*) holobaramin with races at tops of the main branches. Hartwig-Scherer (1998) believes that the fossil, *Homo ergaster/erectus*, also belongs in the human lineage.

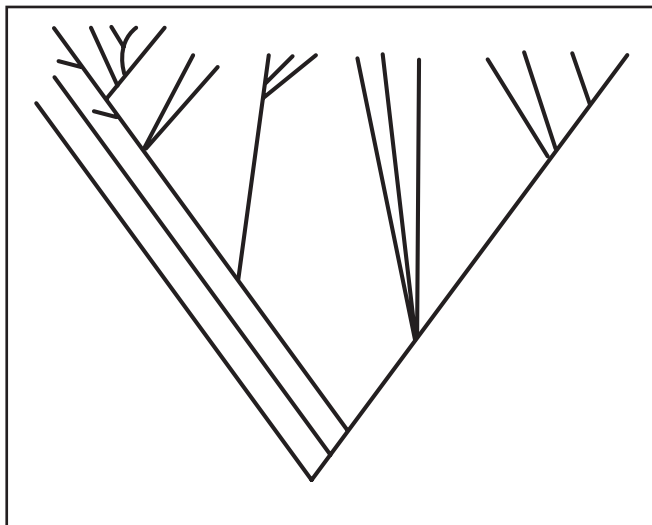


Figure 4. Very generalized representation for all living and extinct sea turtles. Sea turtles are assumed to constitute a holobaraminic collection.

those known living and/or extinct forms of life understood to share genetic relationship. It is an entire group believed to be related by common ancestry.

So now each natural group of related plants or of related animals constitutes a holobaramin; or in more specific creationist terminology the holobaramin consists of all known organisms in a group beginning after God created the original organisms (see Wise, 1992). The holobaramin may be represented as a branching tree, the nodes and tips of the branches representing all the known members (subspecies, species, etc.) of the "kind" ("group", or "type"). See Figure 2. When individuals or groups of apparently related specimens are being compared they may be designated as *holobaraminic* if they constitute parts of one holobaramin.

During recent past decades the creationist researchers have employed the terms "kind", "group" and "type" generally interchangeably; or as individuals the researchers

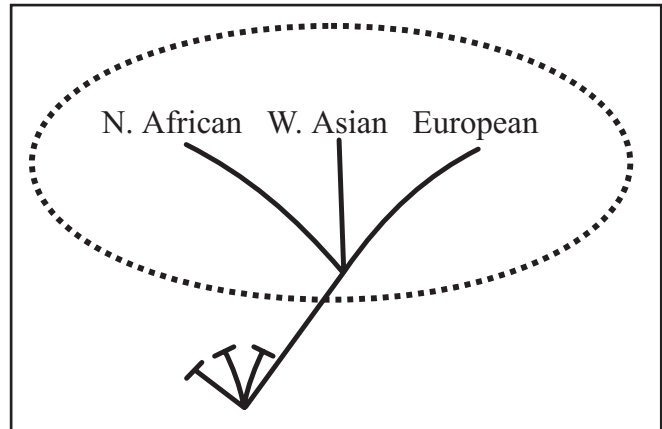


Figure 5. Human monobaramin. Relationship diagram within the dotted oval represents one monobaramin which is a generalized expansion of the Caucasian line in the human holobaramin shown in Figure 3. To emphasize this monobaramin, three other branches seen in Figure 3 have been cut off. Three branches of Caucasians as a whole constitute a monobaramin which is a portion of the human holobaramin. Classic neanderthals may be an extinct branch on the European line, and Cromagnon man also could be on this branch (Cuozzo, 1998; 2000).

have preferred one or another particular general name for Marsh's "baramin," and also for what more specifically and currently may be designated as holobaramins. Now systematists of particular taxons of plants or animals may discard the older terminology and construct their trees showing holobaraminic affinities, and thus the boundaries of common descent.

An important example of a holobaramin would be humans, *Homo sapiens*. At the tips of the holobaraminic branches are the various races (Caucasians, Ethiopians, Mongolians, Amerindians [Amerinds or Native Americans], etc.). See Figure 3. A member of any of these races potentially would be inter-fertile with a spouse of the opposite sex from any other race.

It is not uncommon to find in the anthropological literature reference to upward of eight human geographical races with even additional intermediate populations. However, it is not my intention in this paper to enter into discussions of the different options for what is expressed here in the text or in any of the figures, but merely to illustrate the taxonomic principles involved.

Another holobaramin could consist of the sea turtles (see Wise, 1992; Robinson, 1997). A diagram showing general forms of living and fossil sea turtles may be found in Lutz and Musick, 1997, p. 8. This diagram is called a "cladogram" and is based upon studies by specialists Gaffney and Meylan, but not all authorities agree with their assessment of available data. See also Hirayama, 1998. Figure 4 is a very generalized representation for all

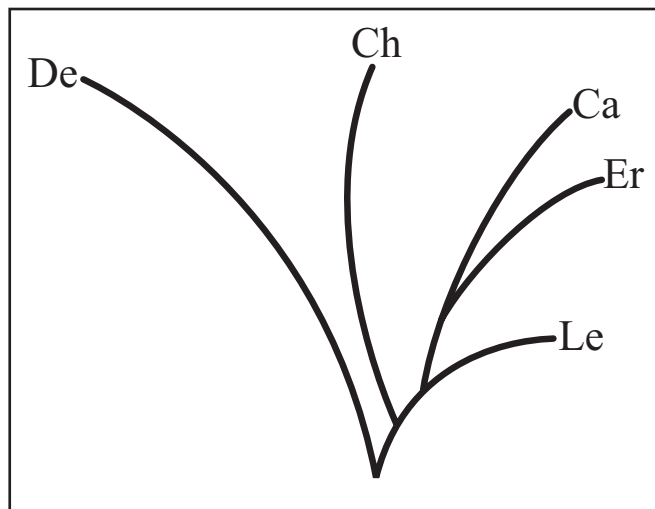


Figure 6A. One monobaramin within the sea turtle holobaramin of Figure 4. The tree shows genetic relations among the five main types of living sea turtles, namely: leatherback turtles, *Dermochelys* (De); green turtles, *Chelonia* (Ch); loggerhead turtles, *Caretta* (Ca); hawksbill turtles, *Eretmochelys* (Er); ridley turtles, *Lepidochelys* (Le).

living and extinct marine turtles. In all of these types of studies the actual *goal* of discontinuity systematics is by means of empirical evidence to determine the boundaries of common descent and thus to converge on the holobaramins.

The different members of a holobaramin could have resulted from a sorting out to the offspring of different genes (DNA) from parental organisms. This is a common occurrence today. Or, since the time of creation there could have been some hereditary modifications of the DNA (mutations), and these were passed on to the diverging offspring. Selection in nature could have influenced the potential for survival of the diverse siblings.

Monobaramins

The second term used in baraminology is *monobaramin* (*mono*, from the Greek for single or one). The term monobaramin is defined by ReMine (1993, p. 444) as:

a group containing *only* organisms related by common descent, but not necessarily all of them. (A group comprising one entire holobaramin or a portion thereof).

When a holobaramin is represented by a tree, one or more branches of that tree would be a monobaramin. For example, among humans, the caucasians would be a monobaramin (Figure 5). Or for the sea turtles, the five current types living in oceans around the world constitute a monobaramin (Figure 6A from Frair, 1982; and see Iverson, 1992, p. 80). Also, the group of green turtles,

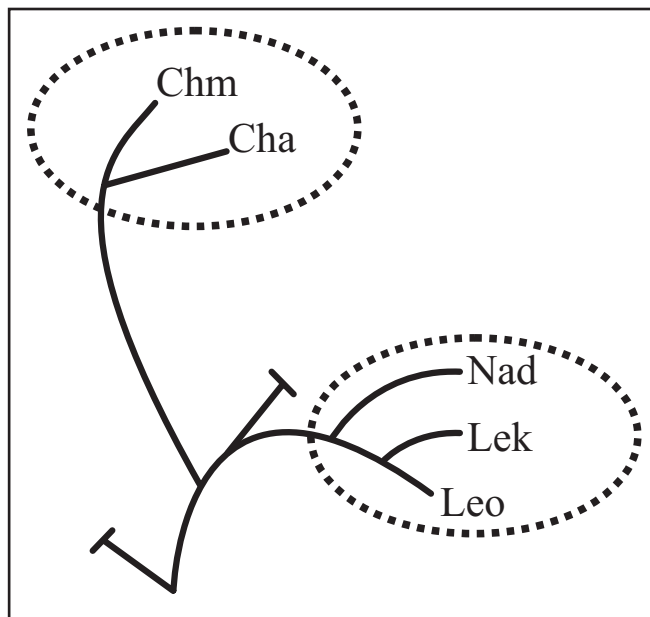


Figure 6B. Two smaller monobaramins within the living sea turtle monobaramin of Figure 6A. The dotted ovals enclose detailed branching patterns (monobaramins) for the *Chelonia* (Ch) limb and for the *Lepidochelys* (Le) limb. The De and Ca/Er branches have been cut off. The *Chelonia* monobaramin consists of the common green turtle, *Chelonia mydas* (Chm) along with the Pacific green turtle, *Chelonia agassizii* (Cha). The *Lepidochelys* monobaramin contains the flatback turtle, *Natator depressa* (Nad); the kemp's ridley turtle, *Lepidochelys kempii* (Lek); and the olive ridley turtle, *Lepidochelys olivacea* (Leo).

Chelonia, or the branch containing the ridley turtle, *Lepidochelys*, each would be a monobaramin (Figure 6B). Individuals or groups may be referred to as monobaraminic if they represent parts of a holobaramin (Figures 5, 6A, 6B, and 7B).

In addition, systematic studies on particular monobaramins where there has been diversification (as the appearance of more recognizable species, subspecies, varieties, etc.) the research on a monobaramin would not differ essentially depending on the systematic philosophy of the investigators. The difference between a (1) phyletic, in the sense of a Darwinian macroevolutionary perspective, and a (2) baraminic (creationist, "limited change", or microevolutionary) discontinuity systematics viewpoint mainly would be that the former involves the use of empirical data for extrapolating to some perceived earlier ancestors. But the baraminologist maintains that thinking about phylogeny should not extend beyond convincing evidence, and that scientists should be relieved of their sense of obligation philosophically to construct extensive phylogenies (evolutionary trees) in the absence of compelling facts.

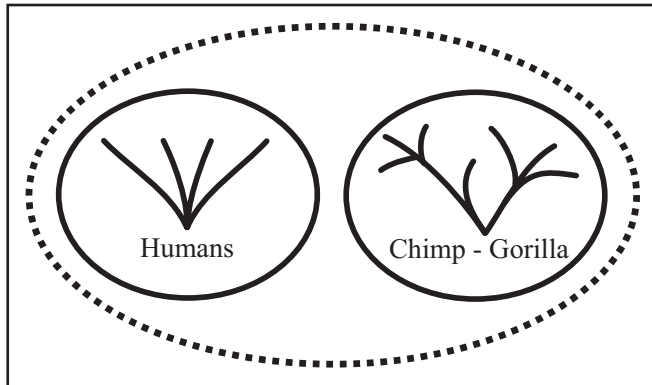


Figure 7A. An apobaramin within the dotted oval. This apobaramin contains the human holobaramin which is reduced from Figure 3. It also encloses the chimpanzee-gorilla holobaramin.

Apobaramins

A third baraminic term is *apobaramin* (Greek *apo*, away from), which “is a group consisting of the entirety of at least one holobaramin” (Wise, 1999–2000). It may contain a single holobaramin or more than one holobaramins. “But it must contain the entirety of each of the one or more holobaramins within it”. No member organism of a holobaramin within an apobaramin shares ancestry with any organism outside of its own holobaramin (this being based upon the definition of holobaramin). See Figure 7A.

The adjective apobaraminic refers to the association between or among distinctly unrelated groups (holobaramins). For example all humans as a group would be apobaraminic because none of its members shares ancestry with any other organisms. The group of all humans and all turtles also would be apobaraminic because no human or turtle shares ancestry with any non-human or non-turtle organisms.

It is believed that the horses (horses, donkeys, and zebras) all are related because they can hybridize, and therefore they belong to a holobaramin. Additionally there is a “dog” holobaramin with monobaraminic branches for the wolves, another for the hyenas, another for the coyotes, for jackals, and more for the hundreds of pet-dog breeds. “Cats” constitute another holobaramin with monobaraminic branches for the lion and the tiger, for the pumas, another for the lynx, domestic cats, etc. (see O’Brien, 1997). A group of all the horses (equids), all the dogs (canids), and all the cats (felids) would be apobaraminic because no horse or dog or cat shares a genetic relationship with any organism which is not a horse, a dog, or a cat.

The turtle apobaramin may consist of one, two, three or four holobaramins (see Wise, 1992). In this present paper I am considering the sea turtles to constitute a holobaramin; therefore a group containing the sea turtle holobaramin, all equids, all canids, and all felids would be apobaraminic

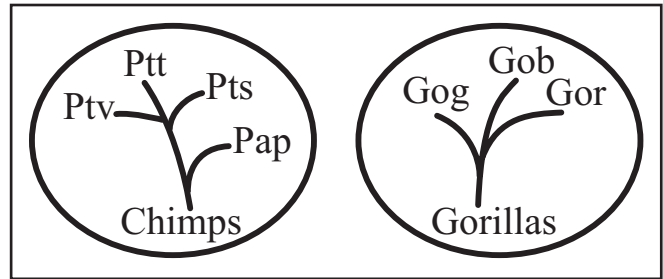


Figure 7B. Two monobaramins, the chimp and gorilla branches from Figure 7A. The chimps are the common chimpanzee, *Pan troglodytes*, and pigmy chimpanzee, or bonobo, *Pan paniscus* (Pap). *Pan troglodytes* has three subspecies: the lower Guinean chimpanzee, *P.t. troglodytes* (Ptt); upper Guinean chimpanzee, *P.t. verus* (Ptv); and eastern longhaired chimpanzee, *P.t. schweinfurthii* (Pts). In the gorilla monobaramin are the western lowland subspecies, *Gorilla gorilla gorilla* (Gog); mountain subspecies, *G. g. beringei* (Gob); and the eastern lowland subspecies, *G. g. graueri* (Gor).

because none of the members of any of these four holobaramins shares genetic relationship with any specimens outside their respective holobaramins.

The term *apobaramin* is a term useful especially during evaluations of two types of organisms (pairwise comparisons). Utilizing pairwise comparisons is the most common taxonomic procedure.

For example the current Order Primates includes apes, humans, lemurs, monkeys and tarsiers. All races of humans belong to one holobaramin; whereas chimpanzees (chimps) along with gorillas are members of another holobaramin. So a group containing the human holobaramin and the chimp-gorilla holobaramin would be apobaraminic (see Figure 7A). Further, a collection of the human holobaramin with *any or all* the other primate holobaramins would be apobaraminic. No member of any of these holobaramins would share any ancestry with a member of any of the other holobaramins within or even outside this apobaramin. See Robinson and Cavanaugh, 1998a for a baraminic study of Primates.

Conclusions regarding a holobaraminic chimp-gorilla relationship (Figures 7A and 7B) are based upon Hartwig-Scherer, 1998. Also Cavanaugh (1999–2000) has informed me that a restudy of data from Robinson and Cavanaugh (1998a) supports the holobaraminic status of chimps and gorillas. However, as explained by Klein (1999, pp. 135–136) the fossil record provides very little that is of any use in understanding the history of chimps and gorillas. When fossils convincingly have been determined to be related to chimps and gorillas they should be added to their holobaramin. Even possibly the chimp-gorilla group should be divided into two separate holobaramins. Figure 7A illustrates how the apobaraminic

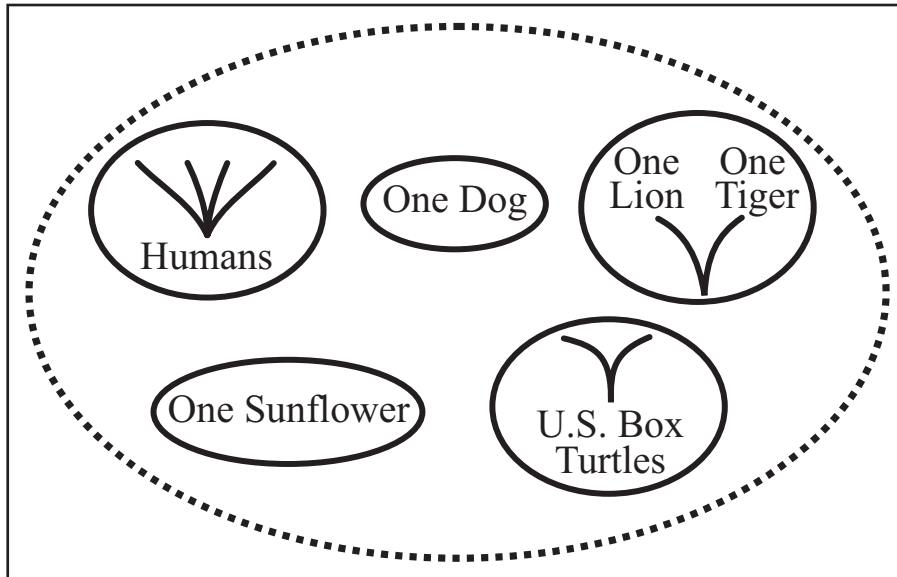


Figure 8. Polybaramin. The dotted line surrounds a polybaramin with a hodgepodge of organisms. Any collection of two or more of the five undotted ovals also would constitute a polybaramin.

category can be useful especially in cases where the included holobaramins possess specimens with considerable similarity across holobaraminic boundaries. So humans can be compared with the organisms structurally and functionally most similar to them, namely chimps and gorillas.

Polybaramins

The fourth term, *polybaramin* (*poly*, from Greek for many), is employed for another mixture of unrelated organisms. It has been defined as a group (two or more specimens) consisting of part of at least two holobaramins. It may be any of numerous hodgepodes which could contain holobaramins, monobaramins, apobaramins, and individual specimens (see Figure 8).

As an example, a polybaramin could contain representatives of all human races, the two species of United States box turtles, one dog, one lion, one tiger, and one sunflower plant. The humans constitute a holobaramin. The box turtles belong to a monobaramin in a turtle holobaramin, the dog to a different monobaramin (in the canid holobaramin), the lion and tiger to another monobaramin (in the felid holobaramin), and the sunflower to a monobaramin within a plant holobaramin.

The adjective *polybaraminic* refers to the association between or among some or all parts of a polybaramin. For example, the sunflower and the human holobaramin would be polybaraminic, as would be the sunflower when compared with a box turtle monobaramin and a dog.

If an investigator is dealing with a polybaramin his taxonomic goal should be to separate its parts into the other

three categories as soon as possible. Each of the monobaramins would need to be subtracted from this polybaramin and then separately studied carefully in order to determine their place in their respective holobaramins. The dog and the sunflower each is part of its own different holobaramin, and each of these holobaramins is unrelated to any other holobaramin in this polybaramin. Also, the humans should be analyzed individually to ascertain their proper relations within a holobaramin.

Further Thoughts

To repeat and expand this somewhat further, the Darwinian macroevolution model is represented by a single tree of relationships, every form of life being

related to every other form of life (Figure 1). In the baraminic model there is a forest of trees without connecting roots (Figure 2). One of these rootless trees would have branches representing only human diversification, another for canids, another for felids, etc.

For people reared on an evolutionary diet the above menu can be difficult to swallow and digest because students of biology have been taught to think genetic relationship rather than genetic discontinuity. But there is a lack of evidence for connecting any holobaraminic group to any other holobaraminic group. This is true for both extinct and extant types of life.

It is common for scientists to utilize trees to depict relationships, but baraminologist David Cavanaugh believes that "trees" possibly may not be the best ways to portray relationships, but "other structures, such as networks or lattices may do a better job within many holobaramins. Tools of pattern recognition, such as projection plots, may perhaps be even better methods" (Cavanaugh, 1999–2000). So it remains to be seen just how relationships popularly will be represented in the future.

Baraminic Terminology

The four terms, *holobaramin*, *monobaramin*, *apobaramin*, and *polybaramin* formally and publicly were introduced by Walter ReMine (1990) at the Second International Conference on Creationism in Pittsburgh, PA 30 July 1990. Later in the week of the same conference Kurt Wise (1990), who had had extensive interchange with ReMine since 1983, endorsed ReMine's *discontinuity* sys-

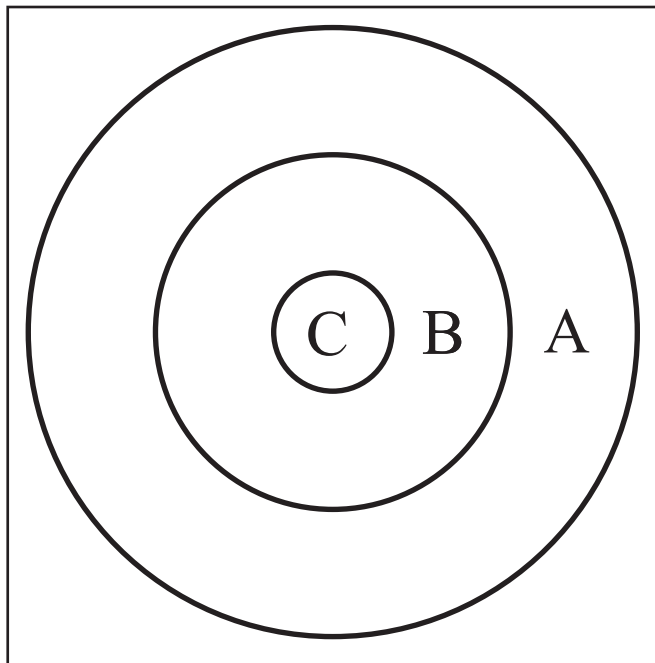


Figure 9. Set of relationships among apobaramins, holobaramins and monobaramins. The outer largest circle A contains a smaller circle B, and this in turn includes the smallest circle C. The A circle represents the apobaramin, B the holobaramin, and C the monobaramin. So circle B is a subset of A, and circle C is a subset of B.

tematics, wedded it to his own young-earth creation position, and stated that the name of this new systematic procedure was “baraminology.”

Wise also introduced a fifth term, namely *archaeobaramin*, which could be conceived as the originally-created individual(s) of each holobaramin. For humans, Adam and Eve would constitute the *archaeobaramin*. Two other terms which Wise has introduced are *neobaramin* which refers to living forms of life and *paleobaramin* for the older organisms. Archaeobaramins are the most theoretical (Wise, 1990); whereas holo-, mono-, apo-, poly-, paleo- and neobaramins are to be determined on the basis of observational information.

Baraminology in Action

It is important to emphasize that the strictly empirical component of baraminology is discontinuity systematics which can be utilized by itself without any reference to religious literature. In fact, most of the sections in this present paper, including the figures, actually are based on discontinuities as observed in nature. ReMine (2000) has pointed out that discontinuity systematics

is intentionally designed to be a neutral, scientific method for studying some of nature’s patterns. We do not begin by assuming discontinuity; rather we

follow the data to *identify* the discontinuities, wherever they may be. This systematic method is an empirical, scientific enterprise—moved by the data, not by theoretical presuppositions.

In the actual process of moving toward the goal of characterizing holobaramins, the taxonomist needs to identify apobaramins and partition them. Subtractive criteria need to be used in dividing the apobaramins into separate holobaramins. Then with the goal of characterizing holobaramins, the taxonomist focuses on the monobaramins, and additive criteria are employed to build these monobaramins.

An analogy for explaining this process has been proposed:

It is like there has been a huge snowfall covering the trees to the top, and we are digging down into the snow to identify the connections, the branches, limbs, and trunk. Is there *one* tree below? Or is it an orchard of separate distinct trees? As the data slowly come into view we will have arguments about what is connected to what, or whether there is discontinuity at a given place. Some researchers will mis-identify various branches as connected, when these later are seen as unconnected, and so forth. But this clears up as we dig. We are not “cutting and pruning” the data. Rather, we leave the data precisely where it is. We merely are cutting and pruning our perceptions—particularly our temporarily mistaken perceptions of the data (ReMine, 2000).

In other words the scientist is iterating tentative taxonomies by increasing or decreasing sizes of the branches to arrive at the best approximation of reality. This systematic procedure is driven by observed facts rather than some presupposed framework.

The goal of baraminology is to characterize holobaramins, but baraminologists do not recognize holobaramins as absolutely distinct from either apobaramins or monobaramins. Apobaramins contain one or more holobaramins. So if an apobaramin has been partitioned and only one holobaramin remains is that holobaramin still an apobaramin? The baraminologist says yes.

Also, if there is a portion (branch) of a holobaramin it is termed a monobaramin. This monobaramin will grow in size and complexity as more specimen branches are added. When a taxonomist has added all the branches which can be found among currently-living or extinct organisms, the taxonomist may judge the tree to be complete according to all currently-existing and applicable information. This means that the “tree”, which could have one or more branches, has all the forms of life believed to share genetic relationship, that is to say that are related by descent. So this group now by definition would be the holobaramin. Is it still a monobaramin? The baraminologist says yes! So how can a group be a mono-

baramin or an apobaramin and be a holobaramin at the same time?

Remine (1993, p. 447) and Wise (1999–2000) explain that we can think in terms of set theory. Consider a large circle, A (apobaramin). An inner portion of it is a smaller circle B (holobaramin), and this includes a still smaller inside region C (monobaramin). See Figure 9. Both the apobaramin (A) and monobaramin (C) are being changed in the direction of the middle circle, holobaramin (B).

Guidelines

In accomplishing the goal of separating parts of polybaramins, partitioning apobaramins, building monobaramins and characterizing holobaramins, a taxonomist needs guidelines for deciding what belongs to a particular monobaraminic branch. These standards will vary depending upon the groups being considered, but general guidelines which have been utilized include:

1. Scripture claims (used in baraminology but not in discontinuity systematics). This has priority over all other considerations. For example humans are a separate holobaramin because they separately were created (Genesis 1 and 2). However, even as explained by Wise in his 1990 oral presentation, there is not much relevant taxonomic information in the Bible. Also, ReMine's discontinuity systematics, because it is a neutral scientific enterprise, does not include the Bible as a source of taxonomic information.

2. Hybridization. Historically Marsh and others have placed this criterion second only to the Bible; for if viable offspring could be obtained from a cross between two different forms, this would be definitive of their monobaraminic status. However, we realize today that the lack of known hybridization between two members from different populations of organisms does not necessarily by itself mean that they are unrelated. The hybridization criterion probably will retain validity, but it is being reconsidered in the light of modern genetics.

3. Ontogeny, namely the development of an individual from embryo to adult. Hartwig-Scherer (1998) suggested that comparative ontogeny followed hybridization in importance as a criterion for membership in a particular type.

4. Lineage. Is there evidence of a clear-cut lineage between and among either or both fossil and living forms.

5. Structure (morphology) and physiology (function). Structures may be macroscopic (large entities such as body organs), microscopic (small, and observed using magnification), and molecular (chemical) configurations.

6. Fossils in rock layers. These studies can include locations of fossil forms in the rock layers, and may entail considerations of Flood sediments.

7. Ecology. It is important to comprehend an organism's niche, that is to say the region where it lives and how it interacts with the environment including other living things.

In order to determine baraminic distances among types of organisms it is important to utilize the most significant data. For instance, molecular studies with mitochondrial DNA and RNA were useful with some turtles, but the author questioned the baraminic utility of ecologic criteria (Robinson, 1997). In a baraminic study of human with non-human primates, the morphological (form) features such as teeth and bones as well as ecological characters including feeding and habitats were more valuable than chromosomal or molecular (hemoglobin and RNA) information (Robinson and Cavanaugh, 1998a). Also see Garcia-Pozuelo-Ramos, 1997; 1998; 1999. However, baraminic research on a broad spectrum of felids has revealed that ecological data were least reliable, and chromosomal data of low reliability. The morphological and molecular (protein and RNA) information were most important (Robinson and Cavanaugh, 1998b). For ongoing studies Cavanaugh (1999–2000) recently has emphasized that:

In particular, proteins, and their DNA patterns, which are part of fundamental cellular processes, have wide applicability in baraminological research. For example, proteins associated with cellular respiration like cytochrome C and cytochrome B are excellent candidates. See for example, the cytochrome C table in Denton (1986).

Statistics involving computer calculations are vital in the above investigations. It is to be expected that when baraminology is accepted widely the science of taxonomy will be revolutionized. When systematists are dealing with a "forest" of trees rather than one large evolutionary tree it is possible that the categories of kingdom, phylum, division, class and even orders will be less useful in classification. However, among living things, groups of features within other groups of characteristics can be observed. These so called "nested patterns" (see ReMine, 1993; Wise, 1998) can extend beyond baraminic categories; so phenetic and cladistic methods may continue to be useful along with discontinuity systematics.

For those who have been steeped in Linnaean taxonomy and evolutionary thinking, discontinuity systematics may appear to be a preposterous proposal. However, this admittedly bold scheme should not be thought of as a departure from reality. Interestingly, on the first of August during the 1999 International Botanical Congress in St. Louis an overflow crowd heard a presentation promoting a so-called PhyloCode, a systematic scheme which would lead to the abolition of kingdoms, phyla, classes, orders, etc. (Milius, 1999). Also see papers by de Queiroz (1992; 1997a; 1997b). The proposed uncomplicated systematic procedure focuses on clades, each clade consist-

ing of a single species and descendants of that species. In other words, the clade would be a holophyletic (genetically- united) group.

However, those utilizing a scheme such as this generally are thinking of clades within clades within larger clades on a macroevolutionary scale; whereas baraminology is more microevolutionary (small changes) which is much less speculative. For other taxonomic literature supporting typology see Scherer, 1993.

How many holobaramins will there be—3,000, 5,000, 10,000, 15,000, or more? At this time the best very tentative answer is, “probably in the low thousands”.

Active Baraminologists

On 6 March 1996 graduate student Neal A. Doran sent an email message to Kurt Wise suggesting a “baraminology study group”. The following day he emailed two other graduate students, Todd Wood and D. Ashley Robinson about this. The responses all were positive, and by 26 March 1996 the group had added Paul Nelson and John Meyer making a total of six. These men worked at identifying pertinent literature and establishing guidelines for the future. In June 1997, Doran, Wise, Wood, and Robinson plus more recent contacts David Cavanaugh and David Fouts met in Dayton, TN where Wise worked, and together they established the Baraminology Study Group (BSG).

In addition to the above-mentioned eight men, there were Pete Williams, Jerry Kreps, and Jeff Tompkins who became involved to varying degrees. In October 1998 Joe Dasso and I accepted invitations to join the group, thus increasing membership to 13.

A three-day conference with the auspicious title “Baraminology ‘99: Creation Biology for the 21st Century” was organized and presented by the BSG in cooperation with the Departments of Biology and Chemistry at Liberty University in Lynchburg, VA, 5–7 August 1999. There were 24 invited participants.

Formal presentations were made by Todd C. Wood, D. Ashley Robinson, Kurt P. Wise, Pete J. Williams, and Paul Nelson. Topics related to baraminology included creation biology, phylogenetic inference, Biblical studies, design theory, the hybridization criterion, evolutionary webs, and non-systematics fields. The final afternoon was devoted to a workshop on baraminology of the family containing camels. These presentations and discussions on camels included an introduction, Biblical and linguistic studies, fossil record, hybridization, molecular studies, phylogenetic distortion, and conclusions. The final evening of the conference included a moderated discussion of “The Future of the BSG and Baraminology.”

Consideration was given to the establishment of a new society and a new journal. Participants volunteered for responsibilities centering on a second conference on the west coast in early 2001.

In spite of some differences of opinion, it was my impression that the group as a whole was very excited about progress made so far and prospects for the future of baraminology. Some of the scientists preferred to believe in an old earth (billions of years), but the leadership and most of the attendees were united in maintaining a young earth (thousands of years old) perspective. An introduction to baraminology and report on the 1999 conference has been written by an attendee, botanist Margaret Helder, 1999.

Concluding Comments

Baraminology may be thought of as a typological approach to classifying forms of life, both living and fossilized. In former centuries scientists theorized typologically more commonly than they do at the present time. However, because of the many difficulties (for example, convergences and reversals) which plague the macroevolutionary thinker, there is a growing receptivity to typology.

Baraminologists believe that they are at the forefront of modern progressive thinking. Those interested in learning more about the ten-year-old field of baraminology should consult the references.

Acknowledgments

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References

- CRSQ: *Creation Research Society Quarterly*
 Bartz, Paul A. 1991. A refinement of biosystematics which reflects baraminic variation. *CRSQ* 28(1):18–20.
 Cavanaugh, David P. 1999–2000. Personal communications.
 Cuzzo, Jack. 1998. *Buried alive: the startling truth about Neanderthal Man*. Master Books, PO Box 727, Green Forest, AR 72638.

- . 2000. Personal communications.
- Denton, Michael. 1986. *Evolution: a theory in crisis*. Woodbine House, Rockville, MD.
- de Queiroz, Kevin. 1992. Phylogenetic taxonomy. *Annual Review of Ecology and Systematics* 23:449–480.
- . 1997a. Misunderstandings about the phylogenetic approach to biological nomenclature: a reply to Liden and Oxelman. *Zoologica Scripta* 26(1):67–70.
- . 1997b. The Linnaean hierarchy and the evolutionization of taxonomy, with emphasis on the problem of nomenclature. *Aliso* (The Rancho Santa Ana Botanic Garden, Claremont, CA 91711–3157) 15(2):125–144.
- Frair, Wayne. 1982. Serum electrophoresis and sea turtle classification. *Comparative Biochemistry and Physiology* 72B:1–4.
- . 1991. Original kinds and turtle phylogeny. *CRSQ* 28(1):21–24.
- . 1999. Creationist classification—an update. *Creation Matters* 4(1):1,5.
- Garcia-Pozuelo-Ramos, Celedonio. 1997. Taxonomy of primates. *CRSQ* 34(2):93–102.
- . 1998. Dental variability in the domestic dog (*Canis familiaris*): implications for the variability of primates. *CRSQ* 35(2):66–75.
- . 1999. Craniodental variability in the domestic dog (*Canis familiaris*) and its implications for the variability in primates. *CRSQ* 36(3):116–123.
- Hartwig-Scherer, Sigrid. 1998. Apes or ancestors?: interpretations of the hominid fossil record within evolutionary and basic type biology. In William A. Dembski, editor, *Mere creation: science, faith and intelligent design*, pp. 212–235. Intervarsity Press, Downers Grove, IL.
- Helder, Margaret. 1999. Introducing baramins. *Creation Dialogue* (5328 Calgary Trail South, Suite 1136, Edmonton, Alberta T6H 4J8) 26(3):6–7.
- Hirayama, Ren. 1998. Oldest known sea turtle. *Nature* 392:705–708.
- Iverson, John B. 1992. *A revised checklist with distribution maps of the turtles of the world*. Privately printed, Richmond, IN.
- Klein, Richard G. 1999. *The human career: human biological and cultural origins*. The University of Chicago Press, Chicago, IL.
- Lutz, Peter L., and John A. Musick. 1997. *The biology of sea turtles*. CRC Press, New York.
- Marsh, Frank L. 1941. *Fundamental biology*. Published by the author, Lincoln, NE.
- . 1969. The form and structure of living things. *CRSQ* 6(1):13–25.
- Milius, Susan. 1999. Should we junk Linnaeus? *Science News* 156(17):268–270.
- O'Brien, Stephen J. 1997 (June). The human-cat connection. *National Geographic* 191(6):77–85.
- ReMine, Walter J. 1990. Discontinuity systematics: a new methodology of biosystematics relevant to the creation model. In R. E. Walsh, editor, *Proceedings of the Second International Conference on Creationism. Volume II, Technical Symposium*, pp. 207–216. Creation Science Fellowship, PO Box 99303, Pittsburgh, PA 15233-4303.
- . 1993. *The biotic message: evolution versus message theory*. St. Paul Science, PO Box 28006, Saint Paul, MN 55128.
- . 2000. Personal communications.
- Robinson, D. Ashley. 1997. A mitochondrial DNA analysis of the testudine apobaramin. *CRSQ* 33(4):262–272.
- Robinson, D. Ashley, and David P. Cavanaugh. 1998a. A quantitative approach to baraminology with examples from the catarrhine primates. *CRSQ* 34(4):196–208.
- . 1998b. Evidence for a holobaraminic origin of the cats. *CRSQ* 35(1):2–14.
- Scherer, Siegfried. 1993. *Typen des Lebens*. Pascal Verlag, Berlin.
- Williams, Pete J. 1997. What does *min* mean? *Creation Ex Nihilo Technical Journal* 11(3):344–352.
- Wise, Kurt P. 1990. Baraminology: a young-earth creation biosystematic method. In R. E. Walsh, editor, *Proceedings of the Second International Conference on Creationism. Volume II, Technical Symposium*, pp. 345–360. Creation Science Fellowship, PO Box 99303, Pittsburgh, PA 15233-4303.
- . 1992. Practical baraminology. *Creation Ex Nihilo Technical Journal* 6(2):122–137.
- . 1998. Is life singularly nested or not? In R. E. Walsh, editor, *Proceedings of the Fourth International Conference on Creationism. Technical Symposium Sessions*, pp. 619–631. Creation Science Fellowship, PO Box 99303, Pittsburgh, PA 15233-4303.
- . 1999–2000. Personal communications.

Reprints Available

Reprints of “Baraminology—Classification of Created Organisms” are available as a separate publication, bound in the cover of this month’s *Quarterly*. Individual copies are \$2.00 each. Add 15% for postage (minimum \$3.00, maximum \$10). Mail your order to: Creation Research Society, P.O. Box 8263, St. Joseph, MO 64508-8263.

Photo Essay

Granitic Plutons and the Flood

Emmett L. Williams*

As one drives along Interstate 10 in Arizona a visual treat awaits at milepost 318 (Figure 1). This picturesque scenery (Figure 2) is popular as a backdrop for western films and television shows. These outcrops of tan-colored Texas Canyon Quartz Monzonite "...show distinctive exfoliation and spheroidal weathering which characterizes erosion of granitic plutons in southeastern Arizona" (Keith and Wilt, 1978, p. 117). "Conspicuous euhedral orthoclase phenocrysts have weathered out of the quartz monzonite..." (Keith and Wilt, p. 118) and have the appearance of warts on the surface of the rock (Figure 3) (Chronic, 1983, p. 551). Outcrops are visible at the rest stop at milepost 318 or you can leave I-10 at exit 318 to study the weathered rocks more closely. An examination of the region around this quartz monzonite location reveals a limited amount of weathered rock "littering" the ground very similar to what can be observed at Panola Mountain, Georgia (Froede, Williams and Brelsford, 1998, pp. 41-44). The lack of weathered talus likely is indicative of Floodwater removal leaving the remaining

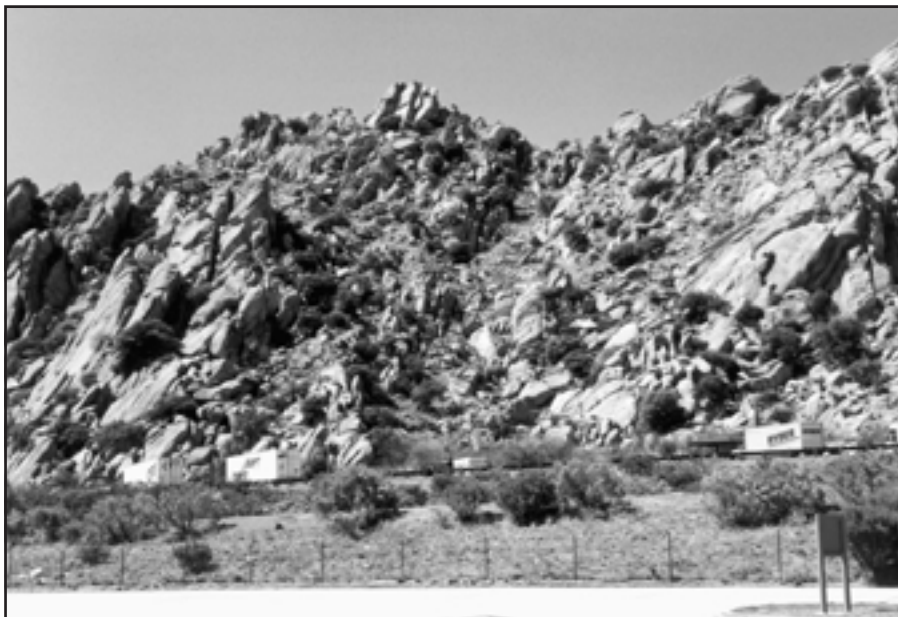


Figure 1. An outcrop of weathered, exfoliated Texas Canyon Quartz Monzonite as viewed from the rest stop at milepost 318 on I-10.

exposed pluton subject to only a few thousand years of weathering. The origin, emplacement, unroofing, and subsequent exposure of the Texas Canyon Quartz Monzonite in relation to the Flood apparently is the same as that of Panola Mountain Granite.



Figure 2. A closer view of weathered, exfoliated Texas Canyon Quartz Monzonite near exit 318 viewed from the road to Dragoon, Arizona.

Appendix

You may wonder why Texas Canyon is found in the state of Arizona? Here is the explanation:

The Adams family from Texas was on its way to the West Coast but got no farther than the canyon now known as Texas Canyon, where Indians stole David Adams' team. With his brothers, Will and Wilbur, Dave settled down on what is known as Adams' Flat to make a go of it. He and his family succeeded (From Barnes, 1960 as quoted in Keith and Wilt, p. 117).

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References

- Barnes, W. C. 1960. Arizona place names. revised edition. University of Arizona General Bulletin 2. Tucson.
- Chronic, H. 1983. *Roadside geology of Arizona*. Mountain Press, Missoula, meeting
- Froede, Jr., C. R., E. L. Williams and J. Brelsford. 1998. Panola Mountain, Georgia: Exfoliation evidence in support of Flood exposure. *Creation Research Society Quarterly* 35:41-44.
- Keith, S. B. and J. C. Wilt 1978. Supplemental road log no. 3; Tucson to Lordsburg via Interstate 10 in Callender, J. F., J. C. Wilt and R. E. Clemons (editors). *Land of Cochise, Southeastern Arizona*. New Mexico Geological Society Twenty-ninth Field Conference Guidebook, Socorro.



Figure 3. Phenocrysts of euhedral orthoclase that have weathered out of the quartz monzonite at Texas Canyon in Arizona.

Book Review

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 a 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 Kimeu 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 (p. 298)."

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 malady 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 (p. 133)."

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."

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The Philosophy of Sequence Stratigraphy Part III — Application to Sequence Stratigraphy

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Abstract

Much of the geologic work done by creationists in recent decades has consisted of reinterpretation of uniformitarian “data,” most of which results in an inevitable assimilation of elements of evolutionist stratigraphy. Sequence stratigraphy has the potential, according to some advocates, to allow creationists and evolutionists alike to break free of the uniformitarian straitjacket that has bound stratigraphy for more than a century. While some creationists advocate abandoning traditional terminology and meth-

ods in toto, others see this as an unjustified hindrance to research and to communication with establishment geologists. The philosophic background necessary to address this issue was established in Part I of this series. In Part II, it was applied to the methods of stratigraphy in general. In Part III, these principles are extended to sequence stratigraphy. The results of this application indicate that elements of sequence stratigraphy may have value for diluvialists, but must be applied prudently.

Introduction

In Parts I and II of this paper, essential philosophic background and its application to stratigraphy in general were presented. In Part III, the series concludes by narrowing that application to that school of thought within the discipline of stratigraphy known as sequence stratigraphy.

Part I, “Philosophic Background,” provided the following conclusions:

- All of the various schools of thought which have arisen in stratigraphy have been inextricably linked to particular worldviews; none is philosophically neutral.
- Science is that branch of philosophy which limits itself to the empirical. Empirical science arose within the context of a Biblical view of reality. Departure from this worldview has resulted in a failure to recognize the limitations of science. History lies outside the realm of science.
- “Mixed questions” require input from a plurality of disciplines and methods. Historical geology is a mixed question, involving both science and history. Neither science nor history can exist independent of a philosophy or worldview. The uniformitarian-naturalist system is not logically correspondent nor is it compatible with the Biblical worldview.

The following conclusions were included in Part II, “Application to Stratigraphy”:

- Methodological naturalism¹ is foundational to the geologic column and incompatible with natural science.
- The Establishment Geologic Paradigm (EGP) is virtually synonymous with the geologic column and fails to

recognize the “mixed question” nature of historical geology.

- Of 13 common stratigraphic methods, only six are defined as purely descriptive. Unfortunately, not even these are commonly free of extrascientific or metaphysical input in practice. This precludes interchange between paradigms resulting from disparate worldviews.
- An empirically defined sequence stratigraphy and the geologic column are mutually exclusive. Sequence stratigraphy as currently practiced is not empirically defined, though this does not preclude development of an empirically defined sequence stratigraphy.
- No correlation can ever be more than tentative.

The background provided by Parts I and II (including references cited) should prove adequate for the reader to evaluate the disparate claims for the efficacy of sequence stratigraphy from the diluvial perspective. Part III builds on Parts I and II, and the glossary provided at the end of this paper is also an extension of the glossaries found in Parts I and II.

¹ (See Part II of this series for an explanation of the uses of the term “methodological naturalism.”)

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What is Sequence Stratigraphy?

Although acrimonious rivalry has existed between some schools of stratigraphic thought (see Table I, Part I), most stratigraphic methods can better be thought of as tools in the stratigrapher's tool box (see Table I). Nonetheless, some sort of heirarchy in methods is necessary, since the neat, dovetail joinery of "independent" methods that the masses find so convincing does not, in fact, exist (Christie-Blick, Mountain and Miller, 1990; Oard, 1985; 1997, pp.11–13; Noël, 1977; Parkinson and Summerhayes, 1985; Thompson and Berglund, 1976; 1977; Verosub, 1975; Watkins, 1971; 1972). Some have argued that biostratigraphy should take precedence (Jeletzky, 1978), but many today promote sequence stratigraphy as the integrating stratigraphic concept or model.

As its name implies, sequence stratigraphy emphasizes sedimentary sequences. Sequences constituting a major portion of North American sedimentary rocks were recognized by Sloss (1963), who is often credited with founding sequence stratigraphy. Berthault (1997, p. 67) argues that it actually began a century ago with Johannes Walther, though its roots go back to ancient cyclic views of history (Dott, 1992). These may be moot points, since what really gave sequence stratigraphy its impetus was seismic stratigraphy. Seismic reflectors were observed in the North Sea, the Gulf Coast of North America, and elsewhere that divided the sedimentary profile into distinct packages over areas of thousands of square kilometers. These packages were interpreted as transgressive-regressive cycles and tied to eustasy, the idea that global sea level has fluctuated throughout earth history and can be used to correlate strata. Many researchers (probably the best known being the late Peter Vail and coworkers at Exxon) have promoted sequence stratigraphy over the past decade or two.

There are slight variations on the theme of sequence stratigraphy. According to R. Walker (1990, p. 780), "There are currently at least four stratigraphies that attempt to subdivide rocks into genetic packages based on bounding unconformities or discontinuities. They are largely conceptual.... They all derive from seismic stratigraphy...." Bartlett (1997) lists these as:

- Classical sequence stratigraphy (the Exxon approach)
- Genetic stratigraphic sequences (the Galloway approach)
- Allostratigraphy²
- Transgressive-regressive cycles

These are the methods known as "sequence stratigraphy." In the past, lithostratigraphy (correlating rocks based on lithology) and biostratigraphy (correlating rocks based on fossils) have been dominant. Magnetostratigraphy (correlation based on paleomagnetism) and pedostratigraphy (correlation based on inferred fossil soil horizons) are more recent developments. Various stratigraphic methods are summarized in Table I. For more detailed descriptions of sequence stratigraphy, see Froede (1994), Bartlett (1997), Davison (1995) and Miall (1997).³

²Of these four approaches, only allostratigraphy is recognized by the North American Commission on Stratigraphic Nomenclature, and some authors do not include allostratigraphy with sequence stratigraphy. Allostratigraphy does differ from the other sequence stratigraphic methods in its descriptive nature (it is based solely on physical discontinuities between units), but I have here followed the example of Bartlett and included it under sequence stratigraphy due to its more obvious similarities with the other methods.

³Froede, Bartlett and Davison write from a diluvialist perspective, while Miall is an evolutionist. Miall's book contains as extensive a bibliography on the subject as any reader could ask.

Table I. Stratigraphic Methods.

Stratigraphic Method	Ref ¹	Desc ²	Gen ³	Description
Lithostratigraphy	N	✓	✓	Correlation by lithology (rock type)
Magnetostratigraphy	N	✓	✓	Correlation by rock magnetic properties
Biostratigraphy	N	✓	✓	Correlation by fossils
Pedostratigraphy	N		✓	Correlation by paleosols
Allostratigraphy	N,B,W	✓	✓	Correlation by lateral facies relationships in sedimentary basin
Seismic Stratigraphy	W	✓		Correlation by geophysical properties
Sequence Stratigraphy	B,W	✓	✓	Correlation by genetic stratigraphic sequences controlled by eustatic cycles
Event Stratigraphy	W,S		✓	Correlation by identification of single geologic events (genetic interpretation)

¹References: B: Bartlett (1997), N: N. American Stratigraphic Code (1983), W: R. Walker (1990), S: Seilacher (1991)

²Descriptive: method has the potential to be empirical (i.e. scientific)

³Genetic: method is usually nonempirical, speculative, or historical in practice

Sequence Stratigraphy: A Scientific Model?

Seismic stratigraphy could theoretically be empirical, but consisting solely of geophysical constructs would afford little in the way of predictive or explanatory power for general geology. Thus, sequence stratigraphy was developed. Sequence stratigraphy offers the hope of an empirical stratigraphy based on the findings of seismic stratigraphy. Davison (1995, p. 228) recommended adoption of sequence stratigraphy by creationists:

It is suggested that this concept be adopted for interpreting Flood geology for the following reasons: (1) [unconformity-bounded sequences] are defined by physical boundaries (unconformities), that is, they are lithostratigraphic (as opposed to time stratigraphic [evolutionary]); (2) each sequence represents the spatial and temporal distribution of a complete depositional 'cycle,' that is, a geologic history; and (3) each sequence refers to a cluster of strata of varying but continuous (relative) age, that is, relatively continuous deposition (within the sequence/depocenter).

This would be grand if sequence stratigraphy were completely objective. The need for empirical criteria is recognized by Davison in his first point above. Slight deviations from objectivity enter with the second and third points. As will be shown below, his efforts in applying sequence stratigraphy to his study area encountered obstacles of an increasingly subjective nature.

That the *genetic implications* in Davison's arguments for acceptance of sequence stratigraphy are common to the practice of the geologic establishment is made clear by several authorities:

...the geologist must define time-equivalent rock packages that are genetic intervals (Vail *et al.*, 1991, p.617, emphasis mine).

Integrating the results of sequence stratigraphic, subsidence, and tectono-stratigraphic analyses yields a *geologic history interpretation with improved temporal resolution* and greater accuracy in predicting lithology. This permits the unraveling of the stratigraphic signatures due to tectonic, eustatic, and sedimentation processes. Sequence stratigraphic analysis divides the stratigraphic record into physical *chronostratigraphic units in which the lithofacies are genetically related* (Vail *et al.*, 1991, p. 619, emphasis mine).

Cycles of relative change of sea level on a global scale are evident throughout Phanerozoic time. The evidence is based on the fact that many regional cycles determined on *different continental margins are simultaneous...* (Vail, Mitchum and Thompson, 1977, p. 83, emphasis mine).

The physical *chronostratigraphic* units defined by sequence stratigraphic criteria are important for making more accurate basin analyses, *paleogeographic reconstructions*, *geologic history interpretations*, resource evaluations of sedimentary basins, and global stratigraphic correlations. Traditional approaches to stratigraphic analysis have different shortcomings in *interpreting paleogeography and geologic history.... Sequence stratigraphy is an interpretive approach* that can integrate outcrop, well-log, and seismic data. This approach provides correlation tools with a *conceptual model for the geologic response of depositional and erosional processes to cyclical base-level changes that identifies and defines the genetic character* of the different types of physical surfaces and stratigraphic intervals within the rock record (Vail *et al.*, 1991, p. 620, emphasis mine).

Sequence stratigraphy is the study of rock relationships within a *chronostratigraphic framework of repetitive, genetically related strata ...*(Van Wagoner *et al.*, 1988, p. 39, emphasis mine).

I therefore emphasize again that the only genetic factor that operates at the Exxon or Galloway scale is the *assumed relationship* between a sequence, or genetic stratigraphic sequence, and one cycle of relative sea level fluctuation (R. Walker, 1990, p. 784, emphasis mine).

The sequence-stratigraphic *depositional models*, together with *detailed paleontological data*, enhance the ability to recognize *genetically related* sediment packages in outcrop sections Over the past several years, stratigraphers at Exxon Production Research (EPR) have attempted to produce a global stratigraphic framework that *integrates* state-of-the-art *magneto-, chrono-, and biostratigraphies ...* (Haq, Hardenbol and Vail, 1987, p. 1156, emphasis mine).

Note how seamlessly ideas such as evolutionary fossil succession are woven into the fabric of sequence stratigraphy.

Bartlett (1997, p. 6) asserts: "Time should *not* be used to define sequence-stratigraphic units. *Interpretation of global origin should now be used to define and describe sequence-stratigraphic unit types*" (emphasis his). *This indicates that while sequence stratigraphy appears to provide a means to break free from the rigid time constraints of traditional uniformitarianism, it continues to incorporate extra-scientific (i.e. genetic) interpretations into the model. It is not, therefore, a scientific model.*

This is clearly demonstrated by both evolutionists and creationists. In the "integrated interpretation procedure" of Vail *et al.* (1991), four or five of the six steps of their procedure clearly require acceptance of traditional historical ideas (e.g. radiometric dating and evolutionary biostrati-

graphy). These various stratigraphic methods (Table I) are used as adjuncts to the hypothetical eustatic curve, in which many cycles of rise and fall in sea level are assumed. That extrascientific elements are integral to sequence stratigraphy is further substantiated by Bartlett (1997, p.10): "Sequence stratigraphy offers to the Flood geologist the concept of cycles *within* cycles of sea-level change" (emphasis his). Froede (1994, p.138) says: "A key to understanding sequence stratigraphy lies in determining the position of worldwide sea-level change (i.e. eustasy) and its resulting depositional sedimentary sequences and systems tracts." Here again appears the assumed oscillation of global sea level. Davison (1995, p.228) also makes clear that his is a mixed question approach: "The hypothesis put forth here is that at certain discrete points *in time* during the Flood, sedimentation was disrupted on a global level and inter-regional or world-wide unconformities were produced, thus forming [unconformity-bounded sequences] of inter-regional scope which should be correlatable on a global scale" (emphasis mine). This is a rather speculative hypothesis on Davison's part.

Neither sequence stratigraphy nor any of the several stratigraphic approaches described above—with the possible exception of allostratigraphy—is purely descriptive. Allostratigraphy, unfortunately, is applicable only to particular sedimentary basins where discontinuities can be adequately determined to map individual units. Although of limited applicability, it may prove beneficial to particular geologic studies by diluvialists. In general, sequence stratigraphic methods are inherently subjective or nonempirical in their dependence upon genetic (interpretative) demarcations.

The Mixed Question Nature of Sequence Stratigraphy

Sequence stratigraphy exhibits a mixed question nature in two ways: 1) as a particular school of stratigraphy, it depends on genetic (i.e. extrascientific) inferences, both in its view of earth history and interpretation of the rocks⁴, and 2) it incorporates other nonscientific stratigraphic methods within the EGP as part of a naturalist-uniformitarian worldview⁵.

Hanneman and Wideman (1991) applied sequence stratigraphic methods to intermontane basins in south-

western Montana, terrain not conducive to lithostratigraphic correlation because of the many rapid lateral facies changes that characterize the basin fill sediments. They attribute much of the confusion in previous stratigraphic efforts to correlation of rocks of *similar lithologies but different ages* (pp.1337–1338). They used paleosols, erosional features, and angular stratal relations to identify unconformities, then traced the "unconformities" in the subsurface seismically based on the inferred paleosols. But the "paleosols" were not the only means used to piece together the "stratigraphic sequences":

If the five major unconformities recognized in the study area are used, Cenozoic basin-fill rocks can be separated into five sequences... *the vertebrate fossil and radiometric age constraints for which are shown...* (p.1339, emphasis mine).

The application of sequence stratigraphy to the Cenozoic strata of southwestern Montana groups strata, regardless of lithology, into rock units that have *chronostratigraphic significance* (pp.1342,1343, emphasis mine).

Thus, while alleviating some of the difficulties associated with lithostratigraphic correlation, they introduced new uncertainties (potential errors) from evolutionary biostratigraphy, radiometric dating, and pedostratigraphy. A U.S. Department of Agriculture soil scientist (Bandy, 1998) stated that the pedostratigraphy employed by Hanneman and Wideman in evaluating the "paleosols" differed markedly from methods employed in the field of soil science, and the interpretations presented are unconvincing. Hanneman and Wideman (1991, pp.1343–1345) go on to correlate the Montana sequences with sedimentary sequences in southwestern Washington and the central Great Plains, relying on interpretations from eustasy and plate tectonics.

Parkinson and Summerhayes (1985, p. 686) are proponents of sequence stratigraphy, yet urge caution:

The danger in using the global curve to explain stratigraphic breaks is that it impairs thinking about local controls. We think it is time to return to the unfettered examination of individual basins on their own merits.

Sequence stratigraphy is inextricably interwoven with the older stratigraphic methods, none of which is free from EGP bias. To insist that these various methods are *independent* lines of evidence is ludicrous.

Other Problems With Sequence Stratigraphy

Although the "mixed" nature of sequence stratigraphy alone prevents wholesale acceptance into the DGP, there are other dangers. Bartlett (1997, p. 19) points out the diffi-

⁴As an example, Bartlett (1997, p. 17) emphasizes the need to distinguish between depositional environments and paleoecologic zones, but this is seldom done by geologists.

⁵Miall (1997) provides many examples documenting the subjective nature of key elements of sequence stratigraphy and other stratigraphic methods.

culty for those working from the perspective of the EGP to maintain objectivity: "What we see in the rock record—the evidence of oscillations of sequences—may be so mixed with the very real component of the *supermega-sequence* signal that genuine, insightful perception may prove obscure or even impossible. The problem is an epistemological one." Yet Bartlett (1997, p. 6) confidently asserts: "Interpretation of global origin should now be used to define and describe sequence-stratigraphic unit types."

Not all share Bartlett's confidence. Roger Walker (1990, p. 777), a mainstream geologist, emphasizes contacts, the key to sequence stratigraphy (and stratigraphy in general): "The significance accorded the contacts is one of the main problems in stratigraphy and sedimentology." He continues (p. 780):

There are currently at least four stratigraphies that attempt to subdivide rocks into *genetic packages* based on bounding unconformities or discontinuities. *They are largely conceptual*, with little or no consideration of 1) scale of application, 2) actual geological examples... or 3) the relationship between the different schemes (emphasis mine).

Walker's observations are important and at least urge a greater degree of caution than expressed by Bartlett's opinion. In addition, Walker (1990, p. 784) has pointed out flaws in the sequence stratigraphic approach of which diluvialists should be aware:

...there is unlikely to be a direct sedimentological genetic relationship between rocks below and above an unconformity, and below and above a [maximum flooding surface]....

...the only genetic factor that operates at the Exxon or Galloway scale is the assumed relationship between a sequence, or genetic stratigraphic sequence, and one cycle of relative sea level fluctuation.

Geologists employing sequence stratigraphy often assume a constant rate of sediment input. This assumption is obviously unrealistic, even for the EGP, but efforts to account for it invariably rely on paleoecologic indicators, inferences of subsidence and paleoclimatology, and other nonempirical variables (Einsele and Bayer, 1991). Efforts to overcome these problems within the context of sequence stratigraphy uniformly rely on extrascientific (historical) assumptions (Dott, 1992; Miall, 1997).

Some have pointed out a very serious flaw in sequence stratigraphy, that two-dimensional cross-sections do not reflect the three-dimensional complexities of even the "best" basin margins: "... since they neglect along-strike complexities, eustatic interpretations based on dip stratal geometries are potentially misleading" (Poulsen *et al.*, 1998, p.1105). "In an overall progradational situation, for instance during highstand conditions, stacked parasequences will appear to step in opposite directions in differently positioned cross-sections.... The contrasting

stacking patterns are important because they contradict the basic premise of sequence-stratigraphic theory that particular stacking patterns are tied to specific sectors of the sea-level curve..." (Martinsen and Helland-Hansen, 1995, p. 439). Two-dimensional stratigraphic sequences correlated to eustatic curves do not necessarily reflect actual depositional history, and evidence may indicate that eustasy was not the most important variable (Poulsen *et al.*, 1998).

Potentially fatal to sequence stratigraphy is its mixed question formulation. "Any approach to global seismic stratigraphy requires calibration to geological time through rock stratigraphy, but there are inherent uncertainties in the time scale, and in the correlation of seismic and rock sections with one another and with the time scale Our ability to test the scheme of global unconformities proposed by Vail *et al.*—that is, to distinguish between global unconformities and those developed on only a regional or local scale—is limited by our ability to determine the ages of unconformities in continental-margin successions"(Christie-Blick, Mountain and Miller 1990, p. 133).

More serious obstacles to acceptance of sequence stratigraphy by creationists are pointed out by Woodmorappe (1996, p. 280):

Recently, claims have been made of the possibility of highly detailed global chronostratigraphic correlations based upon sequence stratigraphy. Miall (1992) provides a devastating critique of these claims. He shows that the range of errors in biostratigraphy, magnetostratigraphy and isotopic dating are such that the precision claimed is a physical impossibility. Furthermore, he highlights the role of circular reasoning and fortuitous correlations in, for instance, the belief that there are 40 discernible global events within just the Cretaceous Period.

There is also at least some element of circular reasoning in even the first-order cycles of the Vail curve. The times inferred for even first-order global regressive sequences contradict each other, and depend upon which database is used. Of course, the sea-level curves should not be directly imported into Flood geology. For instance, 'marine regressive' sequences need not be accepted as such in Flood geology, but may be interpreted as giant reverse-graded beds laid down by Flood waters that are increasing in velocity at that point of deposition.

Froede (1994) points out several EGP weaknesses in the Vail curve (standard sequence stratigraphic approach), including implicit confidence in the Milankovitch mechanism (Broecker and Denton, 1990; DeBoer and Smith, 1994; Dott, 1992, p. 2; Oard, 1984a; 1984b; 1985; 1990; Schwarzscher, 1991; Vail *et al.*, 1991) and Walther's Law (Berthault, 1997; Cowart and Froede, 1994; Froede, 1998, pp.7–13; Johnson, 1992, p. 47; Woodmorappe, 1980,

pp.213–216). Various limitations, including the issue of tectonic overprinting, remain strong (if not intractable) objections (Algeo and Sessler, 1995; Dott, 1992, p.2; Jeletzky, 1978; Johnson, 1992, pp.47,48; Miall, 1986; 1992; Parkinson and Summerhayes, 1985; Pitman, 1978; Thorne and Watts, 1984). Miall (1997, p.9), himself an establishment geologist and firm believer in the Milankovitch mechanism, points out that standard sequence stratigraphy has severe limitations in applicability, that eustasy is but one of several potential causative factors for sequence formation, and that correlation remains a significant problem. The direct connection between sequence stratigraphy as practiced and various fallacious evolutionist methods is inescapable (Algeo and Sessler, 1995; Christie-Blick, Mountain and Miller, 1990; Haq, Hardenbol and Vail, 1987; Pekar and Miller, 1996; Ronov, 1994; Vail, Mitchum and Thompson, 1977; Vail *et al.*, 1991).

What may escape some (but should never escape diluvialists) is the fact that not only is eustasy itself an unsubstantiated concept, but probably impossible to substantiate (Miall, 1997). Its acceptance, like many of the reigning paradigms of geology, was not based on field evidence (Dott, 1992, pp.14,40; Johnson, 1992, p. 48). Miall (1997, p. 15) states, "... one of the principal problems with the assessment of causality is that there are no absolute reference frames for calibration of sea-level change."

Froede (1998, pp.12,13) has pointed out serious problems in identifying unconformity-bounded sequences, and in particular the application of Walther's "Law". As alluded to by Froede, a critical difference exists between the empirical, physico-chemical definition of a depositional environment (e.g. flow regime, pH) and the geographical, paleoecological definition of a depositional environment (e.g. a shallow lagoon in Cretaceous time). *The former definition is scientific and should be employed by diluvialists; the latter is nonscientific and generally employed by evolutionists.*

In summary, difficulties with the method of sequence stratigraphy include:

- Subjective elements in identification of some unconformities and many correlative conformities
- Subjective elements in reconstruction of paleoenvironments and systems tracts
- Subjective elements in identification of many sequence boundaries
- Presence of hiatus in form of maximum flooding surface (Exxon approach) or unconformity (Galloway approach)
- Assumption of relatively constant sediment input
- Extrapolation of two-dimensional simplicity not representative of three-dimensional complexity
- Assumption of eustasy
- Eustasy potentially masked by other depositional variables
- Assumption of Milankovitch mechanism

- Assumption of subaerial erosion surfaces incompatible with Deluge
- Assumption of Walther's "Law"
- Useful only for particular sedimentary basins with passive margins
- Requires considerable data to accurately define systems tracts

Problems Shared With Other Stratigraphic Methods

Still other pitfalls are common to the various stratigraphic methods employed within the context of the EGP and assimilated into sequence stratigraphy. Event stratigraphy, which addresses a smaller scale than typically addressed by sequence stratigraphy (Seilacher, 1991), is genetic by its very nature. It is often used in conjunction with sequence stratigraphy (R. Walker, 1990). As demonstrated above, sequence stratigraphy is not a departure from the geologic column or the idea of evolutionary succession in biostratigraphy. Although some creationists assert that the general biostratigraphic trends presented in the geologic column are indisputable (Mehlert, 1993a, p. 77; Robinson, 1995; 1996; 1997; Ritland, 1981; Snelling *et al.*, 1996), others have countered with qualitative arguments, generally "out-of-order" fossils or formations (Lammerts, 1984a; 1984b; 1985a; 1985b; 1986a; 1986b; 1986c; 1987; Whitcomb and Morris, 1961). I am aware of only one study to date (Woodmorappe, 1981) that has addressed fossil succession on a statistical basis. Woodmorappe admitted that his study was biased in favor of the geologic column, since he tacitly incorporated biostratigraphic "data" from the scientific establishment, with the result that they were heavily affected by EGP bias. His study also was limited to gross successional tendencies at the systems level. Even so, the "order" discovered in his study was far from unequivocal, as elucidated in his TAB model (Woodmorappe, 1983; Mehlert, 1993a; 1993b). Until additional statistical studies *free from EGP bias* have indicated a statistically significant (nonrandom) distribution of the fossils, *the alleged order of the fossils remains far from established. Neither have worldwide unconformities been confirmed* (Morris, 1996, p. 55; Vail *et al.*, 1991, p. 621; Woodmorappe, 1978, p. 193), as appealing as the idea has been over the centuries. As pointed out by other researchers (Froede, 1995; 1998; Reed, Froede and Bennett, 1996), much field work must be done before even regional correlation becomes possible. Fossil succession and worldwide unconformities, though they may be at least partially accurate, remain subjective and unsubstantiated concepts. Introduction of any one of these flawed stratigraphic methods into sequence stratigraphy hampers the method.

Sequence Stratigraphy: Useful Techniques for Diluvialists?

Bartlett (1997) has spoken most forcefully for acceptance of sequence stratigraphy *as a method* by creationists. Davison's (1995) efforts to apply these principles in the field may be the most ambitious by a creationist to date. Davison made a concerted effort to apply the idea of global unconformities within a diluvial context.

Some of the more "radical" (in the eyes of some) diluvialists have sought to free themselves from the shackles of the geologic column entirely. Froede (1994; 1995) and T. Walker (1994) proposed two new stratigraphic schemes within the DGP, the former inclusive of sequence stratigraphic concepts. These represent attempts to break free of the EGP baggage that stifles progress in stratigraphy with mixed question elements. Since both of these are chronostratigraphic *natural history models*, they are not scientific models *per se*. If recognized as natural history models, they may be useful in natural history research. Can sequence stratigraphy play a role in these models?

Froede (1994; 1997), while making clear that he rejects the timescale of the EGP, has attempted to extricate sequence stratigraphic principles from the EGP and use them in *local* settings within the context of the DGP, a controversial approach for some. Bartlett (1997, p. 6) states:

Froede's (1994) and Davison's (1995) declaration rejecting the uniformitarian context of sequence stratigraphy emphasized the secularist's dependence on the evolutionary geologic timescale. Indeed, Froede (1995) proposed a creationist geological timescale including whole new units, groups, divisions, and timeframes. However, a new system of time reference is wastefully repetitious. Likewise, Davison's (1995, p. 224) suggestion that 'creationists need to reinterpret the *rocks*, and not the evolutionists' interpretation of these rocks' moves us dangerously back to square one—to the days preceding William "Strata" Smith (1769–1839).

Instead of proposing a new geological timescale or starting the discipline anew from some obscure position further convoluting the creationist appeal, creationist/Flood advocates should seize and take control of the present secularist debate regarding *global catastrophe*—a philosophic appeal—having made its official debut in the uniformitarian (quietist) literature with the proposal offered by the Alvarez group Time should *not* be used to define sequence-stratigraphic units. *Interpretation of global origin should now be used to define and describe sequence-stratigraphic unit types* (emphasis his).

The problems with Bartlett's conclusion have already been shown. But there are problems with the models promoted by Davison, Froede, T. Walker, and others as well.

These result from difficulties inherent in addressing mixed questions, a frequent paucity of diagnostic data (both historical and physical), difficulties in correlation, difficulties in matching seismic reflectors with sequence boundaries in a meaningful way, and difficulties in determining depositional environment, among other factors. One of the greatest difficulties for those attempting to utilize sequence stratigraphy (partially or wholly) within a creationist worldview is its mixed question nature. How can one accommodate seismic data while maintaining necessary skepticism toward eustasy and the geologic column? Stratigraphic analysis is not easy!

None of the creationist researchers promoting sequence stratigraphy provides a compelling Biblical case for his particular historical idea. Each of those proposing a diluvial natural history model has made a good effort to *exegetically* establish his model on a Biblical basis, but Scripture does not provide a compelling textual case for the degree of precision sought, whether sequence stratigraphic or not. *No Biblical basis is offered for the idea of sea level cycles* (other than the obvious "supermegasequence" of Bartlett). Not even the onset of the Deluge (Genesis 7:11) provides a certain basis for a global unconformity (cf. Froede, 1998, p. 13). Although the first forty days of the Deluge might have left an inter-regional unconformity, even this is far from certain (Hunter, 1996). Without a Biblical⁶ basis, none of these natural history models can progress beyond "enlightened speculation" at best. To the extent that a given natural history model conforms to holy writ, the model may be useful in application to historical data or interpretations. In the majority of geologic studies, they will be limited to interpretations. The essential limitation of geology as both science and mixed question may be most unsatisfying to one who desires to know "what really happened," but failure to recognize that limitation leads only to deception.

Conclusions

Sequence stratigraphy marks a significant departure from the rigid chronostratigraphy that has characterized geology for the past 150 years. It marks a renewed emphasis on scientific data and has been a cause for great optimism on the part of some (Bartlett, 1997). Unfortunately, this optimism appears ill advised when the philosophical basis of sequence stratigraphy is examined.

Sequence stratigraphy does not constitute an empirical (i.e. scientific) geologic model. Sequence stratigraphy is presently enmeshed in the EGP, and thus is unsuitable for

⁶It is possible that extrabiblical historical accounts exist for small areas, though they would be neither as comprehensive nor authoritative as the Bible.

incorporation into the DGP. The “interpretation of global origin” recommended by Bartlett and practiced by those promoting sequence stratigraphy implies correlation, a correlation necessarily based on genetic interpretations. Evolutionists, with implicit faith, employ radiometric dating, assumed eustatic cycles, and (above all) a form of biostratigraphy which assumes evolution. To what extent can a diluvialist expect reliable data from such a source? Separation of empirical data from the “mixed” metaphysical matrix of the EGP is probably not feasible. Sequence stratigraphy is therefore suitable as neither a scientific nor a chronostratigraphic method.

Because mixed question problems require mixed question solutions, “data” cannot be shared between disparate world-views with any reasonable degree of confidence. Empirical elements must be identified, then carefully removed from their “mixed” or metaphysical matrix. It is doubtful whether this is feasible in the majority of cases. *Because sequence stratigraphy is a mixed question approach, combining descriptive and genetic elements, it is not suitable as a stratigraphic scheme for interpretation of geologic data within the DGP.* This is true both because of the inextricably interwoven elements of the EGP in mainstream sequence stratigraphy, and because the method depends on eustatic oscillations not compatible with Scripture and not otherwise supported historically. The only potential exception to the latter objection would be Bartlett’s “supermegasequence,” which might result in a single global transgressive-regressive sequence. Existence of such a sequence might be difficult to establish.

This does not mean that sequence stratigraphy—or at least elements of it—is of no value to diluvialists. Sequence stratigraphy is an attempt to accommodate real (empirical) geophysical data. Further, its emphasis on unconformities is helpful to recognition of real (empirical) divisions in the stratigraphic record (R. Walker, 1990, p.785). These emphases may prove fruitful in future research. If there is an order to the fossils—and there may be—sequence stratigraphic methods may be helpful in understanding that order. This may potentially bolster or elucidate Woodmorappe’s TAB model.

Bartlett (1997, p. 6) decried Davison’s suggestion that ‘creationists need to reinterpret the rocks, and not the evolutionists’ interpretation of these rocks,’ saying it “moves us dangerously back to square one—to the days preceding William ‘Strata’ Smith.” Bartlett is right. And so is Davison. The whole geologic establishment went awry back then, and it is high time we did something about it!

It is highly desirable that a scheme consistent with the objective of stratigraphic analysis as expressed by the North American Commission on Stratigraphic Nomenclature (1983) be developed: “The objective of a system of classification is to promote unambiguous communication in a manner not so restrictive as to inhibit scientific progress.

To minimize ambiguity, *a code must promote recognition of the distinction between observable features (reproducible data) and inferences or interpretations*” (p.847, emphasis mine). Diligent attention to the time-independent definitions of the descriptive stratigraphic methods listed in Table I and below may meet this need:

- *lithostratigraphy* (including lithodemic stratigraphy): recognizing facies changes
- *magnetostratigraphy*: if empirically defined
- *biostratigraphy*: if empirically defined
- *allostratigraphy*: when applicable and when sufficient data are available

The efforts of creationist researchers such as Bartlett, Davison, Froede, and Woodmorappe are commendable. Disagreement, particularly at this nascent stage in the development of the science, is neither surprising nor unhealthy. It is, however, crucial that we maintain a critical perspective toward the various ideas we encounter, including our own (Proverbs 29:25; James 1:5; II Peter 3:3–7; I John 4:1–4). Brand (1974, p. 78) put it well:

This analysis of changing paradigms may help us in our consideration of the relation between science and religion. When a prevailing paradigm, such as the geologic paradigm requiring a long history for life on earth, contradicts sacred history, the problem will not be solved by making a few adjustments in current geologic theory.

Careful attention to the philosophic background and constraints of science, particularly in regard to mixed questions, is vital to the successful development of a scientifically and biblically sound approach to stratigraphy. Humility is also essential (Proverbs 15:33; 29:25). As others have emphasized (Lumsden, 1992; Pearcey, 1989), it is imperative that those called by Christ’s name do only the finest research (Deuteronomy 6:4,5. Proverbs 3:7. Ecclesiastes 9:10. I Corinthians 10:31. Colossians 3:17,23,24). Our Lord deserves nothing less.

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Glossary

depocenter: site of maximum deposition in a sedimentary basin.

Exxon or Galloway scale: sedimentary sequences of regional, interregional or continental scale, often resembling group or supergroup rank per standard nomenclature.

intermontane: located between mountain ranges.
 lithofacies: a mappable rock body distinguished by lithology (i.e. lithostratigraphically).
 maximum flooding surface: the point in the eustatic cycle of maximum areal transgression preceding highstand; used as cycle marker in Bureau of Economic Geology (Galloway) approach (Bartlett, 1997, p. 17).
 megasequence: sedimentary sequence of largest scale recognized in EGP, corresponding to first-order cycles of the Vail Curve.
 Milankovitch mechanism (a.k.a. orbital forcing): idea that climatic change is periodic and driven by slight eccentricities in Earth's orbit, axial tilt, etc.
 paleoclimatology: study (or speculation) of ancient climates, inferred from various data (lithofacies, paleogeography, fossils, etc.).
 paleoecology: study/speculation relative to ecology of an area in ancient times.
 paleoenvironments: past environments, generally inferred from lithofacies, fossils and other data.
 paleogeography: study of geography at points in the past, often inferred from facies changes.
 paleosol: a "fossil soil" or lithified soil horizon.
 radiometric dating: age inferred from ratios of radiogenic isotopes.
 systems tracts: related, contemporaneous depositional systems which reflect position in the transgressive-regressive cycle (e.g. highstand systems tract).
 Walther's Law: doctrine that a vertical facies sequence represents a series of laterally adjacent depositional environments (i.e. geographical and paleoecological environments) and that only those environments observed in proximity today existed in proximity in the past.
 well log data: geophysical data obtained from boreholes (gamma, resistivity, etc.).

References

- CENTJ*: *Creation Ex Nihilo Technical Journal*
CRSQ: *Creation Research Society Quarterly*
GSAB: *Geological Society of America Bulletin*
- Algeo, Thomas J. and Kirill B. Sestavinsky. 1995. The Paleozoic world: continental flooding, hypsometry, and sealevel. *American Journal of Science* 295:787–822.
- Bandy, Richard. 1998. Personal communication.
- Bartlett, Allen C. 1997. Sequence stratigraphy: value and controversy—for whom? *CRSQ* 34:5–22.
- Berthault, Guy. 1997. Sedimentation experiments: is extrapolation appropriate? A reply. *CENTJ* 11:65–70.
- Brand, Leonard R. 1974. A philosophic rationale for a creation-Flood model. *Origins* 1:73–83.
- Broecker, Wallace S. and George H. Denton. 1990. What drives glacial cycles? *Scientific American* 262(1):49–56.
- Christie-Blick, Nicholas, G.S. Mountain and K.G. Miller. 1990. Seismic stratigraphic record of sea-level change. In *Sea level change*, pp. 116–140. National Academy Press, Washington, D.C.
- Cowart, Jack H. and Carl R. Froede, Jr. 1994. The use of trace fossils in refining depositional environments and their application to the creation model. *CRSQ* 31:117–124.
- Davison, Gordon E. 1995. The importance of unconformity-bounded sequences in Flood stratigraphy. *CENTJ* 9:223–243.
- DeBoer, P.L. and D.G. Smith, editors. 1994. *Orbital forcing and cyclic sequences*. International Association of Sedimentologists Special Publication Number 19. Blackwell Scientific Publications, Boston, MA.
- Dott, Robert H., Jr, editor. 1992. *Eustasy: the historical ups and downs of a major geological concept*. Geological Society of America Memoir 180.
- Einsele, G. and U. Bayer. 1991. Asymmetry in transgressive-regressive cycles in shallow seas and passive continental margin settings. In Einsele, Gerhard, Werner Ricken and Adolf Seilacher, editors. *Cycles and events in stratigraphy*, pp. 660–681. Springer-Verlag, New York.
- Froede, Carl R., Jr. 1994. Sequence stratigraphy and creation geology. *CRSQ* 31:138–147.
- . 1995. A proposal for a creationist geological time-scale. *CRSQ* 32:90–94.
- . 1997. The Flood event/ice age stratigraphic boundary on the United States southeastern coastal plain. *CRSQ* 34:75–83.
- . 1998. *Field studies in catastrophic geology*. Creation Research Society Books. St. Joseph, MO.
- Hanneman, Debra L. and Charles J. Wideman. 1991. Sequence stratigraphy of Cenozoic continental rocks, southwestern Montana. *GSAB* 103:1335–1345.
- Haq, Bilal U., Jan Hardenbol and Peter R. Vail. 1987. Chronology of fluctuating sea level since the Triassic. *Science* 235:1156–1166.
- Hunter, Max J. 1996. Is the pre-Flood/Flood boundary in the earth's mantle? *CENTJ* 10:344–357.
- Jeletzky, J.A. 1978. Causes of Cretaceous oscillations of sea level in western and arctic Canada and some general geotectonic implications. Geological Survey of Canada Paper 77–18.
- Johnson, Markes E. 1992. A.W. Grabau's embryonic sequence stratigraphy and eustatic curve. In Dott, Robert H., Jr, editor. *Eustasy: the historical ups and downs of a major geological concept*. Geological Society of America Memoir 180.
- Lammerts, Walter E. 1984a. Recorded instances of wrong-order formations: a bibliography—Part I. *CRSQ* 21:88.
- . 1984b. Recorded instances of wrong-order formations: a bibliography—Part II. *CRSQ* 21:150.

- . 1985a. Recorded instances of wrong-order formations: a bibliography—Part III. *CRSQ* 21:200.
- . 1985b. Recorded instances of wrong-order formations: a bibliography—Part IV. *CRSQ* 22:127.
- . 1986a. Recorded instances of wrong-order formations: a bibliography—Part V. *CRSQ* 22:188,189.
- . 1986b. Recorded instances of wrong-order formations: a bibliography—Part VI. *CRSQ* 23:38.
- . 1986c. Recorded instances of wrong-order formations: a bibliography—Part VII. *CRSQ* 23:133.
- . 1987. Recorded instances of wrong-order formations: a bibliography—Part VIII. *CRSQ* 24:46.
- Lumsden, Richard D. 1992. Error and worse in the scientific literature. *CRSQ* 29:127–132.
- Martinsen, Ole J. and William Helland-Hansen. 1995. Strike variability of clastic depositional systems: does it matter for sequence-stratigraphic analysis? *Geology* 23:439–442.
- Mehlert, A.W. 1993a. An evaluation of the John Woodmorappe Flood geology model—Part I. *CRSQ* 30:77–86.
- . 1993b. An evaluation of the John Woodmorappe Flood geology model—Part II. *CRSQ* 30:149–159.
- Miall, Andrew D. 1986. Eustatic sea level changes interpreted from seismic stratigraphy: a critique of the methodology with particular reference to the North Sea Jurassic record. *The American Association of Petroleum Geologists Bulletin* 70:131–137.
- . 1992. Exxon global cycle chart: an event for every occasion? *Geology* 20:787–790.
- . 1997. *The geology of stratigraphic sequences*. Springer Verlag, Heidelberg.
- Morris, Henry M. 1996. The geologic column and the Flood of Genesis. *CRSQ* 33:49–57.
- Noël, Mark. 1977. The late Weichselian geomagnetic event. *Nature* 267:181.
- North American Commission on Stratigraphic Nomenclature. 1983. North American stratigraphic code. *American Association of Petroleum Geologists Bulletin* 67(5):841–875.
- Oard, Michael J. 1984a. Ice ages: the mystery solved? Part I: the inadequacy of a uniformitarian ice age. *CRSQ* 21:66–76.
- . 1984b. Ice ages: the mystery solved? Part II: the manipulation of deep-sea cores. *CRSQ* 21:125–137.
- . 1985. Ice ages: the mystery solved? Part III: paleomagnetic stratigraphy and data manipulation. *CRSQ* 21:170–181.
- . 1990. *An ice age caused by the Genesis Flood*. Institute for Creation Research, San Diego, CA.
- . 1997. *Ancient ice ages or gigantic submarine landslides?* Creation Research Society Books, St. Joseph, MO.
- Parkinson, Neil and Colin Summerhayes. 1985. Synchronous global sequence boundaries. *The American Association of Petroleum Geologists Bulletin* 69:685–687.
- Pearcey, Nancy. 1989. Your white coat is slipping. *Bible-Science Newsletter* 27(12):3.
- Pekar, Stephen and Kenneth G. Miller. 1996. New Jersey Oligocene “icehouse” sequences (ODP Leg 150X) correlated with global $\delta^{18}\text{O}$ and Exxon eustatic records. *Geology* 24:567–570.
- Pitman, Walter C. III. 1978. Relationship between eustasy and stratigraphic sequences of passive margins. *GSAB* 89:1389–1403.
- Poulsen, Chris J., Peter B. Flemings, Ruth A.J. Robinson and John M. Metzger. 1998. Three-dimensional stratigraphic evolution of the miocene Baltimore Canyon region: implications for eustatic interpretations and the systems tract model. *GSAB* 110:1105–1122.
- Reed, John K., Carl R. Froede, Jr. and Chris B. Bennett. 1996. The role of geologic energy in interpreting the stratigraphic record. *CRSQ* 33:97–101.
- Ritland, Richard. 1981. Historical development of the current understanding of the geologic column: Part I. *Origins* 8:59–76.
- Robinson, Steven J. 1995. From the Flood to the exodus: Egypt’s earliest settlers. *CENTJ* 9:45–68.
- . 1996. Can Flood geology explain the fossil record? *CENTJ* 10:32–69.
- . 1997. The geological column: a concept fundamental to Flood geology. *Origins* (Journal of the Biblical Creation Society) 23:14–30.
- Ronov, Alexander B. 1994. Phanerozoic transgressions and regressions on the continents: a quantitative approach based on areas flooded by the sea and areas of marine and continental deposition. *American Journal of Science* 294:777–801.
- Seilacher, A. 1991. Events and their signatures—an overview. In Einsele, Gerhard, Werner Ricken and Adolf Seilacher, editors. *Cycles and events in stratigraphy*, pp. 222–226. Springer-Verlag, New York.
- Schwarzacher, W. 1991. Milankovitch cycles and the measurement of time. In Einsele, Gerhard, Werner Ricken and Adolf Seilacher, editors. *Cycles and events in stratigraphy*, pp. 855–863. Springer-Verlag, New York.
- Sloss, L.L. 1963. Sequences in the cratonic interior of North America. *GSAB* 74:93–114.
- Snelling, Andrew A., Martin Ernst, Esther Scheven, Joachim Scheven, Steven A. Austin, Kurt P. Wise, Paul Garner, Michael Garton, and David Tyler. 1996. The geological record. *CENTJ* 10:333, 334.
- Thompson, R. and B. Berglund. 1976. Late Weichselian geomagnetic ‘reversal’ as a possible example of the reinforcement syndrome. *Nature* 263:490–491.

- . 1977. The late Weichselian geomagnetic event (reply). *Nature* 267:181–182.
- Thorne, J. and A.B. Watts. 1984. Seismic reflectors and unconformities at passive continental margins. *Nature* 311:365–368.
- Vail, P.R., R.M. Mitchum, Jr. and S. Thompson, III. 1977. Seismic stratigraphy and global changes of sea level, Part 4: global cycles of relative changes of sea level. In Payton, Charles E., editor. *Seismic stratigraphy—applications to hydrocarbon exploration*, pp. 83–97. American Association of Petroleum Geologists, Tulsa, OK.
- . F. Audemard, S.A. Bowman, P.N. Eisner, and C. Perez-Cruz. 1991. The stratigraphic signatures of tectonics, eustasy and sedimentology—an overview. In Einsele, Gerhard, Werner Ricken and Adolf Seilacher, editors. *Cycles and events in stratigraphy*, pp. 617–659. Springer-Verlag, New York.
- Van Wagoner, J.C., H.W. Posamentier, R.M. Mitchum, Jr., P.R. Vail, J.F. Sarg, T.S. Loutit and J. Hardenbol. 1988. An overview of the fundamentals of sequence stratigraphy and key definitions. In Wilgus, C.K., B.S. Hastings, H. Posamentier, J. Van Wagoner, C.A. Ross and C.G. St. C. Kendall, editors. *Sea-level changes: an integrated approach*. Society of Economic Paleontologists and Mineralogists Special Publication No. 42, pp. 39–45.
- Verosub, Kenneth L. 1975. Paleomagnetic excursions as magnetostratigraphic horizons: a cautionary note. *Science* 190:48–50.
- Walker, Roger G. 1990. Facies modeling and sequence stratigraphy. *Journal of Sedimentary Petrology* 60(5): 777–786.
- Walker, Tasman B. 1994. A biblical geologic model. In Walsh, R.E. (editor), *Proceedings of the third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.
- Watkins, Norman D. 1971. Geomagnetic polarity events and the problem of ‘the reinforcement syndrome.’ *Comments on Earth Sciences and Geophysics* 2:36–43.
- . 1972. Review of the development of the geomagnetic polarity time scale and discussion of prospects for its finer definition. *GSAB* 83:551–574.
- Whitcomb, John C. and Henry M. Morris. 1961. *The Genesis Flood*. The Presbyterian and Reformed Publishing Company, Philadelphia, PA.
- Woodmorappe, John. 1978. A diluvian interpretation of ancient cyclic sedimentation. In Woodmorappe, 1993: *Studies in Flood geology*, pp. 199–220. Institute for Creation Research, San Diego, CA.
- . 1979. The essential nonexistence of the evolutionary-uniformitarian geologic column: a quantitative assessment. In Woodmorappe, 1999, *Studies in Flood geology*, pp. 103–130. Institute for Creation Research, San Diego, CA.
- . 1980. An anthology of matters significant to creationism and diluvology: report 1. In Woodmorappe, 1999, *Studies in Flood geology*, pp. 131–144. Institute for Creation Research, San Diego, CA.
- . 1983. A diluviological treatise on the stratigraphic separation of fossils. In Woodmorappe, 1999: *Studies in Flood geology*, pp. 21–75. Institute for Creation Research, San Diego, CA.
- . 1996. Studies in Flood geology: clarifications related to the ‘reality’ of the geologic column. *CENTJ* 10:279–290.

Book Review

Over the Edge by Larry Vardiman

Master Books, Green Forest, AR. 1999, 160 pages, \$9.95

This humorous book describes experiences from two decades of creation tours at Arizona’s Grand Canyon. These bus, raft and backpacking tours are conducted by the Institute for Creation Research. Author Larry Vardiman, research scientist and professional meteorologist, has led many of the tours, totaling more than 2,000 people. He has assembled a personal diary of highlights, while also explaining many Genesis Flood evidences found within the canyon. He describes group discoveries of artifacts and also many spiritual victories. For all who have taken one of the

tours or think of doing so, this book is of interest. Larry writes down many practical tips about visiting the canyon, whether hiking or riding. And in what other book can you find a humorous sketch of creationist Duane Gish, wearing a ten-gallon hat, riding down the trail on a mule?

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Photo Essay

Parasitism by Design? The Surface Micromorphology of Flatworms

Mark H. Armitage and Richard D. Lumsden*

Tapeworms and other invertebrate parasitic flatworms are often characterized as devolved or degenerate organisms since many of them have no mouth or digestive system. Studies with the electron microscope, however, show that this is a trivial matter for a tapeworm because their very tegument, or outer skin is nothing but an absorptive organ, closely resembling the intestinal mucosal lining of the very vertebrate host which they inhabit. Creationists contend that this is a designed tegument, impossible to explain on an evolutionary basis.

As archaic as the Palaeozoic, ... (tapeworms) ... are as modern as tomorrow. they have attained the ideal welfare state with all its beneficence; ... Regarded by some as slimy, loathsome, abhorrent ... they are really very intriguing and fascinating organisms (Stunkard, 1964).

Adult tapeworms, among other flatworms, are parasites of the vertebrate intestine or its adjuncts like the bile duct where their capacity for nutrient assimilation is phenomenal. Paradoxically, these denizens of the bowel are themselves “gutless wonders”, lacking even a vestige of a mouth, alimentary canal or intestine at all stages in their life history. Literally awash in nutrients taken in and digested by their obliging hosts, the tapeworms’ deficit of organs proves to be only trivial. Studies with the electron microscope (this study and Lumsden, 1975) have revealed that the anatomy of the outer tegument (body surface) of some flatworms is essentially that of an intestine turned inside out, where the *entire* body surface becomes the organ for absorption, with the same sorts of structural and physiological specializations for nutrient uptake that we find in the intestinal mucosal epithelium of the very vertebrate host (Figures 1 and 2). The redial stage (a juvenile stage which occurs within the confines of snail host tissues) for the worm *Ascocotyle (Phagicola) diminuta* (Figure 5) manifests the very same sort of tegument. Macroevolutionists attribute this to “convergent evolution” in which a vertebrate and an invertebrate each independently produced identical absorptive tissues—an unlikely hypothesis. In this redial stage, a large number of swimming cercariae develop within the sausage-shaped redia (Figure 6). The cercariae are then expelled through a birth pore (Figure

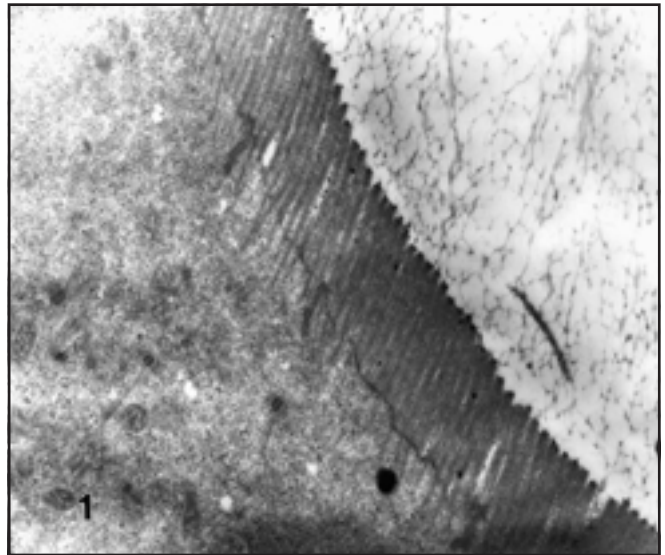


Figure 1. Intestinal mucosa of Pacific killifish, 13,000X (TEM). The intestinal mucosa of this fish is where the flatworm *A. (P.) diminuta* takes up residence. Notice how the tissue of a vertebrate animal seen here and in Figure 2 has a striking similarity to the brush border tissue of the tegument of the invertebrate parasite seen in Figures 3 and 5. Such a close resemblance defies evolutionary explanations.

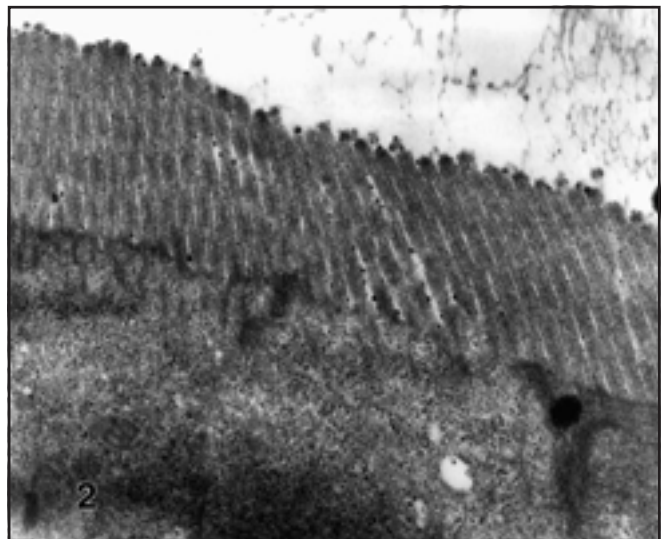


Figure 2. Intestinal mucosa of Pacific killifish, 15,000X (TEM). Here a higher magnification reveals the complex microvilli of the vertebrate intestinal lining.

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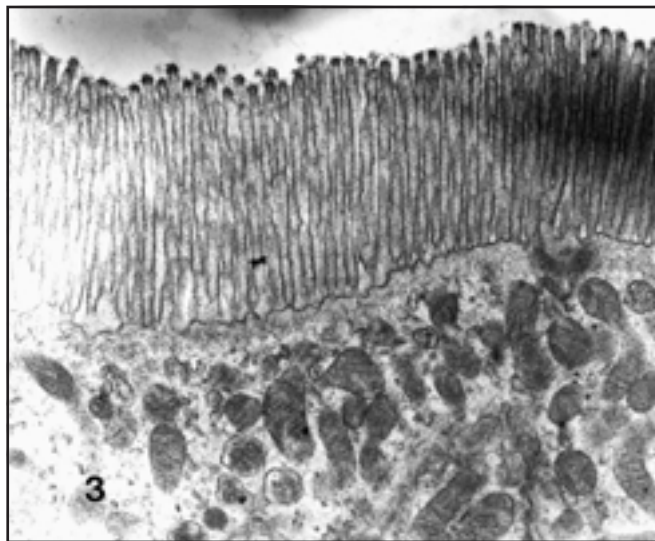


Figure 3. Redial tegument brush border of *Ascocotyle (P.) diminuta* 13,000X (TEM). The brush border microtriches of the invertebrate parasite tegument strikingly resemble the intestinal lining of the very vertebrate host that this parasite inhabits.

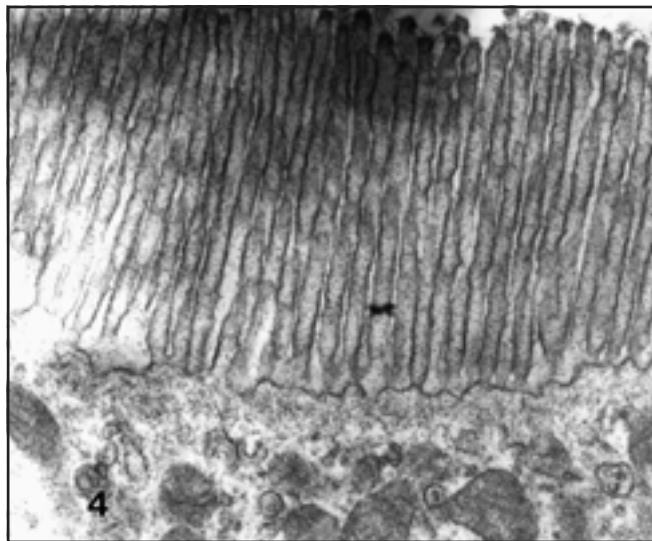


Figure 4. Redial tegument brush border of *Ascocotyle (P.) diminuta* 15,000X (TEM). Here a higher magnification reveals the equally complex microtriches of the invertebrate tegument.

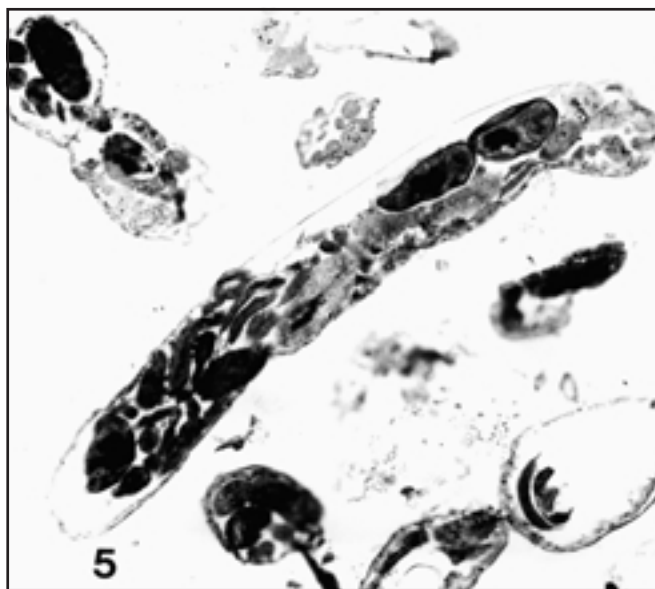


Figure 5. Light micrograph of sectioned redia showing internal cercariae, 200X. The redia, from which Figures 3 and 4 were made, is a sausage shaped structure which develops in the snail host. This redia can hold up to 50 or more developing cercariae.

7). Tegumental specializations include a highly amplified plasma membrane at the microecological interface, containing a variety of transporter proteins or “permeases” which catalyze the uptake of amino acids, sugars, vitamins, etc., and an enzymology which couples the flatworm’s energy metabolism to the work function of “active transport” (Lumsden and Murphy, 1980).



Figure 6. Redia showing closed birth pore, 400X (SEM). In this scanning electron micrograph of a full redia, the multifolded brush border tegument is evident. Notice also the birth pore (arrow) from which cercariae will emerge.



7. Rediae showing birthing of cercariae, 400X (SEM). Here 2 rediae are simultaneously “birthing” cercariae (arrows) which will swim out of the snail in search of the fish host.

Such complexity belies the adage of “devolved parasite degeneracy” where, in the process of their putative evolution from free-living ancestry, flatworms allegedly “lost” the gastrointestinal tract. Quite the contrary—it is our thesis that as intestinal parasites, these organisms are marvelously designed to take maximal advantage of the symbiotic relationship. If creationists find evidence for design in the structure, function, and efficiency of the vertebrate intestinal mucosa, (as they should), how could they interpret the comparable complexity and efficiency of the tapeworm surface otherwise?

Degeneracy is in the eye of the beholder; there is nothing *inherently* perverse about parasitism, at least in the context of biology. No organism is totally independent of other kinds of organisms where reliance upon them in meeting biological requirements is concerned. To one degree or another, all successful organisms exploit their environments. Where the Earth’s biota are concerned, there are three principal habitats: (1) The lithosphere (land), (2) the hydrosphere (water), and (3) the biosphere (other organisms). In their “peculiar” anatomy, tapeworms simply

manifest the features best designed to their “Third World” ecological niche.

Histologically, the tapeworm tegument is a protoplasmic syncytium in which one large cell has many nuclei. Its cytoarchitecture remarkably reminiscent of the syncytiotrophoblast of the mammalian placenta. As form would follow function, the similarity is not coincidental. Both must sustain a high rate of continuous growth in the differentiated state which is the *raison d’etre* for syncytial organization in the first place. The dedicated function of both systems is that of nutrient absorption. The principle here is that of *unity in diversity*, which to creationists would be evidence of utilitarian elegance in design efficiency (as thoughtful engineers would use the term—see French, 1993).

The hallmark feature of the adult tapeworm tegument is a microscopic “brush border” of digitiform projections, termed “microtriches”, the majority of which resemble in most of their features the microvilli of intestinal mucosal epithelial cells. This is also the case for the outer tegument of the redia as mentioned (Figures 3 and 4). These figures show low and high power micrographs of the microtriches (singular microthrix) of a redia, which correspond in morphology to the microvilli of vertebrate intestinal mucosa, in this case, from the intestine of the Pacific killifish (Figures 1 and 2), the very host in which the flatworm develops. Figure 5 shows a light micrograph of a sectioned redia with several developing cercariae inside the redia. In both cases, the patent function of these microvilli is to amplify the physiologically active surface area for absorption, an interpretation consistent with the Michaelis-Menton type kinetics of nutrient uptake manifested and the localization of transport catalytic sites in the membrane so amplified (Lumsden and Murphy, 1980; French, 1993).

A highly significant biochemical corollary is the presence in both the basolateral membrane of the tapeworm tegument and the vertebrate intestinal mucosal epithelium of Na^+/K^+ ATPase activity. This engenders the physicochemical gradients that drive accumulative absorption of several essential amino acids, hexose sugars, nucleosides, etc. (Lumsden and Murphy, 1980; Murphy, 1981). As tapeworms would so nurture their prodigious biosynthetic activities, such as in the production of tens of thousands of eggs per day, they also face the rather banal task of resisting expulsion in the face of intestinal peristalsis. Once again the microthrix plays a role. At various locations such as the scolex, or “head end” of the worm, the microtriches are designed in the form of hooks, functioning as holdfasts (Lumsden, 1975; Lumsden et al. 1982). Again, we have an example of engineering elegance—the specialization of the initial design as demanded by diverse needs.

Glossary

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.

Microtriches: Microvillar surface projections used for nutrient absorption by parasitic flatworms such as the tapeworm, and which resemble the microvilli of the vertebrate gut.

Mucosal epithelium: Vertebrate intestinal lining containing mucous producing cells.

Redial: 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.

Tegument: The outer layer or skin of a tapeworm.

TEM: Transmission Electron Microscope which images metal coated thin sections of tissues to magnifications up to 200,000 diameters using primary or direct electron capture.

References

- French, M. 1993. *Invention and evolution: Design in nature and engineering*. Cambridge University Press, Cambridge.
- Lumsden, R.D. 1975. The surface ultrastructure and cytochemistry of parasitic helminths. *Experimental Parasitology* 37: 267–339. See also *Transactions of the American Microscopical Society* 94(1975): 501–507.
- Lumsden, R.D. and W.A. Murphy. 1980. Morphological and functional aspects of the cestode body surface. (In) C. Cook et al. (editors), *Cellular Interactions in Symbiosis and Parasitism*. The Ohio State University Press, Columbus. pp. 95–130.
- Lumsden, R.D. and W.A. Murphy. 1984. A comparison of phlorizin and phloretin adsorption by the tapeworm *Hymenolepis diminuta*. *Comparative Biochemical Physiology* 79A: 137–141.
- Lumsden R.D., M. Voge, and F. Sogandares-Bernal. 1982. The metacestode tegument: fine structure, development, topochemistry, and interactions with the host. (In) A. Flisser, K Williams, JP Laclette, C. Larralde, C. Ridaura, and F. Beltran (editors), *Cysticercosis: Present state of knowledge and perspectives*. Academic Press, New York. pp 77–233.
- Matthews, J.L. and J.H. Martin. 1971. *Atlas of human histology and ultrastructure*. Lea-Febiger, Philadelphia.
- Murphy, W.A. 1981. *Inhibitor studies characterizing the tegumental hexose transport system of the cestode Hymenolepis diminuta*. Ph.D. dissertation, Tulane University.
- Stunkard, H.W. 1964. The organization, ontogeny and orientation of the Cestoda. *Quarterly Review of Biology* 37: 23–34.

Book Reviews

The Explorers of Ararat and the Search for Noah's Ark by B.J. Corbin
Great Commission Illustrated Books, Long Beach, CA. 1999, 482 pages, \$24.95

Many explorers have climbed the rocks and ice of the mountains of Ararat, but, until now, we have not had a comprehensive report on their trips. B. J. Corbin says in his Dedication, "Though this book is not all-inclusive it gives a good representation of what Ark researchers have experienced while searching for Noah's Ark" (p. 5).

Corbin selected 13 explorers each of whom gives a first-hand account of what he encountered on his expeditions, giving the reader the impression of actually being there. It is as close to reality as will be found in print.

In addition to the experience of being in Turkey and overcoming the problems of obtaining permits, and of actually climbing the mountain or flying over it, the 13 writers tell of the research they had to do while in the United States. They read reports of others who had gone before

them, and they interviewed Ark specialists and those who claimed to have seen the Ark and photographed it.

Most of the authors in the book believe that Noah's Ark is on Mt. Ararat rather than on some nearby mountain. These writers include John McIntosh, Elfred Lee, Bob Stuplich, John Shockey, Robin Simmons, Robert Garbe, Chuck Aaron, John Morris, Ray Anderson, Richard Bright, and B.J. Corbin. Writers who dissented are Bill Crouse and Charles Willis who remind us that the Bible says "the mountains of Ararat" and it is possible that all of the efforts on Mt. Ararat are in vain and the Ark's resting place may be on Mt. Cudi, 200 miles south of Ararat.

Bill Crouse says,

From the perspective of history, there seem to be compelling ancient sources which argue for another

site as the final berth of Noah's Ark (p.149) ...ancient writers argued that the remains of the Ark of Noah could be found on a mountain known as "Cudi Dag" (p.152).

Some of the authorities Crouse quotes from are Berossus, Josephus, Eusebius, Faustus, Epiphanius, as well as several others.

These disagreements as to the location of the Ark might be resolved by The Quran, a 7th Century A.D. document which says, "The Ark came to rest upon Al-Judi..." (p. 344). Of this, Corbin says,

The Modern Muslim Encyclopedia is familiar with the early traditions that the Ark came to rest on Cudi Dag. However, the writer of the article under "Jebel Judi" believes Mohammed was referring to the Judi mountains in Saudi Arabia (p. 344).

Corbin continues,

Elfred Lee went to the Islamic Center in Washington, D.C. to research this issue. The curator of the center showed him a book which said that "Jebel Judi" was a peak of Mount Ararat. The curator also said that Judi results in Cudi which results in Kudi which results in Kurds. So there is a possibility that

finding the Ark on Mount Ararat could substantiate Jewish, Christian and Muslim sources.

This would be one area where Jews, Christians and Moslems actually agree (p. 344).

There are some people who believe that the Ark existed but that the explorers are searching in the wrong places. Albert Groebli believes the Ark is "under the sand dunes of the Dasht-e Kavir in Iran" (p. 314). The Dasht-e Kavir is a desert that was "lifted straight up 2000 feet" (p. 314).

A summary of 50 eye witness accounts is given by Corbin on page 468. However, the accounts differ as to the location so at least some of the reported eye witnesses must be mistaken.

Corbin provides an excellent bibliography but could have vastly improved the book with the inclusion of an index. Knowing that some readers are going to be "hooked" and will want to become "arkeologists" Corbin has written a section called "Recommendations for Future Expeditions" (p. 288). Because most of the book was written by actual Mt. Ararat explorers, this will be an excellent reference book on this subject for many years to come.

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Fossil Facts and Fantasies by Joe Taylor

Mt. Blanco Publishing Co. Crosbyton, TX. 1999, 80 pages, \$20

This creationist guide to fossils contains over 300 color photographs. Many show spectacular details of fossils, ranging from insects to horned crocodiles. Author Joe Taylor is a commercial hunter of fossils and also an artist. His prepared fossil specimens and molded reproductions are sought worldwide by natural history museums and private collectors. Taylor's own *Mt. Blanco Fossil Museum*, opened in 1998, is near Lubbock, Texas.

Discussion includes horse evolution, dinosaur eggs, and human footprints in stone. Excavation work at the Hanson Ranch by creationists in Wyoming is described up through 1996. Taylor believes that the Flood occurred 4,500 years ago (p. 32). He also suggests that a worldwide earthquake, crustal deformation, and animal entrapment accompanied the Lord's cross experience (p. 58).

Now for the difficult part of this review. A flyer accompanying the book claims that a new standard for creationist excellence has been set. However, editing errors appear on nearly every page, including spelling mistakes (lightning, Velikovsky). Author Taylor's anecdotal writing style is

friendly but frustrating. There are fantastic claims, including a ten-foot long living trilobite found on a California beach, but no documentation or references appear in the book on this topic or any other. There is also no index, a common defect of many creationist books. None of the impressive fossil photos include a scale to show sample size.

Author Taylor brags about how quickly he can prepare, mold, and mount a fossil specimen (p. 40). He also complains about the time needed to properly survey and map new fossil finds before their removal (p. 43). Such remarks are the very reason why commercial collectors are disparaged by professionals.

Buy the book and enjoy the interaction with an experienced creationist fossil hunter. The photographs will encourage you to someday visit the Mt. Blanco Museum.

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The Rise and Fall of Haeckel's Biogenetic Law

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Abstract

Evolutionists once commonly believed that all basic life forms which existed in our past multi-millions of years of evolution were rapidly repeated in the few months between conception and birth or hatching. Called the biogenetic law, this belief concluded that all embryos always rapidly pass through their evolutionary history, starting with the one cell stage, then in the case of humans developing into the fish stage, the reptile stage, the mammal stage, ape stage, and finally into a human-child

stage. This theory, commonly explained as "ontogeny recapitulates phylogeny," was cited as a major proof of evolution for over a century. This paper also reviews many of the biogenetic law claims commonly used in pre 1960's textbooks including the gill slits, tail, and yolk sac. Recent discoveries in the field of embryology and a reevaluation of the evidence for the theory has shown it is without foundation and now largely has been discarded by embryologists.

Introduction

Many evolutionists once believed that as the human embryo developed it passed through most of its major past evolutionary stages through which it was believed to have evolved. These people taught that human life begins as a single cell as did the first life forms, then grows into a fish stage, a reptile stage, a mammal stage, an ape stage and before birth ends up at the highest life form evolution has so far achieved, the human stage.

Although by the end of the 1920s the theory had, in Gould's words (1977a, p. 216), "utterly collapsed," it is ironically still mentioned as proof of evolution. As recently as 1987 it was claimed that many of the higher evolved animal embryos passed through "identical" evolutionary ancient stages before acquiring their unique modern features (Kent, 1987). This concept, called both the *biogenetic law* and the *embryonic recapitulation law* (or just the recapitulation law), is summarized by the expression "ontogeny recapitulates phylogeny" which means that "the development of the individual repeats the evolution of the race" (Moore, 1963, p. 608). The recapitulation law states that each successive stage

in the development of an individual represented one of the adult forms that appeared in its evolutionary history. The human embryo with gill depressions in the neck was believed, for example, to signify a fishlike ancestor. On this basis Haeckel gave his gen-

eralization: *ontogeny (individual development) recapitulates (repeats) phylogeny (evolutionary descent)*. This notion later became known simply as *recapitulation* or the *biogenetic law* (Hickman et al., 1996, p. 161).

In the words of Princeton's Conklin:

ontogeny, or the origin of individuals, and phylogeny, or the origin of races, are two aspects of one and the same thing, namely, organic development. There is a remarkable parallelism between the two, and in particular the factors or causes of development are essentially the same in both (1928, p. 64).

In other words, its embryonic stages reveal the development which an animal has gone through

...in the course of its evolution. Embryonic development is a brief and condensed repetition of a series of ancestral stages through which the race has passed. Or, as often stated, ontogeny (the development of the individual) recapitulates phylogeny (the development of the race). (Haupt, 1940, p. 345).

Some authorities have even tried to apply the biogenetic law to plants:

Even in plant development we see recapitulation. Germinating moss and fern spores produce a short filament of green cells which resembles a filamentous green alga. Soon the moss protonema develops into the male and female leafy shoots, while the filament of fern cells develops into the mature prothallus. For a brief period, though, mosses and ferns both pass through a stage reminiscent of the algae from which we think they evolved (Kimball, 1965, p. 546).

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A review of older biology textbooks reveals that the biogenetic law was considered “one of the most important sources of biological evidence for evolution” and for this reason was for years almost always discussed in textbooks that covered biological evolution (Smallwood, 1930, p. 392). Many biology texts still try to argue that the resemblances embryos display to their putative ancestors as they develop is an important proof of evolution.

The biogenetic law was even widely taught in popular lay books such as Dr. Spock's *Baby and Child Care* which sold over 40 million copies in 39 languages. Under the subheading “They're repeating the whole history of the human race” Spock wrote watching a baby grow is “full of meaning” because the development of each child retraces the whole history of the human race, physically and spiritually, step by step. Babies start off in the womb as a single tiny cell, just the way the first living thing appeared in the ocean. Weeks later, as they lie in the amniotic fluid in the womb, they have gills like fish. Toward the end of the first year of life, when they learn to clamber to their feet, they're celebrating that period millions of years ago when our ancestors got up off all fours. It's just at that time that babies are learning to use their fingers with skill and delicacy. Our ancestors stood up because they had found more useful things to do with their hands than walking on them (Spock, 1992, p. 301).

As we will see, this once common conclusion has been shown to be incorrect (McNamara, 1999). Nonetheless, the influence of the biogenetic law in convincing the public of the validity of macroevolution has been enormous, and it still is commonly mentioned in science text books even though it has been totally refuted.

So great was the desire on the part of some to strengthen this [biogenetic] idea, that a classic series of drawings showing embryonic similarities was produced in which the resemblances of the embryos of fish and man were remarkable. They were so remarkable, in fact, that further investigation showed that overzealous artistry had indicated a few resemblances that did not quite exist! (Moore, 1963, p. 608)

The Basis of the Theory

Extensive comparisons of most developing animals has confirmed that a great deal of similarity exists in both the structure and function of body morphology including skeletons, muscles, nerves, body organs and cell ultrastructure. For example, Haupt argues for evolution by claiming that fish gill slits exist during human embryo development and that

the heart is two chambered and the circulatory system distinctly fish-like. The heart then passes through a three-chambered stage, characteristic of

amphibians and reptiles, and finally becomes four chambered, as in birds and in other mammals. Similarly the human brain, in its embryonic development, passes through a series of stages corresponding to adult conditions in the lower vertebrate groups (1940, p. 347).

Embryos of different species share similar structures, and they often appear physically similar, at least superficially, especially in their earlier stages of development. Although in the zygote, cleavage, blastula, gastrula and other stages of development many animal kinds often look very similar, they contain profound differences.

Especially do all vertebrates from amphioxus to humans share fundamental resemblances, but even here many thousands of differences exist. As biological research progressed, more and more differences between fetal development and the life forms the animal supposedly evolved from were discovered, eventually disproving the biogenetic law. One major difference in life is their DNA which differs by many hundreds of thousands or millions of base pairs which eventually results in the more obvious morphological differences that result from the divergence that occurs in the animal's later developmental stages (Richardson et al., 1997).

Even the eggs of many animals display profound differences. Vertebrate eggs vary greatly in size, ranging from the microscopic eggs of mammals to the enormous eggs of birds. Eggs also differ in the conditions under which is necessary for them to develop: some eggs begin as naked cells independent of their parents; others are enclosed in both protective membranes and shells and are incubated by their parents. Still other eggs such as those of humans develop within the body of the mother. Associated with these varying conditions of development are many differences in egg size, rate of development, and methods of nutrition.

Modern History of Biological Recapitulation

The theory that the existence or the “ontogeny” of the fetus “recapitulates” or duplicates the evolution of the race was probably first expounded in modern times by Kiehmeyer in 1793 partly from the observation that a frog tadpole resembles a fish (Rusch, 1969). The theory was then developed by Müller in 1864, and later embryologist Karl Von Baer (1792–1876) published his ideas on the theory in 1828. Darwin in chapter 14 of his book *The Origin of Species* further developed the idea that the embryo's evolutionary history was written in its developmental stages (Darwin, 1859). Later it was elaborated and popularized by a German professor of comparative anatomy by the name of Ernst Haeckel (1834-1919) spelled Häckel in German (Rusch, 1969).

The biogenetic law has proved critically important in converting people to evolution, and for over a century has been cited as a major proof of evolution in science textbooks from high school to graduate school (Taylor, 1984). One reason the law was popular with text book authors was because it was a simple, easily grasped concept that can be effectively illustrated by diagrams which superficially appeared to prove the theory. Even Darwin and Huxley were impressed with Haeckel's illustrations, although as research revealed more and more flaws in his idea, many scientists realized Haeckel's biogenetic law went "far beyond anything resembling science," and it later actually became "an embarrassment to Darwin himself" (Milner, 1990, p. 205).

In a review of the history of the biogenetic law and why it was important, Conklin claimed a law which taught that every animal climbs its own ancestral tree in its development from egg to adult was a "god-send" to evolutionists, and as a result the study of embryology was pursued with feverish zeal...Here was a method which promised to reveal more important secrets of the past than would the unearthing of all the buried monuments of antiquity—in fact nothing less than a complete genealogical tree of all the diversified forms of life which inhabit the earth. It promised to reveal not only the animal ancestry of man and the line of his descent but also the ...origin of his mental, social, and ethical faculties (1928, p. 70).

The biogenetic law influenced the direction of research and it also distorted conclusions about past research findings (De Beer, 1958). As Rusch (1969, p. 27) noted "in most cases, recapitulation was considered to be sufficient cause for the various stages in embryological development" discouraging research into the true causes. Nonetheless, doubts about the theory began to emerge very early in its history:

For a time embryology was studied chiefly to learn the course of past evolution, but owing to the highly speculative character of such studies and to the differences of opinion as to what were original (palingenetic) and what were acquired (coenogenetic) characters, there gradually arose a widespread skepticism concerning the value of embryology for this purpose. Gegenbaur, in 1889, voiced the growing opinion among zoölogists in these words: "If we are compelled to admit that coenogenetic characters are intermingled with palingenetic, then we cannot regard ontogeny as a pure source of evidence regarding phyletic relationships. Ontogeny accordingly becomes a field in which an active imagination may have full scope for its dangerous play, but in which positive results are by no means everywhere to be attained. To attain such results the palingenetic and the coenogenetic phenomena must be sifted apart,

an operation that requires more than one critical *granum salis*." (Conklin, 1928, pp. 70–71).

Since then as serious problems with the "law" accumulated, more and more scientists discounted the theory, some even declaring that no evidence exists that ontogeny ever recapitulates phylogeny and that Haeckel's "biogenetic law" has no foundation in fact (Rusch, 1969, p. 28). Many of the major difficulties in the theory were well known in biology as early as 1928:

Inasmuch as many phenomena of development are mere adaptations to the conditions of embryonic or larval life and could never have been present in adult animals, Haeckel separated such characters, which he called "coenogenetic," from the truly ancestral ones, which he called "palingenetic." Unfortunately there was no certain method of always distinguishing these two types of embryonic characters, but in spite of this difficulty embryology was supposed to afford a short and easy method of determining the ancestral history of every group (Conklin, 1928, p. 70).

Other problems with the theory include the fact that no certain criterion existed by which the

palingenetic or ancestral features of development could be distinguished from the coenogenetic or recently acquired ones, and what one embryologist regarded as ancestral another might consider a recent addition. Furthermore, when there were no living or fossil animals resembling certain embryological forms the fancy was given free rein to invent hypothetical ancestors corresponding to such forms. As a result of such speculations multitudes of phylogenetic trees sprang up in the thin soil of embryological fact and developed a capacity of branching and producing hypothetical ancestors which was in inverse proportion to their hold on solid ground (Conklin, 1928, p. 70).

Unfortunately, in his enthusiasm to prove the law and thereby vindicate evolution, the biogenetic law's major supporter resorted to outright fraud.

Fraud Proven

Many of Haeckel's drawings that he used to support his biogenetic law now have been proven to be grossly fraudulent. Richardson, an embryologist at St. George's Hospital Medical School in London, concluded that generations of biology students

may have been misled by a famous set of drawings of embryos published 123 years ago by the German biologist Ernst Haeckel. They show vertebrate embryos of different animals passing through identical stages of development. But the impression they give, that

the embryos are exactly alike, is wrong ... [Richardson] hopes once and for all to discredit Haeckel's work, first found to be flawed more than a century ago ... (Pennisi, 1997, p. 1435)

The fraud was evidently actually first exposed in 1868 by University of Basel comparative anatomy Professor L. Rütimyer and then by Wilhelm His (1831–1904) in 1874. Dr. His was a comparative embryologist and professor of anatomy at the University of Leipzig. He concluded Haeckel's drawings and conclusions were a gross distortion of the facts. In a review of His's work, Taylor argued that Dr. His proved Haeckel had engaged in blatant fraud and therefore Haeckel

had eliminated himself from the ranks of scientific research workers of any stature (His 1874, p. 163). His, whose work still stands as the foundation of our knowledge of embryological development, was not the first to point out the deficiencies of Haeckel's work, nor indeed was he the last, yet Haeckel's fraudulent drawings have continued to the present day to be reproduced throughout the biological literature (Taylor, 1984, pp. 276–277).

Cambridge University biologist Pitman even claimed that after Haeckel formulated his 'fundamental biogenetic law' in 1868 he

...stated that the entire animal kingdom was descended from an organism resembling the gastrula—an early stage in the embryonic development of most animals. To support his case he began to fake evidence. Charged with fraud by five professors and convicted by a university court at Jena, he agreed that a small percentage of his embryonic drawings were forgeries; he was merely filling in and reconstructing the missing links when the evidence was thin, and he claimed unblushingly that 'hundreds of the best observers and biologists lie under the same charge' (Pitman, 1984, p. 120).

Assmuth and Hull (1915) even wrote a whole book on Haeckel's many frauds and forgeries, concluding that Haeckel knowingly and deliberately falsified documents in an effort to convince readers of the validity of evolution. Nonetheless, for scientific reasons alone, the early promising start of the new theory soon fell on hard times even though many biologists contemporary to Haeckel thought that embryology:

would be a golden key to problems of phylogeny. Yet there was much unsound biology associated with the Biogenetic Law, and *few aspects of evolutionary science have been so heavily attacked in recent years* (Dodson, 1960, p. 51 emphasis mine).

The major reason for the attack was that as "biological knowledge increased ... the biogenetic law has been subjected to considerable criticism" (Carlson, 1996, p. 39). Soon it was clear that the law was lethally flawed even

though some Darwinists still clung to remnants of it. Its flaws were openly discussed in mainline textbooks as early as 1963:

The similarities of embryological development among multicellular animals were intensively studied during the latter half of the nineteenth century. These studies led to the conclusion that the embryonic development of the individual repeated the evolutionary history of the race. Thus, it was thought to be possible to trace the evolutionary history of a species by a study of its embryonic development. This idea was so attractive as to gain the status of a biological principle ... Today the idea of embryonic resemblances is viewed with caution. We can see and demonstrate similarities between embryos of related groups ... However ... the old idea that a human passes through fish, amphibian, and reptile stages during early development is not correct (Moore, 1963, p. 608).

Richardson concluded from his extensive study of Haeckel's work that it may be "one of the most famous fakes in biology." This finding should not have shocked Haeckel's peers a century ago: Haeckel once admitted under pressure that he "used artistic license in preparing his drawings ..." but Haeckel's confession was either forgotten or ignored by those who wanted to use his biogenetic law to support evolution (quoted in Pennisi, 1997, p. 1435). Later Haeckel's drawings were published in the 1901 English language book *Darwin and After Darwin*, and from here they were reproduced widely in English language biology texts for the next 80 years, no doubt because his pictures appeared to provide clear evidence of macroevolution.

Thanks to the work of Richardson et al. (1997, p. 91) the many fatal flaws in Haeckel's work have again resurfaced. Haeckel's drawings of embryos showed the 'tailbud' stage, close to identical for different species. The Richardson team found that embryos at the tailbud stage, which were thought to correspond to a conserved stage of evolution, actually show many major variations in form due to allometry, heterochromy, and differences in body plan and somatic number. These variations foreshadowed important differences in the adult body form (Richardson et al., 1997, p. 91). Richardson believes studying the many *differences* in embryos may prove to be far more fruitful than focusing on the similarities.

Pennisi (1997, p. 1435) noted that while many types of embryos may share certain features at the early stages of development, including what appears to be a tail-like structure on their posterior and certain identifiable body segments, embryos of different animal types possess many major differences which negate the biogenetic theory. Evidence in favor of the biogenetic law was exploited by Haeckel, and the wealth of examples against the law were

ignored. For example, by the time human embryos have developed to the extent of having the number of body segments shown in Haeckel's drawings they possess prominent protrusions called *limb buds* which later develop into limbs. These structures are absent in Haeckel's drawings.

Haeckel not only left out limb buds in his drawings, but even added structures to make the embryos of different animals appear more similar than they actually were. For example, he added a curl to the bird embryo "tail" so it would more closely resemble a human "tail." Haeckel even added features to the select few examples he used to prove his law, all of which were chosen because they seemed to prove his recapitulation theory. Furthermore, of the examples that Haeckel used, he fudged the scale by as much as 10 fold in order to exaggerate similarities among species. A comparison of Haeckel's drawings with accurate drawings or photographs show how enormously distorted, actually outright fraudulent, his drawings actually were (Rusch, 1969, pp. 29–31).

Haeckel also in most cases neglected to name the species he drew to illustrate his theory, falsely implying that the one representative he chose was representative of an entire group. Even closely related embryos such as those of different types of fish can vary greatly in appearance and developmental pathway (Carlson, 1996).

Far more variation exists in vertebrate embryos than was once assumed, and for this reason Richardson's work, by focusing on these variations, does "a great service to developmental biology" helping to better understand development (Gilbert quoted in Pennisi, 1997, p. 1435). As a result of Richardson's work and that of others, Haeckel's 1874 phylogenetic tree based in part on the biogenetic law which was strongly influenced by "Darwin's theory of common descent ... including the unilateral progression of evolution toward humans... have since been refuted" (Hickman et al., 1996, p. 15). Dobson demonstrated that the biogenetic law fails when applied to echinoderms:

The beautifully simple embryology of the echinoderms played an important role in the establishment of the Biogenetic Law. Yet the recent comprehensive study of echinoderm embryology by Fell reveals extensive differences among various groups of echinoderms, and these differences are referable to embryonic adaptations. Fell even casts doubt on the echinoderm-chordate relationship, for the hemichordate larva does not fit into the scheme of larval relationships which he has worked out (Dobson, 1960, p. 52).

Today the current most optimistic status of the "ontogeny recapitulates phylogeny" law was summarized by Trefil as follows:

Nineteenth-century biologists noted that, as an embryo of an advanced organism grows, it passes through stages that look very much like the adult

phase of less advanced organisms ... In the nineteenth century, this so-called biogenetic law was taken to prove that evolution had proceeded on more or less a straight line from the simplest organisms to its epitome in human beings. We no longer have this view of evolution, but the biogenetic law remains a useful generalization about the way an embryo develops (Trefil, 1992, p. 23).

Although most current textbooks no longer use Haeckel's fraudulent drawings, some evolutionists still ignore the overwhelming evidence against recapitulation theory and use the often vague similarities among developing species to argue for Haeckel's theory or a watered down version of it (Rusch, 1969, p. 34). Haeckel's drawings were even prominently displayed on the cover of a recent college text (Gerhart and Kirschner, 1997) and reproduced inside (p. 329) as if they were valid. Drawings similar to Haeckel's were also pictured on an advertisement for another recent college embryology text, but interestingly, Haeckel's ideas were never mentioned in the text itself (Gilbert and Raunio, 1997). The importance of the drawings was noted by Youngson:

How did Haeckel get away with his theory for so long? It was largely, unfortunately, on the basis of his drawings. These became famous and have been repeatedly reproduced by publishers over the course of the last 120 years or so (1998, p. 176).

Many biologists also unthinkingly still cling to some remnants of the biogenetic law. An example is the often repeated claims about fish gill slits which is discussed in greater detail below.

The Putative Gill Slits

To make the ontogeny theory more plausible, its remaining advocates are forced to drop many stages of it and alter numerous major parts of the putative recapitulation path. Some contemporary Darwinists have dropped most of the historically accepted ontogeny stages and claim that only *three* stages are actually revealed in embryology: the fish, tail and hair stages. The major evidence for the fish stage are the "gill slits" evolutionists long claimed were present in human embryos in the early developmental stages (Haeckel, 1920, pp. 328–332). One now classic biology textbook claimed that all vertebrate embryos have gill slits, and that the gill slits "become functional only in the fishes and amphibians ... but their appearance in all vertebrates is indicative of descent from aquatic ancestors" (Haupt, 1940, p. 347). Another, more recent text under a set of drawings similar to Haeckel's asked:

Isn't the resemblance striking? You might mistake one for another at an early stage in their growth. Notice that each embryo, whether it be fish, bird, or

mammal has a tail and gill slits (Figure 41-3). Each also has a two-chambered fish heart. Animals that live in water like the fish have gill slits and breathe by means of *gills*. Yet the embryos of the reptile, the bird, and the mammal also have gill slits—though they never breathe by gills. These animals breathe by means of lungs. As embryos of different animals develop, they begin to differ from one another in structure, and the number of likenesses becomes fewer. However, the great similarity in structure of the early embryos of the fishes, amphibians, reptiles, birds, and mammals points to a common fish-like ancestor for the vertebrates (Gramet and Mandel, 1958, pp. 560–561).

Another more objective account which is still influenced by the “gill slit” misconception explains:

The month-old human embryo has a series of paired bronchial grooves in the neck region. These are matched on the interior by a series of paired gill pouches. This pattern appears not only in man but in the embryonic development of all vertebrates. In the fishes, the pouches and grooves eventually meet and form gill slits, the openings which allow water to pass from the pharynx over the gills and out of the body. In the “higher” vertebrates the grooves and pouches disappear. In man the chief trace of their existence is the Eustachian tube and auditory canal, which (interrupted only by the eardrum) connect the pharynx with the outside of the head (Kimball, 1965, p. 545).

These so called gill slits are actually a set of folds or creases in the neck region called pharyngeal pouches which only superficially resemble the gill slits that develop in fish to allow it to remove oxygen from the water through its gills. The gill slit area in non-fish does not contain even partly developing gills and has no respiratory function, nor does it develop into gills or gill like structures. It is now known that these structures develop into ear cavities, lower jaws and neck parts. An accurate description of the development of this area follows:

The most typical feature in development of the head and neck is formed by the pharyngeal or bronchial arches. These arches appear in the 4th and 5th weeks of development and contribute to the characteristic external appearance of the embryo. Initially, they consist of bars of mesenchymal tissue separated by deep clefts known as pharyngeal or bronchial clefts. Simultaneously, with development of the arches and clefts, a number of outpocketings, the pharyngeal pouches, appear along the lateral walls of the pharyngeal gut, the most cranial part of the foregut.... Pharyngeal arches not only contribute to formation of the neck but also play an important role in formation of the face. At the end of the 4th week, the center of the face is formed by the stomodeum, sur-

rounded by the first pair of pharyngeal arches (Sadler, 1995, p. 312).

Because the folds do not open into the throat or anywhere else, and are not either developing gills or slits, the term gill slits is a misnomer left over from the misleading biogenetic law. For this reason the classic embryology text by Langman stated that:

The pouches penetrate the surrounding mesenchyme but do not establish an open communication with the external clefts. Hence, although development of pharyngeal arches, clefts, and pouches resembles formation of gills in fishes and amphibia, in the human embryo real gills (branchia) are never formed. Therefore, the term pharyngeal (arches, clefts, and pouches) has been adopted for the human embryo (Sadler, 1995, p. 312).

Many researchers recognized as long as 37 years ago that numerous differences existed between the pharyngeal arches and gill slits and one

great difference between the arches in fish and man is that whereas the closing membranes break down in the fish to form the gill slits, they never do so normally in the human being (Harrison, 1963, p. 102).

A survey of 45 recent college level biology textbooks revealed that most did not mention the once common gill slit teaching as evidence for evolution, whereas almost all pre-1950s books surveyed did. One exception actually said that “fish, reptiles, birds, and humans all share in their early development ...gills and a tail” (Raven and Johnson, 1988, p. 322). Another stated: “The early stages of embryonic development are almost identical in different vertebrate species. Numerous structural similarities are shared by the early stages, including the presence of gill pouches and a tail” (Solomon, Berg, Martin, 1999, p. 383).

Some evolutionists in their enthusiasm to prove evolution once even claimed that at one point in development the human embryo actually developed gills and resembled a tadpole, a claim that is totally false (Wells, 1999). As early as 1946 it was well recognized that the gill slit theory needed to be reexamined. The explanation often given for certain traits existing in the embryonic human heart and early circulatory system is that

...they are vestiges of ancestral conditions. Away back in Devonian times, according to this theory, the ancestors of men were aquatic, and the tendency to form gills and a gill circulation still persists. It is an application of the recapitulation theory ...[which as] ...an argument for details of ancestral structure the theory is totally unreliable; the fact that the early mammalian embryo has fetal membranes does not indicate that the adult ancestors of mammals had similar structures. At most we may say that certain embryonic structures, such as mammalian gill clefts, suggest aquatic ancestry. A truly scientific procedure

is to try to find reasons for gill folds (that is all they are in mammals) in the needs of the embryo itself rather than in its ancestors, just as we do for the precocious development of the brain and eye or for the function of the fetal membranes ...The caution suggested here seems desirable in the interest of genuine science. Recent advances in genetics and endocrinology are bringing to light data that may eventually revolutionize our outlook on evolutionary history (Hauber and O'Hanlon, 1946, p. 252).

When their advice was finally heeded and the "truly scientific" procedure was followed, the reason for the gill folds in the embryo became apparent, and this information is now part of most up-to-date human anatomy textbooks.

The Human Tail

The putative human embryo "tail" which gradually is reduced until it usually disappears before birth, is also misinterpreted as an example of "recapitulation." This "tail" is actually the human spine and developing vertebra which ends in the coccyx. The "tail" appearance develops because the brain and spinal chord mature very early in development in order to help coordinate the rest of the body's development, and at this stage the developing spinal column is longer than the embryo torso.

It is for this reason that humans and most animals possess what superficially *appears* to be a tail during their early development. Tailed animals do not have a spinal cord or spinal vertebrae in their tail as do the "tails" of embryo's. Unfortunately many older textbooks published highly misleading and often totally erroneous claims about the human embryo spine. A good example is Haupt's 1940 text which claimed embryology teaches that:

many structures which are permanent in the lower members of a group appear only in embryonic stages in the case of the higher members, and then either later disappear completely, persist as vestiges, or become modified to form other structures. For example, during an early period of prenatal development, the human embryo has a tail as well developed as that of any of the other vertebrates (1940, p. 347).

A survey of modern biology textbooks showed that few today even mentioned the now disproven tail claims.

The Yolk Sac

Another structure that evolutionists once claimed was a useless remnant of the human evolutionary past and was a major evidence of the biogenetic law is the so-called yolk sac (Kaufmann, 1985). Darwinists once alleged that this structure was a remnant of our putative reptilian egg his-

tory. Many evolutionists maintained for years that the yolk sac is a non-functional vestige and another proof of the biogenetic law. Kent (1978, p. 435) stated that the "yolk sac of the mammalian embryo is vestigial" in the fourth edition of his text. For the sixth edition he expanded the discussion on the yolk sac considerably, giving in detail its many functions, and noting only that a yolk sac is "a reminder" of the mammalian "genetic relationship with egg-laying reptiles" (1987, p. 435). In response to the claims by creationists that the yolk sac has a function, Sillman stated in all his years as a biologist scanning the scientific literature that he

...can't recall a single reference in the scientific literature to a "proven" function for the yolk sac in the human embryo. In fact, both yolk sac and allantois, two embryonic membranes that are definitely functional in fish, amphibian, reptile and bird embryos, are vestigial in placental mammals. Their appearance in human (or mammal for that matter) embryos certainly does indicate a genetic kinship with the other vertebrates. It doesn't "prove" evolution occurred—but it does quite clearly, along with a host of other structures and functions, point to genetic linkage of all the vertebrates (Sillman, 1985, p. 1).

In contrast to Sillman's claims, the yolk-sac has now been proven to be a multifunctional organ critical for embryonic life. The classic anatomy text by Hole notes that the yolk sac forms during the second week of development, and has many functions including it produces

blood cells in the early stages of development and gives rise to the cells that later become sex cells. The yolk sac also gives rise to the stem cells of the immune system. Portions of the yolk sac form the embryonic digestive tube as well. Part of the membrane derived from the yolk sac becomes incorporated into the umbilical cord, and the remainder lies in the cavity between the chorion and the amnion near the placenta. The allantois forms during the third week as a tube extending from the early yolk sac into the connecting stalk of the embryo. It, too, forms blood cells and gives rise to the umbilical arteries and vein. (Shier, Butler and Lewis, 1999, pp. 905–906).

The yolk sac's role is eventually taken over by other structures as the organism develops. For example, the yolk sac has a temporary role in producing blood cells before functional bone marrow is formed, and the yolk sac is discarded after the bone marrow develops. We now know that this structure is also critical for development for other reasons as well:

During organogenesis and before the placental circulation is established, the yolk sac (YS) is the primary source of exchange between the embryo and the mother. The YS has nutritive, endocrine, metabolic, immunologic, secretory, excretory, and hemo-

poietic functions... [which serve to transport] critical substances from the mother to the fetus at a time when the YS is the sole or principal maternofetal transport system. (Lindsay et al., 1992, p. 115)

Furthermore, Lindsay et al. (1992, p. 115) found the yolk-sac to be so important that "A persistently abnormally shaped YS is also useful as a predictor of an abnormal [developmental] outcome ...When the YS shape was persistently abnormal ...the outcome was always abnormal." One reason why this is true is, the yolk sac "plays an important role in the maternofetal transport system. Gross changes in its size or shape, therefore, could indicate or reflect significant dysfunction of this transport system" (Lindsay et al., 1992, p. 118).

The Embryological Down or Lanugo

During the so-called hair stage of embryo development, an extremely fine soft downy hair known as *lanugo* or *embryonal down* covers the embryo (Harrison, 1963). Evolution once taught that this hair was evidence of our primate and mammalian stage of evolution and has no function today. We now know that this hair plays an important role in both embryo and fetal development. Early in development a sticky white secretion (the *vernix caseosa*) covers the skin to protect the developing embryo from the corrosive effects of the surrounding amniotic fluid (Butler and Juurlink, 1987). Lanugo hair is most prominent during the seventh and eighth month of fetal development and serves to hold the *vernix caseosa* in place. As the embryo develops, the skin thickens and is keratinized. Consequently, the lanugo hair no longer is needed, and as a result almost all of the lanugo hair is lost just before birth (Carlson, 1996, p. 362).

Some of this downy hair persists throughout life on certain parts of the body, especially on the face and ears. This fuzz is not comparable to the coarse pelts of hair existing on mammals but still can be very useful in certain situations even in adult humans (DuPuy and Mermel, 1995). The outer layer of skin is highly keratinized "dead" epithelial cells and is useless for tactile sensations; therefore, these hairs are necessary to increase tactile sensitivity in order to enable the skin to communicate more effectively with the outside world. Downy hair also can develop extensively over the entire body during famine or in anorexics "to replace the insulation lost by the decrease in body fat" (DuPuy and Mermel, 1995, p. 179).

Other Problems With the Biogenetic Law

A major problem with the "conserved stage" hypothesis of recapitulation is that different organs develop at different times in different species, making it impossible to point to

a single conserved stage when all species have the same body plan (Richardson, 1997b). The biogenetic law originally tried to explain virtually *all* aspects of development:

Man no less than other mammals develops from a fertilized egg, which passes through cleavage, blastula, and gastrula stages. The human embryo has gill slits and aortic arches, which undergo exactly the same transformations that take place in other mammals. Man's heart is at first like that of a fish, consisting of one auricle and one ventricle. His backbone begins as a notochord, is next a segmented cartilaginous rod, then each segment or vertebra consists of five separate bones, and finally each fuses into a single bone. He has in the course of his development three different pairs of kidneys, first a pronephros (or fore-kidney), like that of the lower fishes, then a mesonephros (or mid-kidney), like that of the frogs, and finally a metanephros (or hind-kidney) like that of reptiles, birds, and mammals, which alone survives the adult. His brain, eye, ear, in fact, all his organs, pass through stages in development that are characteristic of lower vertebrates. Even in those adult features that are distinctively human, such as the peculiar form of the hand and the foot, the number of bones in the ankle and wrist, the number of pairs of ribs, the absence of a tail and the relative hairlessness of the skin—in all these respects the human foetus resembles anthropoid apes more than adult man. Why are not these and a hundred other structures made directly? Why this roundabout process of making a man? There is no answer but evolution (Conklin, 1928, pp. 74–75).

The law now is widely recognized as both erroneous and misleading because so many exceptions were found. Another major reason why it is flawed is for the reason that Haeckel based his biogenetic law on the

flawed premise that evolutionary change occurs by successively adding stages onto the end of an unaltered ancestral ontogeny, compressing the ancestral ontogeny into earlier developmental stages. This notion was based on Lamarck's concept of the inheritance of acquired characteristics (Hickman et al., 1996, p. 161).

Probably the major reason the law was disproved was, because organ development was often contrary to what recapitulation predicted. For example, if the human embryo repeated its assumed evolutionary ancestry as it developed

the human heart should begin with one chamber and then develop successively into two, then three, and finally four chambers. Instead, the human heart begins as a two-chambered organ which fuses to a single chamber, which then develops directly into four chambers. In other words, the sequence is 2-1-4, not 1-2-3-4 as required by the theory. The human

brain develops before the nerve cords, and the heart before the blood vessels, both out of the assumed evolutionary sequence. It is because of many similar contradictions and omissions that the theory of embryological recapitulation has been abandoned by embryologists (Gish, 1995, p. 358).

Another excellent example is the development of similar forms of animals from very dissimilar pathways is common at later stages of development.

Many types of animals pass through a larval stage on their way to adulthood, a phenomenon known as indirect development. For example, most frogs begin life as swimming tadpoles, and only later metamorphose into four legged animals. There are many species of frogs, however, which bypass the larval stage and develop directly. Remarkably, the adults of some of these direct developers are almost indistinguishable from the adults of sister species which develop indirectly. In other words, very similar frogs can be produced by direct and indirect development, even though the pathways are obviously radically different. The same phenomenon is common among sea urchins and ascidians (Wells and Nelson, 1997, p. 16).

Many other organs and structures have been found not to develop in the order predicted by the law. Examples Rusch gives include, in mammalian embryos the tongue develops before the teeth, and certain environmental conditions can change the sequence order that embryo differentiation occurs (1969, p. 28). Nor do anatomical evaluations of the developing embryo support recapitulation: "while many authors have written of a conserved embryonic stage, no one has cited any comparative data in support . . . the phylotypic stage is [evidently] regarded as a biological concept for which no proof is needed. This has led to many problems, not the least of which is the lack of consensus on exactly which stage is conserved." (Richardson et al., 1997).

Furthermore, the biogenetic law has misled researchers who for years were looking for evidence that does not exist and ignored or tried to explain away the large body of evidence that contradicted the biogenetic law.

Another major problem is recapitulation in development almost certainly would *not provide the animal with any selection advantages* but instead would likely result in many major selection *disadvantages* during the embryonic stage. The evidence supports Sir Arthur Keith's statement made three-quarters of a century ago regarding embryology and evolution that:

It was expected that the embryo would recapitulate the features of its ancestors from the lowest to the highest forms in the animal kingdom. Now that the

appearances of the embryo at all stages are known, the general feeling is one of disappointment; the human embryo *at no stage* is anthropoid in its appearance (1925, p. 867).

The many flaws which eventually mortally wounded the biogenetic law included the fact that it

became *unfashionable in approach* (due to the rise of experimental embryology) and finally *untenable in theory* (when the establishment of Mendelian genetics converted previous exceptions into new expectations). The biogenetic law was not disproved by a direct scrutiny of its supposed operation; it fell because research in related fields refuted its necessary mechanism (Gould, 1977, p. 168).

As a result of our growing knowledge of biology and development, the law was actually largely discredited almost a half century ago even though it took decades before this new knowledge was reflected in the textbooks:

Often cited as an example of recapitulation are the gill slits which occur during the embryonic development of reptiles, birds, and mammals. These have been considered to resemble the gill slits of adult fish, thus providing evidence of the racial history of the higher forms ... It was first advanced as a result of work upon the larval stages and embryos of animals. In the form above, it has been the subject of much criticism, and is not infrequently referred to as the "so-called Biogenetic Law." In the case of the gill slits cited, for example, it is pointed out that these structures in the embryonic stages of reptiles, birds, and mammals resemble the gill slits of the embryonic, not the adult, stages of fish... The Biogenetic Law was elaborated specifically to point out the significance of resemblances between embryonic stages of descendants and the adult stages of their ancestors. As we have seen, this concept is now largely discredited (Wilson, 1954, pp. 269–270).

Attempts have been made throughout the years to repair and revise the law, but all have failed. One early attempt offered by 19th century embryologist K. E. von Baer argued that early developmental features were *more* widely shared among

different animal groups than later ones ... The adults of animals with relatively short and simple ontogenies often resemble preadult stages of other animals whose ontogeny is more elaborate, but the embryos of descendants do not necessarily resemble the adults of their ancestors. Even early development undergoes evolutionary divergence among groups, however, and it is not quite as stable as von Baer believed (Hickman et al., 1996, p. 162).

Why the Biogenetic Law is Still Taught

No reason now exists to believe that the recapitulation theory is true except that it appears to support evolution. Harvard's Steven J. Gould (1977) even wrote a 501 page book on Haeckel's biogenetic law documenting its history from its appearance in the pre-Socrates days to its demise in the early twentieth century. He claimed that the theory was one of the two or three leading scientific arguments for racism (1977, p. 216). The reason it is still taught is not because the realization that it is erroneous is recent: the biogenetic law was recognized by many as long ago as one-half century as falsified:

For a time during the latter half of the nineteenth century this theory was received with great enthusiasm, and it was predicted that a study of living things in the light of this "law" would revolutionize biology. But, unfortunately, the predictions are not being verified. As a working hypothesis the theory has been a great help, but there are so many exceptions, apparently even contradictions, that its application is frequently misleading (Hauber and O'Hanlon, 1946, p. 156).

Why, then, do many scientists at least nominally still accept biogenetic law? A major reason the biogenetic law or remnants of it are still taught in textbooks and at most colleges is because

...the biogenetic law has become so deeply rooted in biological thought that it cannot be weeded out in spite of its having been demonstrated to be wrong by numerous subsequent scholars. Even today both subtle and overt uses of the biogenetic law are frequently encountered in the general biological literature as well as in more specialized evolutionary and systemic studies (Bock, 1969, p. 684).

Many scientists and writers are either unaware of the criticism of the law, or chose to ignore the evidence against it. Professor Glover claims that the "vast majority" of his medical students believe the human embryo has gill slits even though their medical text on embryology correctly explains that the human embryo does not have gill slits but pharyngeal grooves (Ham, 1992). And Youngson concluded:

While Haeckel's theory of recapitulation was, for a time, almost universally believed, the debunking of Haeckel was not widely known ... His book *The Riddle of the Universe*, an extraordinary mishmash of real science and imaginary nonsense, was a great popular success and ran into numerous editions. So, although his ontogeny ideas were brushed aside at a fairly early stage by the serious scientists, they continued to be accepted by the lay public (Youngson, 1998, p. 177).

Another major reason for the acceptance of the biogenetic law is because it is now part of the accepted

worldview of scientists, a belief that they are exposed to from the earliest days of their training and are daily surrounded by. Most scientists are influenced by social pressure, and many fear recriminations from their fellow scientists if they do not conform to what is currently viewed as correct. To prove their orthodoxy, many scientists have become unscientific and have embraced the world view of twentieth century naturalism (Johnson, 1993).

This problem is no minor matter of interest only to creationists. The biogenetic law "became extremely influential outside of science" and "caused a great deal of mischief" (Milner, 1990). One example Milner cites is the idea that the brains of certain races were stuck at a lower, childlike stage of evolutionary development. In Gould's words, for "a half century the proponents of recapitulation had collected" evidence which "argued that adults of 'lower' races were like white children." Gould notes that proponents of recapitulation asserted the fact that "women are more childlike in their anatomy than men" was proof of their inferiority (1977, pp. 219, 221). Gould gives many examples of the use of the biogenetic law to endorse racism, such as the argument that black males are more primitive than whites because the distance between their navel and penis remains small relative to body height as adults while white children begin with a small separation which increases during growth. The rising belly button was seen as a mark of evolutionary progress, because it could be used to rank the evolutionary level of other primates including the apes (1977, p. 218). Gould also noted that

Recapitulation had its greatest political impact as an argument to justify imperialism. Kipling, in his poem on the "white man's burden," referred to vanquished natives as "half devil and half child." If the conquest of distant lands upset some Christian beliefs, science could always relieve a bothered conscience by pointing out that primitive people, like white children, were incapable of self-government in a modern world. During the Spanish-American War, a major debate arose in the United States over whether we had a right to annex the Philippines. When antiimperialists cited Henry Clay's contention that the Lord would not have created a race incapable of self-government, Rev. Josiah Strong replied: "Clay's conception was formed before modern science had shown that races develop in the course of centuries as individuals do in years, and that an underdeveloped race, which is incapable of self-government, is no more of a reflection on the Almighty than is an undeveloped child who is incapable of self-government (1977a, pp. 218-219).

Moore (1999, p. 1) even concluded that "recapitulation was a leading argument for racists in the late 19th century." Furthermore, some of Sigmund Freud's more radical now discredited ideas came directly from Haeckel's biogenetic

law (Milner, 1990, p. 177). Milner even claims Haeckel's views "became a major cultural force in shaping the militant nationalism in Germany" which led to the holocaust that resulted in the loss of over six million lives (1990, p. 205). This view of development has even been used as an argument to justify abortion in the early stages and is based on the reasoning that it is not wrong to kill life at this early development stage, because the embryo is not yet human, but only a fish or less (Major, 1994, pp. 175–177).

Implications for Creationism

The ontology law was a major weapon in the arsenal used to attack not only creationism but also Christianity, minorities and even the existing social order in favor of communism. Gould noted that recapitulation was Haeckel's favorite argument "to attack nobility's claim to special status—are we not all fish as embryos?—and to ridicule the soul's immortality—for where could the soul be in our embryonic, wormlike condition?" (Gould, 1997, p. 217).

Our ability to reason, to determine right and wrong, to live according to a conscience, to exercise domination over plants and animals, to enjoy music and art, and to worship our Creator are all only a small part of the enormous chasm that separates humans from *every other living creature*. The biogenetic law is only one of many hypotheses which evolutionists have used to try to support their naturalistic theory which is being gradually proven wrong as new evidence accumulates.

Naturalistic evolution requires faith in embryological theory that has now been disproved and belief in evolutionism requires a blind, often credulous faith induced partly by pressure to conform to the world of science which is saturated with naturalism. The history of the biogenetic law should force all persons to look critically at the current lack of evidence for the evolutionary model of origins.

Conclusions

The biogenetic law was based on very superficial similarities in developing embryos. As our knowledge of embryology and especially genetics increased, it became increasingly obvious that the "law" was fundamentally in error.

The three major early scientific objections to Haeckel's version of the biogenetic law can be summarized as follows:

1. The path of embryological development is not general for either organs or body structures. Each ontogenetic stage is an inseparable mixture of organs in different stages of putative ancestral repetition.
2. Larvae and embryos possess many features that help them adapt to their individual mode of life. New char-

acters can be introduced at *any* stage of embryological development.

3. Development can be retarded as well as accelerated. Embryonic or larval stages of ancestors can become the adult stages of descendants—a phenomenon directly opposite to recapitulation (adapted from Gould, 1977, p.168).

The stages of embryological development of many animals show some similarities but the major reason for this is design constraints. Likewise adult organs show much similarity because only so many ways exist to design a heart or lung, and we would expect the *earlier* in development the *fewer* the design possibilities that exist. All sexual reproducing organisms start out as one celled zygotes which superficially look remarkably similar, and as development and differentiation proceed they look more and more different. All hearts begin as a single contracting artery tube which, depending on the animal type, develops into a one, two, three or four chambered heart. A human heart does not start as a simple one chambered heart because our ancestor had a one chambered heart, but because the process of embryological development mandates general simple to complex progression. The same is true for all other organs. Because all life initiates as one cell does not prove all life evolved from one cell, but that this is the only way that life can develop by either asexual or a sexual reproduction methods (Milton, 1997).

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References

- CRSQ: *Creation Research Society Quarterly*
- Assmuth, J. and Ernest Hull. 1915. *Haeckel's frauds and forgeries*. P.J. Kennedy, New York.
- Bock, Walter J. 1969. Evolution by orderly law. *Science* 164:684–685.
- Butler, H. and H. Juurlink. 1987. *An atlas for staging mammalian and chick embryos*. CRS Press, Boca Raton, FL.
- Carlson, Bruce M. 1996. *Patten's' foundations of embryology*. McGraw-Hill, New York.
- Conklin, Edwin Grant. 1928. Embryology and evolution, in *Creation by evolution*. Edited by Frances Mason. MacMillan, New York.
- Darwin, Charles. 1859. *The origin of species*. Reprinted 1897 by D. Appleton, New York.
- De Beer, Gavin. 1958. Darwin and embryology in *A century of Darwin*. Edited by Samuel Barnett. Heinemann, London.

- Dodson, Edward O. 1960. *Evolution process and product*. Reinhold, New York.
- DuPuy, Nancy and Virginia Lee Mermel. 1995. *Focus on nutrition*. Mosby, St. Louis, MO.
- Gerhart, John and Marc Kirschner. 1997. *Cells, embryos and evolution*. Blackwell Science, Malden, MA.
- Gilbert, Scott F. and Anne M. Raunio (editors). 1997. *Embryology: constructing the organism*. Sinauer Associates, Sunderland, MA.
- Gish, Duane. 1995. *The fossils still say no*. Institute for Creation Research, El Cajon, CA.
- Gould, Steven Jay. 1977. *Ontogeny and phylogeny*. Harvard University Press, Cambridge.
- _____. 1977a. Racism and recapitulation, in *Ever since Darwin*. W W Norton, New York.
- Gramet, Charles and James Mandel. 1958. *Biology: serving you*. Prentice-Hall, Englewood Cliffs, N.J.
- Grigg, Russell. 1996. Ernst Haeckel: evangelist for evolution and apostle of deceit. *Creation Ex-nihilo*, 18(2):33–36.
- _____. 1998. Fraud rediscovered. *Creation Ex-nihilo* 20(2):49–51.
- Haeckel, Ernst. 1906. *Natural history of creation* (English translation, 1870). Appleton, New York.
- _____. 1920. *The evolution of man*. D. Appleton, New York.
- Ham, Ken. 1992. A surgeon looks at creation. *Creation Ex-Nihilo*, 14(3):46–49.
- Harrison, Ronald G. 1963. *Textbook of human embryology*. Blackwell, Oxford.
- Hauber, U.A and M. Ellen O'Hanlon. 1946. *Biology: a study of the principles of life for the college student*. F.S. Crofts, New York.
- Haupt, Arthur. 1940. *Fundamentals of biology*. McGraw Hill, New York.
- Hickman, Cleveland, Larry Roberts and Allan Larson. 1996. *Integrated principles of zoology*. William C. Brown, Dubuque, IA.
- His, Wilhelm. 1874. *Unsere Körperform*. C.W. Voegel, Berlin.
- Johnson, Phillip. 1993. Science without God. *Wall Street Journal*, May 10, p. A10.
- Kaufmann, David. 1985. Further comments on baleen fetal teeth and functions for yolk sacs. *Origins Research*, 8(2): 13.
- Keith, Arthur. 1925. The nature of man's imperfections. *Nature*, 116: 867.
- Kent, George C. 1978. *Comparative anatomy of the vertebrates*. fourth edition. C.V. Mosby, St. Louis, MO.
- _____. 1987. *Comparative anatomy of the vertebrates*. sixth edition. Times Mirror Mosby, St Louis, MO.
- Kimball, John W. 1965. *Biology*. Addison-Wesley, Reading, MA.
- Lindsay, Daniel J.; Lovett, Ian S.; Lyons, Edward A.; Levi, Clifford S.; Zheng, Xin-Hua; Holt, Susan C.; and Dashefsky, Sidney M. 1992. Yolk sac diameter and shape at endovaginal US: predictors of pregnancy outcome in the first trimester. *Radiology*, 183: 115–118.
- Major, Trevor. 1994. Haeckel: The legacy of a lie. *Reason & Revelation* 14: 68–70.
- McNamara, Ken. 1999. Embryos and evolution. *New Scientist* 164(2208): 1–4.
- Milner, Richard. 1990. *The encyclopedia of evolution*. Facts on File, New York.
- Milton, Richard. 1997. *Shattering the myth of Darwinism*. Park St Press, Rochester, VT.
- Moore, John A. (Editor). 1963. *Biological science: an inquiry into life*. Harcourt Brace and World, New York.
- Moore, Randy. 1999. Science, objectivity & racism. *American Biology Teacher*, 61(4):1.
- Müller, Fritz. 1869. *Facts and arguments for Darwin* (English translation). John Murray, London.
- Pennisi, Elizabeth. 1997. Haeckel's embryos: fraud rediscovered. *Science*, 277: 1435.
- Pitman, Michael. 1984. *Adam and evolution*. Rider, London.
- Raven, Peter and George Johnson. 1988. *Understanding biology*. Times Mirror/Mosby College Publishing, St. Louis.
- Richardson, Michael. 1997a. Embryonic fraud lives on. *New Scientist*, Sept 6, p. 23.
- _____. 1997b. Heterochrony and the phylotypic period. *Developmental Biology*, 172: 412–421.
- Richardson, Michael, James Hanken, Mayoni Gooneratne, Claude Pieau, Albert Raynaud, Lynne Selwood, Glenda Wright. 1997. There is no highly conserved embryonic stage in the vertebrates: implications for current theories of evolution and development. *Anatomy and Embryology*, 196: 91–106.
- Rusch, Wilbert. 1969. Ontogeny recapitulates phylogeny. *CRSQ*, 6(1): 27–34.
- Sadler, Thomas W. 1995. *Langman's medical embryology*. Williams and Williams, Baltimore.
- Shier, David, Jackie Butler, and Ricki Lewis. 1999. *Hole's human anatomy and physiology*, eighth edition. McGraw Hill, New York.
- Sillman, Emmanuel I. 1985. Further comments on baleen teeth and functions for yolk sacs. *Origins Research*, 8(2): 13.
- Smallwood, William Martin. 1930. *A text-book of biology*; sixth edition. Lea & Febiger, Philadelphia, PA.
- Solomon, Eldra Pearl, Linda Berg, and Diana Martin. 1999. *Biology*. Saunders, Orlando, FL.
- Spock, Benjamin. 1992. *Dr. Spock's baby and child care*. sixth edition. A Dutton Book, New York.
- Taylor, Ian. 1984. *In the minds of men*. TFE Publications, Toronto, Ontario, Canada.

- Trefil, James. 1992. *1001 things everyone should know about science*. Doubleday, New York.
- Wells, Jonathan and Paul Nelson. 1997. Homology a concept in crisis. *Origins and Design*, 18(2): 12–19.
- Wells, Jonathan. 1999. Haeckel's embryos and evolution. *The American Biology Teacher* 61(5):345–349.

- Wilson, Carl. 1954. *Botany*. The Dryden Press, New York.
- Youngson, Robert. 1998. *Scientific blunders, a brief history of how wrong scientists can sometimes be*. Carroll & Graf, New York.

Book Review

Show Me God by Fred Heeren

Day Star Publications, Wheeling, IL. 1995, Revised 1998, 393 pages, \$23

As one who purports to be seeking scientific evidence for a Creator God, the author of *Show Me God* has been looking in all the wrong places. He has listed, often in technical detail, the pronouncements of secular researchers who are skeptics, agnostics, or atheists. Heeren finds that there is consensus as to the probability that the universe did have a beginning, that there is evidence of design in our solar system (the anthropic principle), and that it all began with a big bang some twenty billion years ago with galaxies and planets slowly condensing from clouds of gaseous matter.

The work of young-earth creationists is dismissed as inconsequential, and evidences for a young universe are ignored. Most often quoted as authorities in cosmology are Albert Einstein, Stephen Hawking, Fred Hoyle, and Robert Jastrow. Steven Jay Gould, Carl Sagan, Hugh Ross, and Richard Dawkins also are often cited in the copious notes at the end of each chapter. In short, the opinions of fallible human beings are accepted above the authority of God's inerrant Word. Wrong information is given as to the sources of recent creation "tradition" (p. 183).

The author must be given credit for wide-ranging research, describing even some of the most bizarre theories as to cosmic perceptions. He quotes physicist Robert Gange (p. 378):

The deepest conclusion of quantum physics is that the only reason anything has physical existence is because of human consciousness. . . It's no longer *things* that are described by science, but *observations* that are described by science. . . So what in point of fact *is*, is only because of human consciousness that is making observations through this particular oxygen-burning organic machine.

Such pronouncements remind one of the well-known quip, "Some people will believe anything as long as it isn't in the Bible."

Although Heeren himself professes belief in what he calls the IIP God—Infinite, Independent, Personal—he evidently feels compelled to try reconciling this belief with current theories of the cosmos. Chapter 9 is entitled "Alternative Explanations for Design" and describes various theories which try to avoid the necessity for a Designer.

Then, astonishingly, come chapters setting forth the author's deep belief in the Designer and in the Gospel. Entitled "Implications of Design" and "Is the Gospel Logical?" these chapters could have been written by the most devout evangelical preacher. There follows a chapter giving brief biographies of "Fifty Believers Who Led the Way in Science." Then, back to skepticism with the final chapters: "Everything You Ever Wanted to Know About 20" Century Cosmology" and "Q and A with Today's Leading Cosmologists."

Parts of the book consist of facetious, informal exchanges with an imaginary editor. Illustrations are frequent, and some of the photos of celestial objects are quite beautiful.

This book is the first in a proposed series of four "Wonders that Witness" volumes. But as long as the author continues to waver between two opinions (1 Kings 18:21) his work will only confuse, not enlighten seekers of Biblical and scientific truth. This book was also reviewed earlier (DeYoung).

Reference

- DeYoung, D. 1996. Review of *Show Me God* by Fred Heeren. *CRSQ* 33(2): 103.

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Notes from the Panorama of Science

Coal-bearing Strata within an *In-situ* (?) Fossilized Paleo-Fern-Tree Forest: Which Models And Settings Apply?

Carl R. Froede Jr.*

Introduction

One method by which uniformitarians reconstruct Earth's history is by comparing the vertical stratigraphic profiles of ancient and modern depositional environments. Since they assume a correlation between modern and ancient environments, the uniformitarian model *always* drives the interpretation. Creationists should not require that assumption in a Biblical approach. We must take the physical information and interpret it within a young-earth Flood-based framework. Carboniferous strata exposed along a short segment of State Highway 30, one and a half miles east of Spencer, Tennessee (Figure 1) provide us with an opportunity to test competing uniformitarian and creationist assumptions. Some uniformitarians believe that this coal and plant fossil-bearing outcrop represents a Pennsylvanian age fern-tree swamp forest (Jones, 1977). Alternative models have also been proposed by uniformitarians. How would the young-earth Flood model explain this setting? I will compare uniformitarian and creationist models to the physical setting and determine which paleoenvironments might be relevant and appropriate in explaining how fossilized fern trees and adjacent coal-bearing strata were buried and preserved.

The Tennessee State Highway 30 Outcrop

The outcrop is found along a winding stretch of State Highway 30 approximately 1.5 miles east of Spencer, in Van Buren County, Tennessee (Figure 1). Much field work has been conducted by uniformitarian geologists in this section of Tennessee in mapping the economical coal-bearing Carboniferous strata on the Cumberland Plateau (Jones, 1977; Wanless, 1946). Jones (1977, p. 4 – Stop 5) described the history of the Pennsylvanian strata within this specific area as:

Beneath the coal bed lies light-gray seat earth or underclay (the ancient soil on which the coal forest grew). The overlying coal bed represents the fossil remains of this forest, which grew in a fresh water swamp. This swamp was covered up and entombed by the overlying siltstone and shale. The remains of

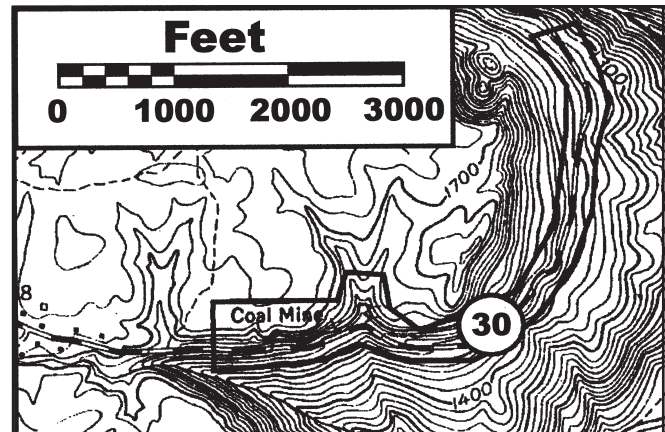


Figure 1. The base map showing the outcrop along Tennessee State Highway 30, east of Spencer (area within black lines running parallel to the road). This area exposes the lowest sections of the Pennsylvanian (clastics and coal-bearing strata) along with the top of the Mississippian (marine limestone). The map is a modified section of the U.S. Geological Survey Spencer, Tenn. topographic quadrangle.

several standing fossil stumps are proof of the muddy burial of the coal forest. Later, sands probably derived from a nearby coastline were washed in over these fresh water deposits.

This description represents the standard *in-situ* (i.e., autochthonous) swamp model. This has been the primary prehistoric depositional model used by most uniformitarians to explain the formation of coal layers in Cumberland Plateau strata (Figure 2). However, the overlying and underlying strata at this specific section fail to support Jones' interpretation. His interpretation does not work because there is no evidence that any fern-trees ever grew out of the paleosol layer (Figure 3). No fossilized fern-tree roots are present within this paleosol, and there is no evidence of zonation or soil-horizon development (Figure 4). Rather, it appears that organic vegetative matter was washed into this area, was rapidly buried, and was then compacted. This layer was altered into the coal seam we find presently (this is allochthonous deposition). Hence, there is no paleoenvironmental connection between the fossilized fern-tree trunks in the overlying sand/siltstone strata and the underlying "paleosol" in which these forests once grew. This was not a swamp environment. Is there a better explanation?

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Figure 2. This is the section exposed at the coal mine locale in Figure 1. The progression is from clays on the bottom followed by an overlying coal layer of varying thickness, and capped by a highly cross-bedded fine-grained sandstone. This section has in the past been typically defined using the swamp model because near-vertical fossilized fern trees have been identified in the overlying sandstone. However, the rapid burial necessary to preserve the near-vertical fern trees fails to support this low-energy setting, and many uniformitarians now use higher energy depositional environments to explain how these strata formed.

While some uniformitarians may continue to support the swamp interpretation, the physical evidence demands other paleoenvironmental interpretations. Within the past 20 years the study of coal-producing paleoenvironments has exploded, providing sedimentologists with many settings that could have produced coal deposits. Today, the most popular coal forming paleoenvironmental model for the Cumberland Plateau strata is the prograding delta with crevasse splays. This is an allochthonous model for coal formation—i.e., the original woody material now comprising the coal layer was brought in from outside the area in which it was deposited.¹

The Deltaic/Crevasse Splay Paleoenvironment

Deltas form where rivers discharge sediment and organic debris from the continent into the sea. This paleoenvironment is presently popular in interpretations of the vertical stratigraphic profile in many areas within the Cumberland Plateau where coal layers are present (see Baganz, Horne, and Ferm, 1975; Bergenback, 1978;

¹In his investigation of fossilized wood at Big Bend National Park within Dawson Creek, Williams (1993, p. 111) concluded that the silicified trees were of an allochthonous origin—see references contained therein for additional creationist work on this subject.



Figure 3. At the coal mine locale—Figure 1. A sand cast of a fern tree is just within and below the shadow in the center of this photograph. There is no physical evidence to support the Jones interpretation that this tree once grew out of the underlying clay layer. Neither the underlying coal layer nor the deeper clay layer show any indication of disturbance—which should be present if the fern tree roots once extended through the coal layer into the clay. There is no physical evidence anywhere along this outcrop that fern trees once grew out of the clay layer. Rather, it appears that they were washed into this area and rapidly buried.

Briggs, 1974; Cecil, Dulong, Cobb, and Supardi, 1993; Horne, Ferm, Caruccio and Baganz, 1978; Sheehan, 1988; Wanless, Baroffio, and Trescott, 1969). Crevasse splays are common in modern river systems and have been well studied in an effort to understand their historical equivalent (Figure 5). They typically form during periods of high freshwater discharge through the delta system. Where the river levee is breached, a crevasse forms and sediment-laden water pours into the adjacent interdistributary bay depositing the transported load of sediments

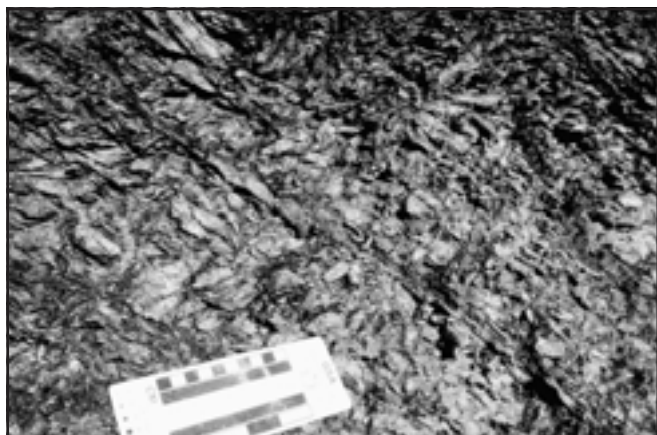


Figure 4. At the coal mine locale—Figure 1. A closeup photograph showing the highly bioturbated marine clay immediately beneath the coal layer. Jones believed that this bioturbation represent the roots of the former fern-tree forest. However, the traces do not taper or present any evidence of plant origin. Rather, the bioturbation give every indication of a marine tracemaker and likely represents short-period intensive bioturbation associated with the global Flood (see Cowart and Froede, 1994; Froede and Cowart, 1996).

and organic material, creating the splay deposit. Deposition continues until the breach is blocked by the build-up of clastic and organic remains (Figures 6 and 7).

Uniformitarians invoke excessive “time” both before and after historical crevasse-splay depositional events occur, but the physical evidence to support their model simply does not exist. For instance at this outcrop, if the seat earth is a paleosol then where are the soil horizons? The presence of bio-traces within the underclay support a marine setting, yet no marine body fossils (e.g., snail or clam shells) have been identified. In the uniformitarian model the formation of the splay would be followed by subsidence which would return this area to within the marine environment where bioturbation should mix the sediments and organic material over the hundreds to thousands of years that this splay existed in a delta (Figure 5). Yet at this outcrop all the contacts between the various layers are sharp and unmixed, there is no evidence of any bioturbation, and no evidence of any long-term weathering effects or subsequent soil development. Crevasse splays should repeat themselves (both vertically and horizontally) throughout this area as the former delta continued to develop and change channels throughout time. However, these channels have not been identified within this area because they are not clearly represented by the strata. The source area for all of these deltaic deposits remains poorly defined. The physical record of this outcrop fails to support either uniformitarian interpretation.

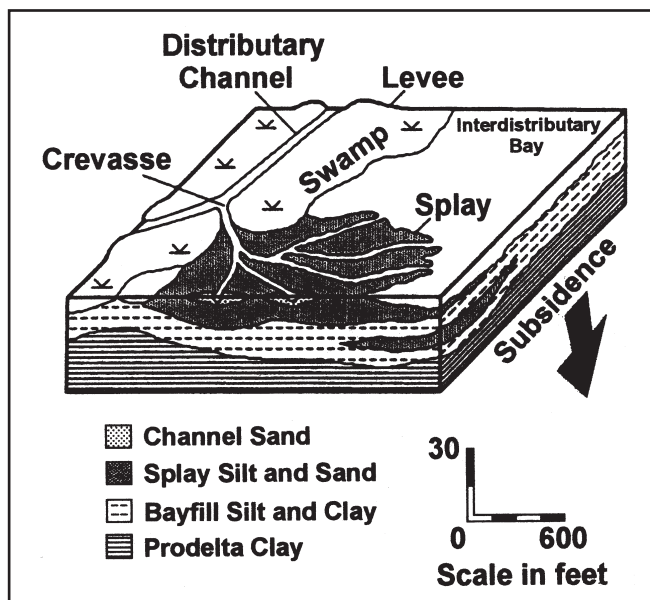


Figure 5. The majority of the Southern Appalachian coal-bearing strata are now believed to have originated within this prograding deltaic paleoenvironment where the occasional crevasse created a splay deposit which our locale is used to support. The stratigraphic layers represent a change in environments from a marine clay to an overlying coal-bearing layer capped by a fine-grained sandstone which contains the impressions and casts of ancient plants. While this is what is physically noted within our study area—what is missing from the strata is any evidence that all of this occurred millions of years ago over the course of millions of years. Modified from Sheehan, 1988.

A Young-Earth Flood Model Perspective

Uniformitarian paleoenvironmental interpretations are primarily based on the time/facies development requirements of their model. Creationists must propose and defend a more catastrophic interpretation for much of the stratigraphic record. This concept is supported by physical evidence exposed along the outcrop that suggests a rapidly-forming deposit. I propose that these sediments along with the associated organic debris were derived from the east with the uplift of the Appalachian Mountains during the earliest portion of the Flood (Lower Flood Event Division). These materials were washed into the rapidly subsiding basin and compacted by the addition of clastic sediments. Following burial and compaction, the mass of plant material was altered into a coal layer. This depositional setting would have operated much like a prograding deltaic environment with the primary exception being westward driven sheet-type deposition forming adja-



Figure 6. At the coal mine locale—Figure 1. A fossilized fern tree trunk extends downward from the ceiling of the overlying fine-grained quartz sandstone. This fern tree is in a near vertical position and must have been buried rapidly in order to preserve it from destruction. While the crevasse splay depositional setting fits this type of physical evidence, there is no supporting evidence for the uniformitarian model requirement of millions of years since this short-term event occurred.

cent to the rapidly uplifted Appalachians. The short duration between the succeeding deposits prevented the possibility of sediment mixing or bioturbation of the stratigraphic units. The vertical stratigraphic profile of an ideal crevasse-splay/prograding delta environment (see Figure 5) is *not* found at this specific locale, no prodelta clays were observed moving down section to the top of the Mississippian carbonates.

The two uniformitarian depositional settings invoked to explain the vertical stratigraphic column exposed along the Tennessee State Highway 30 outcrop fail to adequately address the physical rock record. The strata reflect high-energy deposition which occurred over a very short



Figure 7. This photograph shows an impression of a reclined fern tree trunk which was buried in the fine-grained sandstones actually beneath the strata found at the coal mine locale. As we walked eastward on Tennessee State Highway 30, we walked back in time and lower within the stratigraphic section. We observed an abundance of plant fossils preserved as casts and molds within high-energy cross-bedded fine-grained quartz sandstones. This continued until we reached the top of the Mississippian limestones. However, according to the prograding delta model we should have observed these fossilized plants within the prodelta clays. Deltas build out on prodelta clays—and yet none exist! Is the long-term prograding deltaic model of the uniformitarians the best one to explain what we observed along this section? The obvious answer is *no*!

period. What is missing is evidence for elapsed “time”—either before, during, or after the clastic and organic debris were deposited. Rather, it appears that these materials were deposited rapidly, and were not subject to any weathering, bioturbation, erosion, etc., which could have modified them. The fossilized tree-trunks did not originate from a

deeper “paleosol” layer, rather they reflect the high-energy environment in which they were deposited and rapidly buried. Catastrophic deposition and unaltered burial is best explained within the framework of the young-earth Flood model.

Acknowledgments

The author has benefitted from discussions and a tour of this area courtesy of Mr. Robert L. Powell. Additional information was obtained from a video presentation made by Australian geologist John MacKay, and supplied to me early in my investigation. The views expressed within this article are my own and do not necessarily represent those of either Robert Powell or John MacKay. Any errors in the information which I present are my own. I am thankful for field assistance provided to me by Mr. Powell along with Drs. Emmett L. Williams, and John K. Reed. My wife was kind enough to provide me the time to investigate and report my findings of this locale and I am grateful for her continuing support. Glory to God in the highest (Prov 3:5–6).

References

- CRSQ: *Creation Research Society Quarterly*
- Baganz, B. P., J. C. Horne, and J. C. Ferm. 1975. Carboniferous and recent Mississippi lower delta plains: A comparison. *Transactions of the Gulf Coast Association of Geological Societies* 25:183–191.
- Bergenback, R. E. 1978. Field Trip 5: Carboniferous depositional environments in the southern Cumberland Plateau. In Milici, R. C. (Field trip chairman). *Field trips in the Southern Appalachians*, Report of Investigations No. 37, pp. 63–86. Tennessee Division of Geology, Nashville.
- Briggs, G. (editor). 1974. *Carboniferous of the Southeastern United States*. Geological Society of America Special Paper 148. Boulder, CO.
- Cecil, C. B., F. T. Dulong, J. C. Cobb, and Supardi. 1993. Allogenic and autogenic controls on sedimentation in the central Sumatra basin as an analogue for Pennsylvanian coal-bearing strata in the Appalachian basin. In Cobb, J. C. and C. B. Cecil (editors). *Modern and ancient coal-forming environments*. Geological Society of America Special Paper 286. Boulder, CO. pp. 3–22.
- Cowart, J. H. and C. R. Froede Jr. 1994. The use of trace fossils in refining depositional environments and their application to the creationist model. *CRSQ* 31: 117–124.
- Froede, C. R. Jr. and Jack H. Cowart. 1996. Dougherty Gap: Evidence for a turbidity current paleoenvironment. *CRSQ* 32:202–214.
- Horne, J. C., J. C. Ferm, F. T. Caruccio, and B. P. Baganz. 1978. Depositional models in coal exploration and mining planning in Appalachian region. *American Association of Petroleum Geologists Bulletin* 62:2379–2411.
- Jones, M. J. 1977. *Field guide to the geology of the Fall Creek Falls area*. Tennessee Division of Geology Guidebook. Nashville.
- Sheehan, M. A. 1988. *Ichnology, depositional environment, and paleoecology of the upper Pennington Formation (Upper Mississippian), Dougherty Gap, Walker County, Georgia*. Unpublished Masters thesis. University of Georgia, Athens.
- United States Geological Survey 1974. Spencer, Tenn.: Van Buren County. Topographic quadrangle—7.5 minute series.
- Wanless, H. R. 1946. *Pennsylvanian geology of a part of the Southern Appalachian coal field*. Geological Society of America Memoir 13. Boulder, CO.
- Wanless, H. R., J. R. Baroffio, and P. C. Trescott. 1969. Conditions of deposition of Pennsylvanian coal beds. In Dapples, E. C. and M. E. Hopkins (editors). *Environments of coal deposition*. Geological Society of America Special Paper 114, pp. 105–142. Boulder, CO.
- Williams, E. L. 1993. Fossil wood from Big Bend National Park, Brewster County, Texas: Part II—Mechanism of silicification of wood and other pertinent factors. *CRSQ* 30:106–111.

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The Catastrophic Effects of Hurricane Danny on Island and Beach Zone Erosion along the Southeastern End of Dauphin Island, Alabama

Carl R. Froede Jr.*

Introduction

Dauphin Island, Alabama provides an excellent field laboratory for the study of a typical Gulf Coast barrier island (Froede, 1995a, 1997) [Figure 1]. An understanding of the changing geomorphology and sedimentology of the island can potentially aid creation-catastrophists in contemplating the short-term and high-energy geological processes which operated during the Ice-Age and Present-Age Time-frames (Froede, 1995b; Reed, Froede, and Bennett, 1996). This note presents information about the rapid formation of large drainage ditches (dendritic washout channels) during the course of Hurricane Danny. This process might explain the initiation and development of various canyons following the withdrawal of Floodwater, throughout the course of the single (post-Flood) Ice Age, and into the Present Age.

Large-scale Precipitation Events Across the Island

Typically, precipitation which falls across Dauphin Island rapidly infiltrates downward through the unconsolidated porous and permeable quartz and heavy-mineral sands. Normally, little to no surface water runoff occurs across the sandy surface of the island. This vertical influx of water serves to recharge the shallow groundwater table. Within the subsurface, the groundwater moves toward an adjacent area of discharge, either the Mississippi Sound or Gulf of Mexico. The travel time for groundwater migration ranges from months to years. Occasionally, storm events occur across the island which change surface run-off and shallow groundwater conditions. This results in the formation of new erosional and/or depositional settings.

Hurricane Danny

Over the course of a two day period in July 1997, Hurricane Danny produced more than thirty inches of precipitation across the eastern portion of Dauphin Island (Conn, 1997; Auburn University, 1997). This occurred because the storm stalled over this area from midnight, Friday, July 18, to 3 p.m. Saturday July 19 (USA Today, 1997) [Figure 2]. Most of the rain readily penetrated the highly porous and permeable beach and dune sands. However, in some instances the large volume of water raised the water table

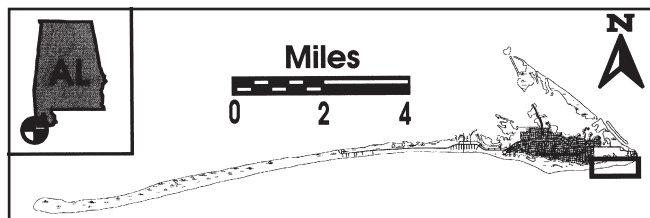


Figure 1. Dauphin Island, Alabama showing the area covered for this investigation (in black box on southeastern end of the island). Modified from the U.S. Geological Survey Biloxi map.

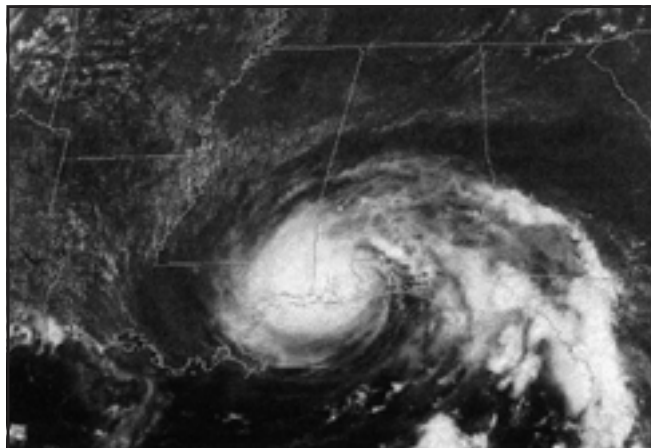


Figure 2. This is the visible image of Danny as seen from the GOES-8 National Weather Service satellite, taken on July 19, 1997, at 11:45 CDT. The hurricane is stalled over the eastern end of Dauphin Island. Modified from Auburn University website image, 1997.

above the ground surface and overland flow was initiated. Surface water run-off drained toward the Gulf of Mexico, ultimately pouring from the top of the beach-cliff scarp along low lying areas. This resulted in the formation of several minor drainage channels across the southeastern end of the island (Figure 3).

A combination of overland flow and mounded groundwater conditions allowed surface water to accumulate sufficiently to pond in the lower areas between the sand dune field and the beach-cliff scarp. Eventually, the ponded surface water reached sufficient depth to initiate overland flow ultimately exiting at low areas along the beach-cliff scarp (Figure 4). The surface water incised downward as it discharged over the cliff scarp, forming a channel. With continued incision at the beach-cliff scarp, the channel eventually intercepted the elevated groundwater table. Fluidization of the sands within the rapidly deepening channels followed. The development and headward erosion of the drainage channels occurred rapidly once the groundwater table and surface water channels were connected. This resulted in the formation of deep, well-defined drainage channels with steep-sided walls. The drainage channels appear as miniature canyons (Fig-

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Figure 3. A shallow drainage ditch which discharged accumulated surface water off the beach-cliff scarp. This channel did not intercept the groundwater table. The dark areas within the channel are accumulations of pine needles lying on top of suspended roots which still span the channel. The sand fluidized as it moved within the small channel towards its point of discharge.

ures 5–7). In many cases these dendritic drainage ditches extend tens of feet back into the island (Figures 8 and 9).

Fluidized Sand

My reason for proposing that the sands fluidized within the drainage channels is based on the condition of the roots and fine rootlets still found within those channels. The plant roots within the drainage channels are still perfectly preserved. It appears that they had not experienced any physical damage as the sands moved within the channel. During my visit to the island three weeks following Hurricane Danny, I noticed that many of the roots still extended across the channels and were unaffected by the removal of the sand (Figures 10 and 11). The sand had simply liquified and flowed at first downward into the deepening channel, and then lat-

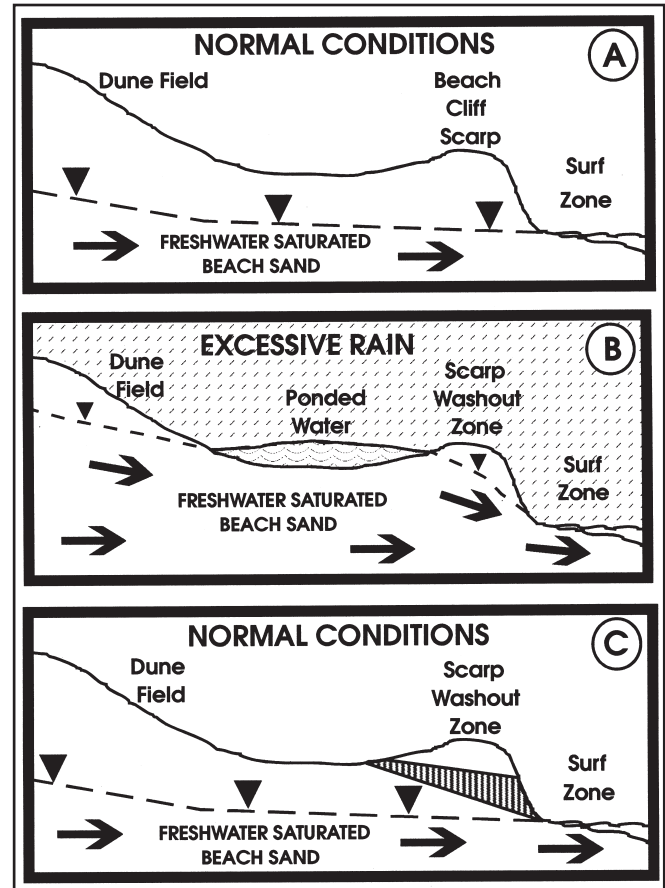


Figure 4. A three-part diagram showing the hydraulic forces which occurred to create the washout channels. Part A shows the beach area under normal conditions. The elevated groundwater table (indicated by the black triangles and dashed line) under the dune fields moves from the island toward the Gulf of Mexico. Part B shows what the heavy rains associated with Hurricane Danny did in this part of the beach area. The groundwater table was significantly elevated, and water ponded in low swales in front of the dune fields. Eventually the water was able to drain at areas of low relief along the beach-cliff scarp. Where these channels intercepted the groundwater table is where significant washout channels formed. Part C shows the return to normal conditions where the groundwater table has dropped below the bottom of the drainage channel. All that remains are various washout channels and the roots of plants.

erally toward the Gulf of Mexico. If the sand had behaved as a flowing mass then the roots would have been broken as the sand flowed in the channel.

Missing Deltas

At the mouth of each of these washout channels there was no evidence of any sand accumulation or delta (Figures 12 and 13). In some cases, the area drained was half the size of



Figure 5. Looking toward the dune field from the surf zone. This photograph shows the steep-sided channel walls. The material is unconsolidated quartz beach sand. Scale along the right side of the opening is three feet long divided into six-inch units. Note that the channel extends back several tens of feet from the beach-cliff scarp. A thin layer of brown mud lies on the bottom of the channel.



Figure 6. Another drainage channel with steep-sided walls. Note the bifurcation in the flow channels as it moved back into the beach-dune zone. The scale (three feet long in six-inch units) is along the left side of the channel. Brown mud lies along the bottom of the channel.



Figure 7. A drainage channel with an isolated pine tree island. Sand remains at the former sandy surface where the plants roots were sufficiently close together to prevent erosion. The sand has been removed from around the base of the pine tree with the formation of the drainage channel.

a football field, and large volumes of sand were washed through the channel into the Gulf of Mexico. A sand delta would be expected at the mouth of each of these washouts. There are no sand deltas present due to two factors; tidal position and longshore currents. The storm did not significantly raise or influence the height of the tides, and there was little to no storm surge associated with it. The sand that washed out of these channels went into the surf zone and was reworked via the longshore currents operating during the course of the storm. These currents spread the sand along the front of the surf zone in a westerly direction.



Figure 8. The washout channel extends 50 to 75 feet back into the beach-dune zone. Note the exposed trees of a former paleo-maritime forest which were once buried by the sand dunes. Water stands in the bottom of the channel because it was incised below the groundwater table.

Implications to the Young-Earth Flood Model

Many studies have been conducted on rapid canyon formation within the framework of the Young-Earth Flood model (see the Appendix in Williams [1998], for a guide to creationist writings on this subject). Many different mechanisms and conditions are believed necessary to account for the formation of these features. This note introduces the rapid nature by which steep-walled dendritic drainage ditches can form in unconsolidated beach sand (see also Williams, 1988). Overland flow as a result of an elevated

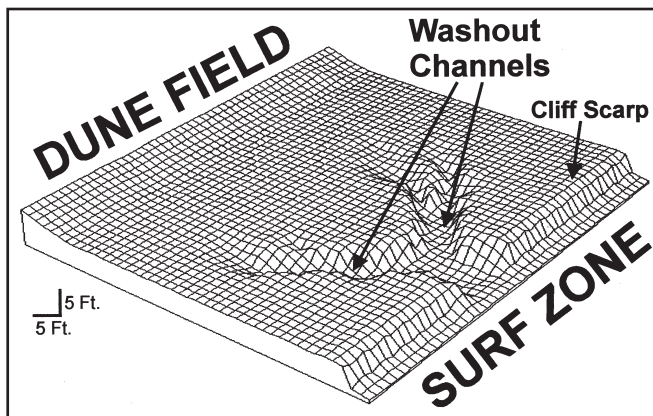


Figure 9. A generalized diagram showing the relative size of one of the washout channels in its geomorphological expression. As water accumulated at the front of the dune field, it was able to mound enough to eventually connect to a surface discharge channel which directed flow gulfward toward a low point along the beach-cliff scarp.



Figure 10. Pine tree roots still extend across a washout channel. If the sand moved as a mass the tree roots would have been broken or abraded. The scale in the center of the channel is three feet long divided into six-inch units.

groundwater table resulted in the formation of these steep-sided washout channels of significant relief (three to five feet high). Perhaps portions of the continental landmasses experienced this same kind of rapid erosion where, following Floodwater withdrawal, heavy precipitation created ponded areas where channels formed and cut down to the groundwater table. Possibly what are now submerged canyons formed out on the continental shelves in this manner when sea-level dropped sufficiently (during the single post-Flood Ice Age) to create this same fluidized state. Additional study of specific sites may answer these questions.



Figure 11. The scale is suspended eight to ten inches above the drainage channel, by a mat formed of pine needles lying on top of undamaged plant roots. After it fluidized, the sand was removed by dropping into the deepening channel, and then moving along the channel to the point of discharge.

Acknowledgments

This document was reviewed by Dr. Emmett L. Williams and Mr. Jerry Akridge, both of whom provided me with many helpful comments. Dr. Brian Rucker supplied me with helpful references about Hurricane Danny from his Pensacola, Florida locale—thanks Brian! Any mistakes or errors are mine alone. I wish to thank my wife Susan who continues to support me in my research and writing efforts. To God be all the Glory. Proverbs 3:5,6.

References

- CRSQ: *Creation Research Society Quarterly*
 Auburn University website. 1997. Rainfall from Danny.
 Accessed 8/17/97. Made available from:



Figure 12. Looking toward the Gulf of Mexico, across the drainage channel containing the pine tree island. Note that there is nothing left of the tremendous sand which was discharged out of this channel. The beach has reconstructed its surf zone, but the profile fails to reflect any of the sand that passed across this area. The channel is approximately 30 feet wide at its opening.

http://www.acesag.auburn.edu/departement/nws/danny/dan_rain.gif

Conn, L. 1997. More than 30 inches of rain take toll on Dauphin Island. *Pensacola-News Journal*. July 20. p. A2.

Froede, C.R., Jr., 1995a. Dauphin Island, Alabama: Evidence for rapid erosion. *CRSQ* 32:143–149.

———. 1995b. A proposal for a creationist geological timescale. *CRSQ* 32:90–94.

———. 1997. Dauphin Island, Alabama: Radiocarbon dating and questions about age. *CRSQ* 33:238–239.



Figure 13. Another smaller washout channel area where the sand was discharged into the surf zone. Note the large pine tree root (approximately 1.5 inches in diameter) which still spans the channel. There is no evidence that sand accumulated in front of this area. Longshore currents in operation during the storm simply carried the discharged sands to the right and away from the front of this channel.

Reed, J.K., C.R. Froede, Jr., and C.B. Bennett. 1996. The role of geologic energy in interpreting the stratigraphic record. *CRSQ* 33:97–101.

USA Today. 7/26/97. Hurricane Danny Timeline. Accessed 8/18/97. Made available from:

<http://www.usatoday.com/weather/wdanny5.htm>

Williams, E.L. 1988. Santa Elena Canyon—1986. *CRSQ* 25:52–54.

———. 1998. Rapid canyon formation: The Black Canyon of the Gunnison River, CO. *CRSQ* 35:148–155.

U.S. Geological Survey. 1982. Biloxi: MISS.-ALA.-LA. 1:100,000-scale metric map.

Cornelius Van Til on the Existence of God

To begin with then I take what the Bible says about God and his relation to the universe as unquestionably true on its own authority. The Bible requires men to believe that he exists apart from and above the world and that he by his plan controls whatever takes place in the world. Everything in the created universe therefore displays the fact that it is controlled by God, that it is what it is by virtue of the place that it occupies in the plan of God. The objective evidence for the existence of God and of the comprehensive governance of the world by God is therefore so plain that he who runs may read. Men cannot get away from this evidence. They see it round about them. They see it within

them. Their own constitution so clearly evinces the facts of God's creation of them and control over them that there is no man who can possibly escape observing it. If he is self-conscious at all he is also God-conscious. No matter how men may try they cannot hide from themselves the fact of their own createdness. Whether men engage in inductive study with respect to the facts of nature about them or engage in analysis of their own self-consciousness they are always face to face with God their maker.

Cornelius Van Til, 1967, *The Defense of the Faith*, 3d ed., p. 195. Presbyterian and Reformed, Phillipsburg, NJ.

Letters to the Editor

Teeth and Toe Patterns in Marsupials

The polyprotodont marsupials according to Young are viewed as being more primitive than the diprotodonts which are considered to be specialized (Young, 1978, p. 562). The polyprotodonts have several pairs of incisors and a normal toe arrangement in the feet, whereas in the diprotodonts (which are herbivores) only one pair of incisors exists and some of their toes are either fused or reduced. The fusion or reduction of toes is the case in a number of herbivores which helps to narrow the surface contact with the ground thereby increasing running capacity. An example of this in both diprotodont marsupials and placental mammals can be seen in the case of the kangaroo and the horse. Likewise in the case of polyprotodont marsupials and placental mammals one can see in the case of the tiger cat (*Dasyurus maculatus*) and the wild cat family Felidae both have a number of sharp incisors and separate toes furnished with powerful claws, indicative of a carnivorous diet and hunting habits. The bandicoots are marsupials having reduced toes to varying degrees but also having the tooth pattern of the polyprotodonts. This is a perfect match for the bandicoot because while they are

swift of foot, they also have a meat-eating diet! Both groups are clearly well suited to their way of life. To say that one has primitive traits and the other group does not is invalid.

Finally, another view seems to have been brought into question. The discovery of a 55 million year old tooth from a placental mammal in Australia, puts the placental mammals living there at the same time as the marsupials and it looks like the marsupials prevailed (Anderson, 1992, p. 17).

References

- Anderson, I. 1992. 'Long in the tooth' mammal theory. *New Scientist* 134(1817):17.
 Young, J. Z. 1978. *The life of vertebrates*. Oxford University Press, England.

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Pneumatization found in *Archaeopteryx*

Before 1979 a description of the anatomy of *Archaeopteryx* would have included a statement that the bones were solid. In 1979 I made a phone call to an establishment that had one of the fossils of *Archaeopteryx* and was told that new work on this fossil showed that it had hollow bones. At that time this news had not been published, however I mentioned this discovery in my 1987 paper on *Archaeopteryx*. What became clear was that, while the bones were hollow, they were not pneumatized. Finally, in 1998, a re-examination of *Archaeopteryx* showed that this fossil did indeed have pneumatization of its bones. Among the areas that pneumatization was discovered, are the cervical vertebrae and anterior thoracic vertebrae (Britt, Makovicky, Gauthier and Bonde, 1998, pp. 374–376). We have come a long way since the discovery of the very first fossil of *Archaeopteryx* and now after about 140 years we have finally discovered that they had pneumatization after all.

Now that pneumatization is found in *Archaeopteryx*, we are told by the authors that pneumatization is not an adaptation for flight *per se*, which of course is true, but the fact is the lack of it was often pointed out by others as though it were. Having pneumatization brings *Archaeopteryx* under

the broad heading of normal, instead of being the odd one out in being a bird with solid bones. It is true that birds such as swallows and swifts have pneumatization, but at the same time, their bones are filled with material, making them in this sense solid. On the other hand, birds like the hornbills have the most extensively hollow bones of any birds, but are poor fliers (Brown, 1987, p. 78). Even so, it is pneumatization, and now *Archaeopteryx* can join that list. I have a feeling there are still things we have yet to learn about *Archaeopteryx*.

References

- Britt, B. B., P. J. Makovicky, J. Gauthier, and N. Bondie. 1998. Postcranial pneumatization in *Archaeopteryx*. *Nature* 395:374–376.
 Brown, Colin. 1987. Another look at the *Archaeopteryx*. *Creation Research Society Quarterly* 17:87, 109.

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Creation Research Society Board Meeting Field Trips

The Creation Research Society (CRS) held its annual Board meeting in Atlanta, Georgia May 18–20, 2000. Field trips were conducted on Saturday, Sunday, and Monday to Stone Mountain (GA), Providence Canyon (GA), and DeSoto Falls/Little River Canyon (AL), respectively. The field trip leaders (Jerry Akridge and Carl Froede Jr.) provided a summary field trip guidebook to the participants which included CRS board members and regular members from as far away as Seattle, WA. A great time was had by all the field trip attendees. The field trip leaders thank everyone for attending and for keeping things interesting with stimulating questions.

The Stone Mountain field trip was attended by 20 individuals who witnessed first-hand the massive granitic pluton which rises 780 feet above the surrounding topography. The group walked around several sections of the mountain and was presented with multiple evidences of rapid formation, emplacement, and uplift. An excellent example of cross-cutting relationships was presented which allowed the group to understand this important geologic concept. Various dikes (both aplite and pegmatite) were discussed and examined by the field trip attendees. Perhaps the best examples of the rapid emplacement and cooling of the once molten granite was presented by several xenoliths observed on the western side of the pluton. The last stop occurred at a diabase dike outcrop which cross-cut the Stone Mountain Granite.

The Providence Canyon field trip got off to a bumpy start with missing two turn-offs from the interstate. However, once on their way the group was able to observe the termination of the Piedmont just north of Columbus, GA/Phenix City, AL (at the Phenix City gneiss/migmatite) and proceed to coastal plain strata. One of the stops allowed the group to closely examine the K/T boundary in Georgia. This contact occurs between the Clayton Formation and the underlying Providence Sands. Both of these strata occur in Providence Canyon, but are



Figure 1. Examining an aplite dike in Stone Mountain Granite. Photograph provided by Rich and Ginger Overman.



Figure 2. Participants stand close to the edge of an overlook, admiring the scenic beauty of the many colored sands exposed in one of the canyons at Providence Canyon State Park.

not easily examined within the canyons. Seven individuals attended this field trip and witnessed the large canyon system which rapidly developed over the past 150 years. The group walked a section of the rim and explored the bottom of one of the many canyons in the state park. Fortunately, no one experienced the “quick sands”—Providence Canyon being one of the few places in the United States where

quick sands are common. The group was able to see cross-bedded sands, kaolin balls, and *Ophiomorpha* (i.e., shrimp) trace fossils. The Providence Canyon sands exhibit a variety of colors and according to some uniformitarians each is considered a distinct fossil soil (i.e., paleosol). The group was quickly able to see through the uniformitarian model and note that millions of years were not necessary to deposit these sands, and they never existed as paleosols. Rain cut short this interesting field trip, but attendees were able to see everything they needed to see to understand that millions of years are not necessary to explain canyon formation.

On Monday, eight participants traveled for two and one-half hours to northeastern Alabama to attend the last (and possibly the best) field trip. The group stopped at several places where waterfalls were present and Jerry Akridge provided an excellent discussion about how waterfalls likely formed following the Flood, Jerry also explained how canyons as large as Little River Canyon formed starting with the withdrawal of Floodwater and extending through the Ice Age into the present. Excellent examples of pea gravels and fossilized ferns were also provided as testimony to the massive power of the global Flood. A stop



Figure 3. Jerry Akridge explains the formation of Little River Canyon Falls to field trip attendees.

was made at the Sallie Howard Chapel which incorporates a large “pseudo-hoodoo” into the front of the chapel. Although several attendees were on a tight schedule to make out-bound flights, all were able to see everything that is impressive about this area of northeastern Alabama.

Carl R. Froede, Jr.
A. Jerry Akridge

Book Review

God at Ground Zero by Curt Sewell

Master Books, Green Forest, AR. 1997, 278 pages, \$19.99

The book is subtitled “The Manhattan Project and a Scientist’s Discovery of Christ, the Creator.” A vivid photo on the cover shows the first atomic explosion in the New Mexico desert in July, 1945. The author, an electronics engineer, witnessed the test and has taken the phrase “Ground Zero” (epicenter, central point of action) as a metaphor for God’s action as Creator and as the center of Sewell’s own life.

Although his early schooling included standard evolutionary dogma, the author became a Christian as a young adult. College studies seemed to reinforce his belief in evolution, so that it became imperative to resolve such a conflict with biblical views.

For years I felt as if I were sitting on a fence, wavering between two semi-firm beliefs....Both sets of doctrines were important to me, and they each seemed to possess good foundational reason....On Sundays, I could believe the Bible, but on workdays I had to disregard important Biblical sections. (pp. 11–12).

Having tried various compromises (progressive creation, the “Gap theory” etc.) Sewell was given creationist literature by a friend. Thus began, in the late 1960’s, his search through the writings of both creationists and evolutionists. Finally came the conviction that creation is a better explanation than is evolution, and a full commitment to God and His magnificent creation.

Written with students in mind, the book is easy to read while giving accurate, well-documented information to counter the misinformation on origins so prevalent in schools and in the media. The central chapters comprise "Arguments Favoring Creation," "The Great Flood of Noah," and "Arguments Against Macro-evolution." The author's technical training has enabled him to give a detailed critique of radioactive dating with its many flaws and inconsistencies.

A final chapter, "Religious and Philosophical Arguments" includes a number of quotations from distin-

guished writers defining evolutionism as a philosophical belief rather than a science. A brief history of philosophy and of the Christian faith, with evidences for the validity of Biblical origins, is followed by a concise presentation of the Christian Gospel. There is no index, but a good annotated list of books for further reading.

Carol Armstrong
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Book Review

The Design Inference: Eliminating Chance Through Small Probabilities by William A. Dembski
Cambridge University Press, Cambridge, UK. 1998, 243 pages, \$59.95

This title has appeared on at least one list of the twentieth century's "Top 100 Books." The author refers to it as a monograph, a revised version of his philosophy dissertation from the University of Illinois at Chicago (1996). With additional studies in mathematics, probability theory, and complexity theory Dembski comes to his subject well qualified. The problem: How to distinguish events which are the result of design from those due to regularity (natural law) or to chance.

The design inference does not indicate what the design agency was, nor how it operated. These are separate problems. But by demonstrating "patterned improbability" the indication of design in an event precludes chance as an agent.

Dembski's text is dense with symbols and equations, although he employs some intriguing practical examples illustrating improbabilities. The reader will do well to focus on a flow chart entitled "The Explanatory Filter" (p. 37), which illustrates a clear and simple method for distinguishing chance from design.

Of special interest to creationists is a case study, "The Creation-Evolution Controversy", pp. 55-62. Further con-

siderations regarding the same argument are discussed in the chapter on Small Probability, in which the claims of Richard Dawkins as to spontaneous origin of life are answered.

The chapters on probability and complexity theory condense a great amount of material into some 30 pages each. Other researchers have written large books on each of these subjects, and Dembski's abbreviated treatment will be difficult to follow for all but the mathematically trained.

In an epilog, Dembski states that he believes the main significance of the design inference for science is that it detects and measures information. Where systematic information is found, design and not chance must be inferred. Other researchers also have concluded that information is the central problem of biology, and is essential to a theory of human consciousness.

The book has an index and an extensive list of references.

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Erratum

CRSQ 36(3), December 1999, page 134. In paragraph 2 of the first column, replace each S(C) that appears between (5) and (6) with the script A that appears after (4).

Creation Research Society Board of Directors Meeting May 2000

On Thursday 18 May 2000 a meeting of the Board of Directors (BOD) was held at the Wyndham Garden Hotel, Duluth, Georgia, from 2100 hours to 2230 hours to review plans for the committee meetings on Friday. On Friday 19 May 2000 between the hours of 0800 and 1700 the Research, Membership, VACRC, CRSnet, Quarterly Editorial, Constitution/Advanced Planning, Publications, RATE and Finance Committees each met separately for approximately two hours to plan for the Saturday business meeting.

On Saturday 20 May 2000 the closed business meeting of the BOD was called to order at 0800 hours. Present: T. Aufdemberge, E. Chaffin, D. DeYoung, W. Frair, R. Gentet, D. Gish, G. Howe, D. Kaufmann, L. Lester, G. Locklair, J. Meyer, E. Williams, G. Wolfrom. Absent: R. Humphreys, J. Reed.

The minutes of the 1999 BOD meeting were accepted as distributed prior to the meeting. Secretary Kaufmann reported that the following were elected for a three-year term: Chaffin, Lester, Reed, Wolfrom.

The Treasurer's report by Gentet was presented and accepted. A budget of \$238,000 income and \$238,000 outgo for the year 2000 was accepted.

The membership report by Wolfrom was given as follows: total membership for 1999/00 was 1615 (630 voting, 642 sustaining, 330 subscriber and 13 students). This is a loss of 37 from the 1998/99 membership year.

The CRSnet report by Wolfrom resulted in the following actions. The name of the Committee was changed to the Internet Committee. Permission was granted by the BOD to give the Committee permission to investigate a proposal from Paul Taylor of Eden Communications for the CRS to join Christian Answers Network. The Committee may accept the proposal if the details of the partnership are found to be acceptable and beneficial to the CRS internet enterprise.

The Quarterly Editorial report by Williams was given as follows: geology and biology are the two most prevalent areas for articles in the CRSQ out of the 19 possible subject areas. Each issue of the CRSQ has a balance of articles, notes, letters and book reviews.

The Creation Matters report was given by Wolfrom noting that we need to acquire more manuscripts.

The Research Committee report by Chaffin was presented and accepted.

The Membership Committee report by Kaufmann resulted in the following actions. Since the Gish Debate Workshop was so successful, Kaufmann is to pursue holding two Debate Workshops during the next year possibly in New York City, Kansas City or Phoenix. The Vice Presi-

dent will write a letter to lapsed members encouraging them to renew their membership.

The Van Andel Creation Research Center (VACRC) report by DeYoung was accepted with a budget of \$134,000 income and \$134,000 expenses for the year 2000.

The Quarterly Committee report by Williams was presented and accepted.

The Constitution/Advanced Planning Committee report by Frair made minor word changes in our Goals and Strategies document.

The Publications Committee report by Howe resulted in the following actions. It was decided that at the end of each fiscal year hereafter, the VACRC Director will calculate the amount of VACRC money spent on Publications Committee (PC) expenses. Upon approval of the PC Chairman and the CRS Treasurer, that amount will be subtracted from the PC balance and added to the VACRC balance. There is a book balance of funds that will allow the production of future books.

The RATE (Radioisotopes and Age of Earth) Committee report by Chaffin stated that their book will be published this summer.

The Finance Committee report by Aufdemberge resulted in the following actions. We will continue to purchase Class A shares of mutual funds. The reinvestment of the proceeds from our funds is left to the discretion of the Finance Secretary. The following indemnification statement was adopted by the BOD: This corporation shall indemnify the officers, directors, employees and such other persons as designated by the BOD, to the fullest extent permitted by the Articles of Incorporation and the laws of the State of Michigan.

It was passed to nominate the following for the BOD election in 2001: D. DeYoung, R. Samec, R. Humphreys, D. Kaufmann, G. Locklair, E. Williams.

D. DeYoung and D. Boylan were elected as Fellows of the Creation Research Society.

The following officers were elected for 2000/2001: President: D. DeYoung, Vice President: E. Chaffin, Secretary: D. Kaufmann, Treasurer: R. Gentet, Membership Secretary: G. Wolfrom, Financial Secretary: T. Aufdemberge.

The BOD approved sending a complete set of CRSQ's to K. Wise to replace those lost in a fire.

It was passed to hold the 2000 BOD meeting in Phoenix/Chino Valley, Arizona, Thursday, May 31 to Saturday, June 2.

The meeting was adjourned at 1330 hours.

Respectfully submitted,
David A. Kaufmann, Secretary

Instructions for Authors

Submission

An original plus two copies shall be submitted to the editor of the *Quarterly*. Due to the expense involved, manuscripts and illustrations will not be returned to authors.

All submitted articles will be reviewed by at least two technical referees. The editor may or may not follow the advice of these reviewers. Also, the prospective author may defend his position against referee opinion.

The editor reserves the right to improve the style of the submitted articles. If the revisions of the editor and referees are extensive, the changes will be sent to the author. If the changes are not acceptable to the author, he may withdraw his request for publication.

After the peer review is finished and all changes have been made to the article, a final copy will be requested. This should be accompanied by a computer disk containing a copy of the article. Please label the disk with the name and version of the word processor program used, such as WordPerfect 9.0. Authors who provide either an email address or fax number will receive a proof copy of their article just prior to publication.

Authors are requested to supply a list of key words for subjects covered in their articles.

The *Quarterly* is a journal of original writings. Only under unusual circumstances will we reprint previously published manuscripts. Never submit an article to two or three journals, including ours, hoping all of them will publish your work. When submitting an article, please state if the material has been published previously or has been submitted to other journals.

Appearance

Manuscripts shall be computer-printed (or typed) and double-spaced. If you are unable to provide a copy of your paper on computer disk, one final paper copy should have no handwritten marks of any kind in the text area, although you may write page numbers at the very bottom of each page.

Although it is nicer to be positive, there seem to be a lot of important negatives:

- Do not indent the first word of each paragraph; separate paragraphs by an extra blank line instead.
- Never press the space bar more than once anywhere, not even at the ends of sentences.
- Do not hyphenate words at the ends of lines.
- Do not use all capital letters for anything (titles, etc.).
- Do not use bold type in the paragraphs; use italics to call attention to words.

- Do not use multiple spaces for tables and similar material. Use tabs instead.
- Do not use dashes (—) for definitions, but use colons instead, e.g., “NR: Not recorded.” Where dashes are appropriate, to indicate a pause in thought, please use *two hyphens* (with no spaces on either side) if your word processor does not offer an actual dash.

Each footnote should be included *in the text*, surrounded by [brackets], immediately after the text to which the footnote applies.

All figures and drawings must be of high quality, therefore, no sloppy hand drawings or freehand lettering will be accepted. Unacceptable illustrations will result in rejection of the manuscript for publication. Photographs must be prints rather than slides. Do not embed pictures in text files.

References and Book Reviews

References should be in the current *Quarterly* style. Additional references from the same author(s) should be preceded by three underline characters in place of the name(s). The examples below should cover most possibilities.

CRSQ: *Creation Research Society Quarterly*. [for multiple *Quarterly* references]

Cockman, Joneen. 1988. Collecting plants for the Creation Research Society Herbarium. *CRSQ* 24:187–193.

Margulis, Lynn. 1971a. The origin of plant and animal cells. *American Scientist* 59:230–235.

———. 1971b. *Origin of eukaryotic cells*. Yale University Press, New Haven, CT.

Hitchcock, A. S. 1971. *Manual of grasses of the United States*. Dover Publications, New York.

Walker, Tasman B. 1994. A biblical geologic model. In Walsh, R.E. (editor), *Proceedings of the third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.

Book review headings, like references, have a particular style which should be followed. This issue of the *Quarterly* will provide examples.

Length

Manuscripts containing more than 25 pages are discouraged. If a topic cannot be covered to the author's satisfaction in this number of pages, the author should divide his material into separate papers that can be serialized in the *Quarterly*. Book reviews should be limited to 1000 words.

Creation Research Society

Membership/Subscription Application and Renewal Form

The membership/subscription categories are defined below:

1. **Voting Member** those having at least an earned master's degree in a recognized area of science.
2. **Sustaining Member** those without an advanced degree in science, but who are interested in and support the work of the Society.
3. **Student Member** those who are enrolled full time in high school or undergraduate college.
4. **Senior Member** voting or sustaining members who are age 65 or older.
5. **Life Member** a special category for voting and sustaining members entitling them to a lifetime membership to the Society.
6. **Patron Member** a special category for voting and sustaining members who either make a one-time \$2,500 contribution to the Society's general fund, or contribute \$500/year for five years. A Patron Member receives a life-time subscription, a plaque, and has his or her name listed in the *Quarterly* each year.
7. **Subscriber** libraries, churches, schools, etc., and individuals who do not subscribe to the Statement of Belief.

All members (categories 1–6 above) must subscribe to the Statement of Belief as defined on the next page.

Please complete the lower portion of this form, and mail it with payment to the membership secretary:

Dr. Glen W. Wolfrom, Creation Research Society, P.O. Box 8263, St. Joseph, MO 64508-8263.



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Creation Research Society

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

Activities—The society is solely a research and publication society. It does not hold meetings or engage in other promotional activities, and has no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund is maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible. As part of its vigorous research and field study programs, the Society operates The Van Andel Creation Research Center in Chino Valley, Arizona.

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

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

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

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

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

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