

CRSQ

CREATION RESEARCH SOCIETY QUARTERLY



Volume 42

December 2005

Number 3

Creation Research Society Quarterly

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Cover design by Michael Erkel:

Michael Erkel and Associates, 1171 Carter Street,
Crozet, Virginia 22932

The *Creation Research Society Quarterly* is published
by the Creation Research Society, 6801 N. Highway 89,
Chino Valley, AZ 86323, and it is indexed in the *Chris-
tian Periodical Index* and the *Zoological Record*.

Send papers on all subjects to the Editor:
Kevin L. Anderson, Van Andel Creation Research Cen-
ter, 6801 N. Highway 89, Chino Valley, AZ 86323.

Send book reviews to the Book Review Editor: Don B.
DeYoung, 200 Seminary Dr., Winona Lake, IN 46590.

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ISSN 0092-9166

Printed in the United States of America

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Haec Credimus

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

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Larry Vardiman, Andrew Snelling, and Eugene Chaffin (editors). 2005. Institute for Creation Research and Creation Research Society, approximately 876 pages. \$80.00 (hard cover).

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An Initial Investigation into the Baraminology of Snakes: Order—Squamata, Suborder Serpentes

Tom Hennigan*

Abstract

Evolution theory predicts that the ancestry of organisms can be traced down a hypothetical evolutionary tree and eventually back to the first living cell. Creation theory postulates that ancestry can be traced back only a limited distance to a starting organism of that type. Instead of a “tree” the creation model has a “forest” of unrelated organisms with vast genetic potential. I hypothesize that the snake taxon originated from one or more originally created “trees” or “kinds” that have diversified into the snakes of today and that snakes are unrelated to any other group. In order to test this hypothesis, the snake taxon was analyzed using a discontinuity matrix and the data suggest that snakes can be considered a group unto themselves. Subsequently, a literature search was begun in order to determine additive evidence for relatedness. Three families were identified for their interspecific and intergeneric hybridization tendencies and within each family certain genera and species were classified into subgroups of related snakes. This initial investigation indicates that many snakes have the ability to hybridize, even when they are reproductively isolated over great distances, and are capable of a large degree of variation within a “species.” As more data are gathered and quantified, I predict that evolutionary hypotheses will continue to be frustrated because of faulty metaphysical assumptions and will strongly suggest that snakes began from one or a few originally created kinds, just a few thousand years ago.

Introduction

Historically, the evolution model of common descent predicted that we should see continuity among all organisms and that species could be traced along the evolutionary tree to a single-celled ancestor. That prediction has not born itself out. The whole question of just what a “species” is has come under fire for many years. Evolutionary taxonomists maintain that the species taxon is the “currency” of biology

at the same time that they realize the term “species” has more than twenty meanings, each of which is vigorously debated among biologists (Agapow et al., 2004). Much of the difficulty arises from the presuppositions of the evolutionary worldview, which is built upon the metaphysic of materialism.

Creation theory, to the contrary, postulates a “forest” of organisms in which each “tree” began with an originally created pair designed with vast genetic potential for variation but discontinuous with (not related to) the other created “kinds.” Although there is great variation within each “tree”, there is a limit to biological change and those limits cause serious problems for an evolutionary model involving common ancestry (Lester and Bohlin, 1989). The creationist

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Accepted for publication: June 14, 2005

begins his scientific inquiry with a Biblical understanding of our world and interprets it from a theistic metaphysic.

The materialistic and the theistic worldviews present very different visions when trying to understand how life progressed on earth. Concepts of morality, God, and even biosystematics can have grossly different explanations and interpretations based on different worldviews. The materialist view postulates that snake ancestry can be traced along the evolutionary tree to the lizards. Up until recently, the prevailing belief was the marine hypothesis, which stated that snakes evolved from limbless marine lizards. Many evolutionists, however, are interpreting new data that favor snakes having descended from terrestrial lizards (Ross, 2004). There is little evidence for either the marine or terrestrial hypotheses in the fossil record however, and much snake morphology appears highly designed and unique to the snake group.

Baraminology is a creationist method of biosystematics that begins with Genesis 1:24–25 and predicts that we should see major unrelatedness, or discontinuity, among various taxa because God made them after their kinds. The purpose of baraminology is to discover the boundaries of the created kind or holobaramin. A *holobaramin* is defined as all the organisms within the group that are related with each other but not related to any other group. In other words, all members of that group began with an original created pair. Humanity is an example of a holobaramin group in that the members are related by common descent to the originally created Adam and Eve.

The *monobaramin* is a group of organisms related to one another by common descent, but not necessarily all of them (ReMine, 1993). For example, if a tree represents the human holobaramin, then one or more branches representing specific people groups (such as Caucasians and Ethiopians) would each represent a subset of all humans or a human monobaramin (Frair, 2001).

The *apobaramin* consists of a group of creatures that do not share ancestry with any other group. For example, turtles are an apobaramin because they share no common ancestor with any other group, such as birds, or snakes. But it also means that within the turtle apobaramin there may be one or more created holobaramins. The apobaramin is different than the holobaramin in that the apobaramin may be made up of creatures that were derived from one or more originally created kinds. In contrast, the holobaramin has been identified as such because all members have been traced back to one created pair. Therefore, humans are not only a holobaramin because they can be traced to the originally created Adam and Eve but also they are an apobaramin because they share no common ancestor with any other group (Frair, 2001).

The purpose of this paper is to view snake biosystematics from the creationary standpoint and to initiate an investigation of snake baraminology upon the premise that God produced life according to specific created kinds (Genesis 1:24–25). In the case of snakes, it is unclear whether all snakes came from one or a few originally created pairs. I hypothesize that snakes are discontinuous with any other group and are therefore an apobaramin. The goal is to determine if all snakes came from one or a few original created pairs by grouping related snake taxa using additive evidence and separating unrelated snake taxa using subtractive evidence in order to identify one or more snake holobaramins. Eventually I would like to develop a creationary model of snake biosystematics that would be more consistent with the taxonomic data, and that would avoid the ambiguous species concept. Hopefully, it would likewise have a more robust predictive value than the current evolutionary origins model.

Serpents in the Bible

In order to determine true discontinuity, baraminologists have an analysis called the Discontinuity Matrix (Wood and Murray, 2003). The serpentes taxon was analyzed using this matrix and the results are summarized in Table I.

The first step was to find out what the Bible says about snakes. Although the Bible does not claim discontinuity for snakes, it implies discontinuity, suggesting that snakes are unrelated to other organisms. The Hebrew transliteration for “serpent” in Genesis 3:1 is *Nachash* or *Nahash* meaning “shining whisperer”, and referring to serpent or snake (Harris et al., 1980). It is derived from the assumed Hebrew root *nhsh*. Revelation 12:9 unveils the identity of the serpent as the devil, Satan, and is not referring to a wild snake that talks. It is unclear, however, whether it was a snake whom Satan indwelt in Genesis or whether “snake” was just another name for Satan.

Nehushtan is used over 30 times in the Old Testament and is the most common word for “snake” (Harris et al., 1980). Certain snake characteristics used in conjunction with this word, include stealth (Genesis 49:17), poisonous bite (Prov. 23:32), snake “charming” (Eccl. 10:8), climbing ability on a smooth surface (Amos 5:19), “licking the dust” (Isa. 65:25), and making a hissing sound (Jer. 46:22) (Harris et al., 1980). Though once in a while there are other creatures to which this Hebrew word might refer, the above list suggests that the Bible implies snakes are a group of their own, discontinuous with other groups.

Other questions that may determine discontinuity also were asked. As a taxon, snakes have many unique characteristics that include: 120 to over 400 precloacal vertebrae,

Table I. Discontinuity Matrix for Serpentes.

Does the Bible claim discontinuity for snakes?		No
Does the Bible imply discontinuity for snakes?	Yes	
Do most of the members of the group exhibit a novel metabolic pathway not found in other groups or only in groups known to be discontinuous?	Unknown	
Is the similarity of ingroup comparisons significantly greater than ingroup vs. outgroup comparisons?	Yes	
Do most members of the group possess novel cell types or structures not possessed by other groups or only in groups known to be discontinuous?	Yes	
Do most members of the group possess novel organs or anatomical structures not possessed by other groups or only in groups known to be discontinuous?	Yes	
Is the overall morphological similarity within the group significantly greater than the similarity of the group with other groups?	Yes	
Does the group occupy an environment notably different from other organisms?		No
Are stratomorphic intermediates that would connect the group to other groups mostly absent?	Yes	
Is the lowest member of the proposed ancestral group found in a higher layer than the lowest member of the group of interest?		No

Compiled from (Wood and Murray, 2003, p.95)

a branch of the trigeminal nerve that is enclosed within the braincase, a lack of muscles in the ciliary body of the eye, the left arterial arch larger than the right, and the brain enclosed in a rigid box made of bone (Pough et al., 2004).

All are carnivorous. Their respiratory system consists of a stunted left lung and a longer right lung (Pough et al., 2004). Compared to other reptiles, whose livers and stomachs are S-shaped, the snake liver and stomach are fusiform. These unique snake characteristics, coupled with the Biblical data and the poor fossil record connecting snake and lizard ancestry, (Pough et al., 2004; Ross, 2004) show that six out of ten discontinuity criteria, with one unknown, can be answered in the affirmative on the Discontinuity Matrix (see Table I). This suggests that the snakes can be considered an apobaramin or a group unrelated to all other groups.

Snake Monobaramins

It has been estimated that there are about 2300 species of snakes in the world (Conant and Collins, 1998). Depending on the taxonomic source, there are about 15 families of snake species. Trying to identify snake species is in continual flux and can be controversial, as is true of most taxa. One's definition of "species" often determines the identification of same.

In baraminology, there are many characters of organisms that determine continuity or relatedness. The ability to hybridize was the main character investigated for this paper. Hybridization suggests a close biochemical relationship between two organisms and is an important additive evidence for ancestry within a "kind" in the identification of monobaramins. It is also realized, however, that just because two organisms are unable to hybridize does not mean they are unrelated. There are many environmental, behavioral, biochemical and morphological reasons why hybridization might not be possible between related organisms. For this reason, baraminologists look at the creature holistically and analyze as many characters as possible including morphology, anatomy, behavior, environmental niche, and biochemistry. A holistic view that allows the organism to be classified based on the totality of real data effectively eliminates much of the subjectivity and bias possible.

A literature search was done in order to document the ability of snakes to hybridize, both in the wild and in captivity. From this initial search, three families were identified: Boidae (Table II), Colubridae (Table III), and Viperidae (Table IV). Many snake taxa were capable of hybridization interspecifically, intraspecifically, and/or intergenerically within each family.

Snake breeders frequently cross various members of snake taxa in order to discover the variation that can be

Table II. Hybridization in Boidae

Hybrid Pairing	Artificial/Natural	Fertility	References
<i>Morelia spilota metcalfei</i> x <i>Morelia s. bredli</i>	Artificial	Fertile	Hoser, 2001
<i>Morelia s. metcalfei</i> x <i>Morelia s. mcdowelli</i>	Artificial	Fertile	Hoser, 1999
<i>Antaresia childreni</i> x <i>A. maculosus</i>	Artificial	Fertile	Hoser, 1993
<i>Antaresia childreni</i> x <i>A. stimsoni</i>	Artificial	Fertile	Hoser, 1993
<i>A. maculosus</i> x <i>A. child./maculosus</i> hybrid	Artificial	Fertility assumed	Hoser, 1993
<i>Morelia s. spilota</i> x <i>M. amethystina</i>	Artificial	Fertility assumed	Hoser, 1988
<i>Morelia s. spilota</i> x <i>Liasis fuscus</i>	Artificial	Fertility assumed	Hoser, 1988
<i>Morelia s. spilota</i> x <i>Liasis mackloti</i>	Artificial	Fertile	Banks and Schwaner, 1984
<i>Morelia s. spilota</i> x <i>Morelia amethystinus</i>	Artificial	Fertile	Banks and Schwaner, 1984
<i>Boa c. constrictor</i> x <i>Boa c. imperator</i>	Artificial	Fertile	Meyer-Holzapfel, 1969
<i>Python regius</i> x <i>Python breitensteini</i>	Artificial	Fertile	Chernof, 2004

produced and to sell those variants profitably. Breeder websites such as kingsnake.com have ongoing discussions of many current crosses hobbyists have accomplished. Tables II–IV contain summaries of some of the known hybrids from the professional literature though a few are from personal correspondences with herpetoculturalists and field herpetologists.

Family Boidae (Table II) consists of about 17 genera with 75 or more species (Museum of Zoology, Ann Arbor, Michigan). Members of the genus, *Morelia* (carpet pythons) in that family, readily hybridize interspecifically with each other, and intergenerically with *Liasis* (Australian and rock pythons), producing fertile hybrids.

The children's pythons (*Antaresia* sp.), also in Boidae, hybridize interspecifically producing fertile hybrids in both f_1 and f_2 generations. Crosses between various subspecies of *Boa* have produced fertile offspring in zoos. Interestingly, the Borneo python (*Python breitensteini*) and ball python (*Python regius*) have produced hybrids in captivity. This is surprising for many because these two species are reproduc-

tively isolated in the wild. The Borneo python is native to Sumatra and Malaysia, while the ball python is indigenous to Western and West Central Africa. From these data *Morelia/Liasis*, *Python*, and *Antaresia* were identified as three probable monobaramins, within the Boidae taxon.

The Colubridae family (Table III) is the largest snake taxon comprising about 1700 species which is more than 74% of all snake species. Many genera readily hybridize both naturally and in captivity. Members of the *Nerodia* complex of water snakes, for example, often intergrade in the wild. Some have even adapted to saltwater while others thrive in fresh water, demonstrating an interesting genetic variation in related species (Lawson et al., 1991). Herpetoculturalists have crossed at least 14 different species, in captivity, across the three genera *Pantherophis*, *Pituophis*, and *Lampropeltis* (Table III). They often question the taxonomic conclusions of what defines a species.

Historically the genera *Toluca* and *Conopsis*, which are Mexican endemics, have been differentiated by one single character, a groove on each posterior maxillary tooth.

Table III. Hybridization in *Colubridae*.

Hybrid Pairing	Artificial/Natural	Fertility	References
<i>Nerodia fasciata</i> x <i>N. sipedon</i>	Natural intergrades	Fertile	Lawson et al., 1991
<i>N. f. confluens</i> x <i>N. sipedon</i>	Natural intergrades	Fertile	Lawson et al., 1991
<i>N. f. pictiventris</i> x <i>N. sipedon</i>	Natural intergrades	Fertile	Lawson et al., 1991
<i>Nerodia f. confluens, fasciata, pictiventris</i> x <i>N. clarkii, taeniata, compressicauda</i>	Natural intergrades	Fertility between salt and freshwater snakes	Lawson et al., 1991
<i>Zamenis persicus</i> x <i>Z. situla</i>	Artificial	Fertile	Ryabov, 1998
<i>P. guttatus</i> x <i>P. obsoletus</i>	Artificial	Fertile	Siderva et al., 2003
<i>Elaphe schrenckii</i> x <i>Elaphe anomala</i>	Artificial	Fertile	Siderva et al., 2003
<i>P. climacophora</i> x <i>E. anomala</i>	Artificial	Fertile	Siderva et al., 2003
<i>P. situla</i> x <i>Z. persicus</i>	Artificial	Fertile	Siderva et al., 2003
<i>P. o. obsoletus</i> x <i>P. quadrivittata</i>	Natural Intergrades	Fertile	Conant, 1998
<i>Lampropeltis g. getula</i> x <i>L. g. floridana</i>	Natural Intergrades	Fertile	Conant, 1998
<i>L. t. triangulum</i> x <i>L. t. elapsoides</i>	Natural Intergrades	Fertile	Conant, 1998
<i>L. t. triangulum</i> x <i>P. g. guttatus</i>	Artificial	Fertile	Batton, 2000
<i>L. getula splendida</i> x <i>L. holbrookii</i>	Natural Intergrades	Fertile	Cole, 2004
<i>P. o. lindheimerii</i> x <i>P. bairdi</i>	Natural Intergrades	Fertile	Cole, 2004
<i>L. getula holbrookii</i> x <i>L. g. nigra</i>	Natural Intergrades	Fertile	Cole, 2004
<i>Diadophis punctatus arnyi</i> x <i>D. p. regalis</i>	Natural Intergrades	Fertile	Cole, 2004
<i>Storeria decayi subspecies</i>	Natural Intergrades	Fertile	Cook, 1993
<i>Thamnophis subspecies</i>	May integrate in NW California	Fertile	Morrison et al., 1998.
<i>Pantherophis, Pituophis, Lampropeltis</i>	Artificial breeding across genera common	Fertile	Kingsnake.com
<i>Pituophis catenifer annectens</i> x <i>P. melanoleucus</i>	Artificial	Fertile	Kennard, 1980

Toluca was said to have this trait while *Conopsis* did not. Otherwise, the two groups were difficult to distinguish and several taxonomists questioned whether this single trait was appropriate in the determination of its taxonomic status (Goyenechea and Flores-Villela, 2002). Consequently, a study was done, looking at a suite of characters that included snout-to-vent length, total length, number of ventral and subcaudal scales, shape of hemipenes, dorsal/ventral color patterns, and tooth grooves. In all, about 18 characters were studied in 199 members of *Conopsis* and 460 members of *Toluca* (Goyenechea and Flores-Villela, 2002). They found that all of the characters that were compared

intergenerically were variable and were found in both genera. They recommended that all ten species and subspecies be kept under one Genus called *Conopsis*.

Grismer et al. (2002) questioned the taxonomy of sand snakes (*Chilomeniscus*) after comparing four species of *Chilomeniscus* on such traits as color pattern, head scale morphology, ventral scale counts, and supra/infra labial counts. They found that these traits varied interspecifically. The authors concluded that there was no discrete difference between three of the four species of *Chilomeniscus* but maintained that *C. savagei* be separate because of its unique head scale arrangement. These four species: *C.*

Table IV. Hybridization in *Viperidae*.

Hybrid Pairing	Artificial/Natural	Fertility	References
<i>Sistrurus catenatus</i> x <i>Crotalus horridus</i>	Natural	Fertile	Klauber, 1997
<i>Crotalus adamanteus</i> x <i>Crotalus atricaudatus</i>	Natural	Fertile	Klauber, 1997
<i>Crotalus r. ruber</i> x <i>Crotalus h. helleri</i>	Artificial	Fertile	Klauber, 1997
<i>Crotalus s. scutulatus</i> x <i>Crotalus unicolor</i>	Artificial	Fertile	Klauber, 1997
<i>C. scut./unicolor</i> x <i>C. scutulatus/unicolor</i>	Artificial	Fertile	Klauber, 1997
<i>C. o. oreganus</i> x <i>C. scutulatus</i>	Artificial	Fertile	Klauber, 1997
<i>Crotalus atrox</i> x <i>Crotalus atricaudatus</i>	Artificial	Fertile	Cole, 2004
<i>Gloydus saxatilis</i> x <i>Gloydus halys</i>	Natural	Fertility Assumed. Controversial taxonomic status.	Kudryavtsev and Bozhansky, 1988
<i>Agkistrodon contortrix mokasen</i> x <i>Agkistrodon c. phaeogaster</i>	Natural	Fertile. Little molecular variation with copperhead subspecies.	LeClare, 2004
<i>Bitis gabonica</i> x <i>Bitis arietans</i> <i>Bitis gabonica</i> x <i>Bitis nasicornis</i>	Natural and Artificial	Fertile. Their ranges overlap in the wild.	Dexter, 2002

sinctus, *C. punctatissimus*, *C. stramineus*, and *C. savagei* are clearly related. To distinguish species based on a minor variation places too much emphasis on one characteristic. Likewise it draws attention to the philosophically ambiguous species concept. Based on hybridization and the great variation found in closely related snakes, I have identified the following genera as six probable monobaramins: *Nerodia*, *Pantherophis/Lampropeltis/Pituophis*, *Diadophis*, *Thamnophis*, *Toluca/Conopsis*, and *Chilomeniscus*.

Family Viperidae (the pit vipers) consists of about 200 species which make up about 10% of all snake species. Table IV lists four genera that hybridize with each other both in the wild and in captivity. The Massasaugas (*Sistrurus*) and the timber rattlers (*Crotalus*) have been known to produce fertile hybrids (Klauber, 1997). The copperheads (*Agkistrodon*) have little molecular variation between the subspecies which may intergrade naturally (LeClare, 2004).

The Aruba Island rattler (*Crotalus unicolor*) is one of the rarest rattlesnakes in the world (Klauber, 1997). It is found off the coast of Venezuela and though geographically isolated from the Mojave rattlesnake (*Crotalus scutulatus*), the

two species, Aruba Island rattler and Mohave rattlesnake, produced a fertile hybrid in captivity.

The genus *Bitis* includes the gaboon viper (*B. gabonica*), puff adder (*B. arietans*), and rhinoceros viper (*B. nasicornis*). Their territories overlap in the wild in Africa and they are thought to intergrade. In captivity they have hybridized interspecifically (Dexter, 2002). Therefore, I suggest that the genera *Crotalus/Sistrurus*, *Agkistrodon*, and *Bitis* each be classified as a monobaramin within the pit viper taxon.

Conclusions and Further Research

A common argument leveled against creation science is that it has no predictive value. Historically, the evolution model of common descent predicted that we would see continuity among all organisms and that they could all be traced to a single-celled ancestor. Alternatively, the creation model predicts that we should see discontinuity among various taxa because God made them after their kinds. The current evidence suggests that certain organisms are discontinuous with other organisms. For example, snakes have unique

characteristics that set them apart as a taxon, making them discontinuous with other organisms and classified as an apobaramin. This initial investigation also indicates that many snakes have the ability to hybridize, even when they are geographically isolated, and are capable of a great degree of variation within a “species.” In addition to kingsnake.com there are other informal internet sources that discuss the current hybrids being produced; they can be readily located using various search engines. Hybridization and species variation show that subgroups, based on close relationships, can be identified as monobaramins within the three families researched. Within Boidae, *Morelia/Liasis*, *Python*, and *Antaresia* were identified as three separate monobaramins. *Nerodia*, *Pantherophis/Lampropeltis/Pituophis*, *Diadophis*, *Thamnophis*, *Toluca/Conopsis*, and *Chilomeniscus* were identified as six monobaramins within the colubrid taxon and in the viper family the three monobaramins were *Crotalus/Sistrurus*, *Agkistrodon*, and *Bitis*. The goal is to determine whether all snakes came from an original pair or from two or more original pairs in the quest to identify the holobaramin(s).

There is still much to be done in order to complete their baraminology. As a taxon, they must be looked at holistically and other characters must be identified. From these data baraminology techniques such as the baraminic distance method, and the Analysis of Patterns (ANOPA) will help quantify significant similarities and differences between snake taxa (Wood and Murrery, 2003). Quantitative analysis will give us a better handle on the biosystematics of serpentes, and from a Biblical perspective, I predict that a better model of snake origins will emerge. This will provide an opportunity to consider the Bible’s claims and ultimately to understand the Creator’s outline.

Glossary

Apobaramin – consists of at least one group related by common ancestry but does not share ancestry with any other member outside its own group. (Example: Snakes are hypothesized to be an apobaramin because they do not seem to share a common ancestor with any other group such as birds or fish. It is unknown, however, whether snakes are made up of one or more holobaramins because it is unclear whether they arose from one or a few originally created snake “kinds.”)

Baraminology – a creationist method of biosystematics used to identify the originally created “kinds” and incorporating discontinuity criteria and other creationist assumptions.

Discontinuity or discontinuous with – a significant difference between two groups of organisms. (Example: Turtles are distinctly different creatures than birds and therefore

turtles are discontinuous with birds.)

Holobaramin – all of the organisms in a group that are related to one another but not related to any other group. (Example: All humans are classified as a holobaramin because all are descended from the original Adam and Eve and are not related to any other organism.)

Monobaramin – a group of organisms related to one another by common descent, but do not necessarily include all of the organisms in that holobaramin. (Example: Caucasians and Amerindians would be monobaramins in the human holobaramin because they represent a subset of humans but do not represent all people in the human holobaramin.)

Morphology – the study of the form and structure of organisms.

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Book Review

The Truth About Human Origins by Brad Harrub and Bert Thompson

Apologetics Press, Inc., Montgomery, AL. 2003, 517 pages, \$18.00.

Brad Harrub and Bert Thompson are to be commended for this anthropological endeavor! Together they present a comprehensive and up-to-date book on the status of our supposed evolutionary relationship with ape-like ancestors. Dr. Harrub is the Director of Scientific Information at Apologetics Press and serves as Associate Editor of *Reason & Revelation*, a monthly journal on Christian evidences. Dr. Thompson is the Executive Director of Apologetics Press and is the Editor of *Reason & Revelation*.

In this book they discuss the record of the rocks, more

specifically, the various fossil remains that have been alleged to be our ape-like ancestors. The authors provide a brief but excellent discussion on biological taxonomy and human evolution and ask whether man truly evolved from the apes. They then present the various fossil forms and their current status. There are excellent artist renditions of many of the creatures discussed, a positive feature of the book. They discuss the Laetoli footprints and give examples of fossil errors. It is important to have anthropological and paleontological book updates. Ideas change quickly in these fields, particularly in regard to mankind. The book indicates that the actual evidence is one thing; the inferences drawn from that evidence are entirely another. Data do not explain

themselves; rather, they must be interpreted. And therein is an important point that is often overlooked. Rarely is it that the data is in question; it is the interpretation placed on the data that is in dispute.

Harrub and Thompson talk about the molecular evidence of human origins and the latest research regarding chromosomal counts and genomic differences. They provide a creation analysis regarding “Mitochondrial Eve”, its demise, the molecular clock mitochondrial dating of our supposed ancestors, the serious errors in mitochondrial DNA dating found in the scientific literature, and whether human and Neanderthal DNA are a match.

The problem of gender and sexual reproduction is discussed. Harrub and Thompson contend, based on the available evidence, that the complexity, informational content, and intricacy associated with sexual reproduction demand that it is a product of intelligent design. The origin of sex from asexual to sexual reproduction is discussed along with various evolutionary ideas of how this might have taken place. From an evolutionary point of view the question is asked, “Why does sex exist at all?” No one has been able to explain from an evolutionary viewpoint the origin of sex and the origin of the incredibly complex meiotic process that makes sex possible. Other subjects discussed include differences between various species, differences between human and animal sexuality, anatomical and cellular differences between human males and females, the complexity of the human reproductive system, and the future of human reproduction.

The problem of language and evolutionary theories regarding the origin of speech are discussed. It is concluded that Adam and Eve were created with the ability to understand verbal communication and to speak between themselves as well as with God. The Tower of Babel incident is shown to be consistent with the notion that a small number of languages, separately created at Babel, diversified into the huge variety of languages today.

The brain’s language centers, “Broca’s area” and “Wernicke’s area” and the anatomy of speech are discussed as well as the vast differences between humans and animals. The complexity of language clearly is uniquely human. Harrub and Thompson indicate that all attempts to shed light on the evolution of human language have utterly failed due to the lack of knowledge regarding the origin of any language. This leaves a huge gulf to bridge the gap between humans and the grunts, barks, and chatterings of animals.

The problem of the complexity of the human brain also is discussed. Harrub and Thompson give a brief history of the brain. They talk about the supposed evolution of the brain and the mystery (from an evolutionary point of view)

of how we evolved a brain with so much mental capacity or potential. The precision and complexity of our brain, and the way in which it is able to interact with our mind clearly point to an intelligent Designer.

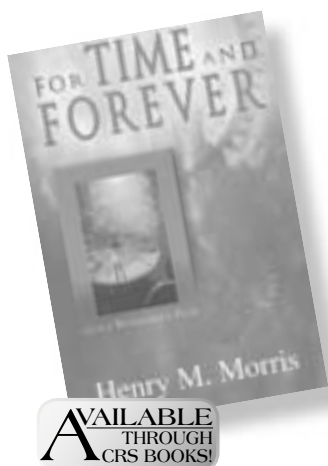
Another book section deals with the evolution of consciousness. I found this section particularly interesting and fascinating. The many quotes assembled alone make the book worthwhile. The consciousness discussion includes its importance, mystery, and the brain-mind interaction. Some very interesting questions are asked: Where in the brain is awareness, or consciousness located? Is it a function of the whole brain or only a part? Is it a property of neurons or nerve cells? Is there more than one level of consciousness? What does it mean to be unconscious and what mechanisms determine whether we are conscious or not? Attempts are made to define exactly what consciousness is and I found it ironic that what I was thinking turned up later in the book and that was that “I am aware that I am aware.” Can the same be applied to animals? Are they aware as we are aware? I have my own thoughts regarding these questions but will leave that for another time.

Why and how did consciousness arise? Something I thought of that may not be in the book (this is a large book and I may have overlooked it) was a possible evolutionary explanation as to how consciousness may have arisen. It is just conjecture, and I certainly don’t believe it, but if I thought of it then I’m sure evolutionists have thought of it, and that is that consciousness arose for survival value. Being aware of one’s environment may aid in self-preservation and therefore may be of adaptive value and become a primeval instinct. Consciousness became an instinct and it developed from that need. Again, I am not saying I believe this. As far as I know there is no empirical evidence to even suggest it.

I also wonder if a computer with sounds and language could be made for a chimpanzee say, to be able to speak by using a computer. Is that possible? I personally don’t believe it would work but it would be an interesting experiment.

There is excellent discussion regarding philosophical questions as well as physical questions regarding the mind and the soul that makes for great reading. The final section considers the problem of skin color, differences between human and animal blood types, what is a ‘race’, and much more. This book should be in all serious creationist libraries. The book is a comprehensive resource of information and includes a fine listing of references as well as name and subject index.

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Book Review

For Time and Forever by Henry Morris

Master Books, Green Forest, AR, 2004, 222 pages, \$13.00.

This book covers a wide number of topics including creation, evangelism, Islam, the anthropic principle, and cosmology. Some of the content is gathered from past articles in *Acts and*

Facts. Dr. Morris begins the book by reflecting on his life. A civil engineering degree strengthened his early interest in creation studies. There are many ways to carry out the Genesis 1:28 dominion mandate, and our duty is to understand and manage nature (p.14). Dr. Morris further suggests that the mandate may one day apply beyond the earth to include the stars and galaxies (p. 32). Interesting comments are made on the author's own books, now numbering more than 50 volumes. He also lists the classic books

which made an early impression on himself (p. 46).

As always, Dr. Morris provides a menu of original new food for thought. According to Psalm 119:89, the Bible text actually was established before creation (p. 49). The physical universe may be infinite in extent according to several biblical texts (p. 165). In the future, heavenly state there will be no need for police, lawyers, or doctors (p. 205). One could add to this list locksmiths, armed services, and NASA. Dr. Morris suggests that engineers will still be needed to help explore the totality of creation. Similar humor and informality shows up throughout the book. Thanks, Dr. Morris, for hitting another home run, this one covering 222 pages.

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Book Review

Johannes Kepler and the New Astronomy by James Voelkel

Oxford University Press, New York. 1999, 141 pages, \$12.00.

This book is one of a biography series called Oxford Portraits in Science. Kepler (1571–1630) is of special interest to creationists because

of his faith and several new insights are provided here. The Protestant Kepler family lived in part of Germany controlled by Roman Catholicism. Four centuries ago religious persecution and torture were common. Johann walked a delicate line, maintaining his faith while becoming Imperial Mathematician for the local Catholic authorities.

Kepler's father was a failure who abandoned his family. Mother Katharina was accused of being a witch and some of her practices encouraged the reputation. Kepler rescued her from severe punishment and showed unusual insight into the excesses of his day. He cast horoscopes for needed income and was quite successful, all the while knowing that astrology was gibberish. In 1601 he wrote that he disliked

“nourishing the superstition of fatheads!” (p. 27). One can imagine the private conversations Kepler had with Galileo (1564–1642) concerning astrology.

Kepler spent years analyzing the astronomy data collected by Tycho Brahe. The book carefully explains how Kepler arrived at his three laws of planetary motion. In his final hours in 1630, probably suffering from pneumonia, he was asked on what he pinned his hope of heaven. Kepler's reply: “Solely on the merit of our savior Jesus Christ, in which is founded all refuge, solace, and deliverance” (p. 129). This unusual quote in an Oxford University Press publication is probably due to general editor Owen Gingerich, a man of strong Christian faith. Kepler's grave location is unknown, lost during the following years of religious war. However, Kepler's discoveries and testimony remain with us.

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Origin and Significance of Sand-Filled Cracks and Other Features near the Base of the Coconino Sandstone, Grand Canyon, Arizona, USA

John H. Whitmore*

Abstract

Conventional geology proposes that the Coconino Sandstone formed when wind-blown desert sand migrated over the mud-cracked floodplains of the Hermit Formation. The contact between these two Permian formations was studied along ten trails in the Grand Canyon. Special attention was given to sand-filled cracks that occur at the base of the Coconino penetrating the Hermit, features usually interpreted as mud cracks. The most notable cracks are widest (up to 25 cm) and deepest (up to 10 m) along the Bright Angel Fault on the South Rim. Cracks are always present near major faults, but become narrower, shallower and are sometimes absent altogether as horizontal distance from faults increases and vertical displacement along faults decreases. Vertical laminations within the cracks, U-shaped cracks, cracks that dissipate upwards, slickensides not caused by faulting and other features make the mud crack theory suspect. They might be better explained as clastic dikes (or sand intrusions) which originated by injection during tectonic activity *after* the deposition of the Coconino Sandstone. Evidence near the base of the Coconino such as load casts, burrows and vertebrate trackways, suggests the Coconino was rapidly deposited in an aqueous environment. Cross-cutting relationships indicate the Bright Angel Fault was active during the Precambrian, then quiescent until the Cenozoic (Miocene to Pliocene). If the clastic dikes were caused by tectonic activity, either the Coconino was unlithified or only partially lithified in excess of 200 million years (unlikely, in a conventional scenario) or that only a short amount of time passed between deposition and faulting, greatly reducing the supposed duration of geologic time.

Introduction

The boundary between the Permian Coconino Sandstone and the underlying Hermit Formation is one of the most distinct contacts observable around the rim of the Grand

Canyon in Arizona. Most works that discuss these formations mention the sand-filled cracks that occur at the base of the tan, cross-bedded Coconino Sandstone and penetrate the brick-red Hermit Formation. White (1929) and McKee (1934) were the first to describe these features in detail. No one has since questioned their interpretation that these features were giant desiccation mud cracks that were filled by Coconino desert sand blown across the flood plains of the Hermit. Since McKee, the cracks have been little studied. The most notable cracks are up to 25 cm wide and up to

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Accepted for publication: February 17, 2005

10 m deep along the Bright Angel Fault on the South Rim. A reconnaissance study was made by Whitmore and Peters (1999) of the Coconino/Hermit contact. They found that crack length varies from location to location, cracks are absent at some locations, load casts and burrows occur at some locations near the base of the Coconino, and that the contact is transitional in the eastern end of the Grand Canyon. Sipes and Peters (2000) came to the conclusion the cracks were true mud cracks, primarily because of their polygonal nature. They compared the cracks to large desiccation polygons that can sometimes form in playa lake beds (Fife, 1977; Goetz, 1980; Lang, 1943).

The dominant view of the Coconino is that its large cross beds are remnants of ancient desert sand dunes because of their similarity to modern desert dunes (McKee, 1979). From a creationist perspective, very little work has been done on the Coconino and Hermit, and both formations need to be thoroughly reexamined before we can definitively determine how they might have been deposited during the Flood. To this end, Austin (1994) challenged the desert sand dune interpretation for the Coconino, suggesting the cross bedded deposits are the result of large

submarine sand waves. Brand (1979) and Brand and Tang (1991), found that vertebrate trackways, most common in the lower part of the Coconino, might be best explained as being formed in an underwater environment, not in an exposed, dry environment.

This work will help creationists further understand how the Coconino and Hermit may have formed during the Flood, within short biblical time constraints. I will argue that the sand-filled cracks could not have formed as a result of desiccation, but are likely sand intrusions or clastic dikes that can form only when sand becomes fluidized. I will also show how a clastic dike interpretation questions the validity of the passage of more than 200 million years in the Grand Canyon.

Methods

The Coconino/Hermit contact was studied along seven trails on the South Rim and three trails on the North Rim of the Grand Canyon (Figure 1). South Rim locations included (from east to west) Tanner, Hance, South Kaibab, Bright Angel, Waldron, Dripping Springs, and South Bass



Figure 1. Trail locations and northeast trending faults, pertinent to this study. Sand-filled crack lengths are indicated by ovals and vertical fault displacements are indicated by rectangles. Fault locations are approximate.

Table I

Diagnostic Criteria for Mud Cracks	Refs	Comparison with Sand-Filled Cracks at Grand Canyon
V or U cross section; can have parallel sides	1,2	Present
Infilled from above	1,3	Yes
Fill shows internal stratification and great range of fill and texture	2,4	No, homogeneous texture
Multiple generations (orders) of cracking	1,5	Possibly present
Associated with surficial features (e.g., tracks, rain impressions, etc.)	1	Not present
Usually small, but can be very large	6,7,8,9	All sizes present, but most are large
Commonly, though not always, form complete (connected) polygonal patterns	2,5,10	Incomplete polygons?
Usually straight; sometimes curved	3,5	Most straight
Cracks of same generation have similar depths	11	Depths vary
Can branch and change width	3	Present
Horizontal cracks develop at depth; depth is $\sim 1/3$ polygon size	12	Not present
Associated with “mud curls”	9,13	Not present
Correlate to high clay percentage in sediments	14	Hermit is clay rich
Can have radial pattern	2	Unknown

1. Pummer and Gostin (1981); 2. Shrock (1948); 3. Smoot (1981); 4. Diller (1889); 5. Reineck and Singh (1980); 6. Fife (1977); 7. Goetz (1980); 8. Lang (1943); 9. Longwell (1928); 10. Kidder (1990); 11. Sipes and Peters (1990); 12. Konrad and Ayad (1997); 13. Allen (1986); 14. Olsen and Haugen (1998)

Trails. The Hermit Trail was also investigated, but the contact was poorly exposed. North Rim locations included (from east to west) North Kaibab, North Bass and Thunder River Trails. The Bill Hall Trail was investigated, but the contact was covered (although it can be seen a few hundred meters from the trail). The Nankoweap trail was not hiked since Abbott and Cook (2004) described the contact as poorly exposed. Along the eastern North Rim, the contact is present between Point Imperial and Cape Royal, but there is no trail access. Cracks were seen with a small telescope at some locations there, but could not be observed in detail. Data are not available for the remote western Grand Canyon where there are few roads and trails. Field work was done in 1997, 1999, and 2004. Field notes, photographs, and measurements were made at most locations.

The literature was examined to develop criteria for mud cracks, syneresis cracks, diastasis cracks, and clastic dikes (or sand intrusions) so the Grand Canyon cracks could be properly identified (Tables I–IV). The literature was also

examined for background information on the respective formations and processes. Large playa mud cracks were examined at Lake Lucerne, near Lucerne Valley, California for comparison.

Results

The Hermit Formation

Blakey and Knepp (1989, p. 334) described the Hermit formation as being comprised of “red mudstone, siltstone, flat-bedded, ripple-laminated, and cross-stratified sandstone, aphanitic limestone and sedimentary-pebble conglomerate.” Blakey (1990a) described the Hermit as fine-grained, consisting of brownish red siltstones, mudstones, and fine-grained sandstones. It forms a slope, just below the resistant, cliff-forming Coconino Sandstone. The Hermit varies in thickness from about 30 m in the eastern part of the Grand Canyon to about 270 m in the western part of the Grand

Table II

Diagnostic Criteria for Syneresis Cracks	Refs	Comparison with Sand-Filled Cracks at Grand Canyon
V or U cross sectional shape	1,2,3	Present
Infilled from above or below	3	Present from above
Generally only one generation of cracks	3	Many sizes of cracks
From salinity change, loading, or shrinkage of mineral lattices	1,2,3,4,5	Hance Trail cracks possibly from loading
Slight bend or branching at base of crack common	2	Present
Can form polygonal shapes; commonly less regular than mud cracks and often incomplete	2,4,6,7	Hints of incomplete polygons
Compaction often results in oblique orientation of cracks to bedding planes	4	Present at Hance Trail
Can form from tectonic disturbance	8,9	Link to Bright Angel Fault?
Can have preferred orientation	4	Possible
Display bulbous elements when formed by compaction	4	A few are present
Curling of polygons can occur	1	Not present
High sinuosity	3,7	Not present
Muddy fill	7	Not present
Can form radiating (star-like) patterns	10	Unknown

1. Burst (1965); 2. Kidder (1990); 3. Pummer and Gostin (1981); 4. Donovan and Foster (1972); 5. White (1961); 6. Moore (1914); 7. Smoot (1983); 8. Flower and Ives (1946); 9. Pratt (1998a,b); 10. Snyman (1950)

Table III

Diagnostic Criteria for Diastasis Cracks	Refs	Comparison with Sand-Filled Cracks at Grand Canyon
When viewed on bedding planes, they can show orthogonal intersections	1	Present
Vary from complete to incomplete polygons	1	Possible
Most cracks jagged and irregular	1	Present
Many bifurcate downward, and have multiple branches both upward and downward	1	Present
Cracks can be uniformly open, tapered (up or down), or dilated along verticals	1	All present
Cracks can pinch, bulge, or swell	1,2	Present
Cracks are often of varying lengths and not always vertical. Compaction can distort both length and orientation	1	Present
Experimentally reproduced in layers of hardening plaster and sand subjected to shearing	3	Link to Bright Angel Fault?

1. Cowan and James (1992); 2. Kriz and Stepanek (1979); 3. Cowan et al. (2001)

Table IV

Diagnostic Criteria for Clastic Dikes	Refs	Comparison with Sand-Filled Cracks at Grand Canyon
Caused by tectonism, sudden loading, sudden failure, or high fluid pressure	1,2,3,4,5,6,7	Caused by Bright Angel Fault?
Generally massive; but can show flow structures and oriented and deformed mica grains	1,2,8,9,10,11,12,13,14	Most are massive; some have flow structures; some have aligned grains
Dike walls can show flute and groove marks	13	Not observed
Grading of sedimentary grains may occur parallel to crack walls	13	Unknown; no thin section study
Most consist of coarse silt to fg-mg sand. Well sorted, spherical, fg sand is most susceptible to intrusion	1,2,4,9,15,16	Coconino is well sorted, rounded sand
Dikes vary greatly in thickness and spacing	9,16,17	Present
Dikes can branch and branches can then coalesce	2,7,9,14,16,18,19	Present
Dikes can intersect other dikes	16	Present
Megapolygons can develop in subsurface	20,21	Possibly present
Incomplete and complete polygonal patterns exist	21,22,23	A few are present
Dikes can have preferred orientation based on tectonic factors	1,4,9,17,18,21,24	Not present
Slickensides or evidence of shearing can occur on sides of dikes; intrusions are associated with faulting and can occur along fault planes	4,9,14	Present at Bright Angel and North Kaibab trails
Dikes can be injected downwards	5,21	Dikes injected from Coconino to Hermit
Dike formation requires: (1) pressure gradient between fluid in intrusion and fluid in fracturing rock, (2) trigger mechanism, (3) tensile strength in fracturing rock	4	Relatively lower permeability in Hermit may have caused pressure differential; Hermit appears to have some tensile strength

1. Diller (1889); 2. Dott (1966); 3. Flower and Ives (1946); 4. Jolly and Lonergan (2002); 5. Pogue (1998); 6. Reimintz and Marshall (1965); 7. Shoulders and Cartwright (2004); 8. Haff (1944); 9. Harms (1965); 10. Hiscott (1979); 11. Jenkins (1925); 12. Laird (1970); 13. Peterson (1968); 14. Waterston (1950); 15. Lowe (1975; 1976); 16. Newsom (1903); 17. Jolly et al. (1998); 18. Boehm and Moore (2002); 19. Truswell (1972); 20. Bellamy (1977); 21. Silver and Pogue (2002); 22. Froede (1998); 23. Raza et al. (1981); 24. Anderson (1951)

Canyon (McNair, 1951). White (1929), performed a comprehensive study of the Hermit, but he focused primarily on plant fossils and a few animal tracks within the unit. He noted that the formation varies from shale to conglomerate, but consists mostly of intensely rippled sandy shales and silts, with angular to subangular sand grains. He claimed that “stream ripples are omnipresent throughout the formation” (p. 17). This could not be confirmed and I saw few sedimentary structures near the top of the Hermit.

The lower contact of the Hermit is with the Esplanade Sandstone, and is clearly unconformable in some places, but not in all. Noble (1922) and White (1929) described huge “hollows” cut into the Esplanade by the Hermit. The

largest of these were 21 m deep, 0.8 km wide, and filled with shale (see White, 1929, p. 13, plates B and C). He commented that the Esplanade must not have been well lithified when the Hermit was deposited because the hollows appear to have been easily cut into the sandstones and there are no lithified pieces of Esplanade within the Hermit. Blakey (1990a) agreed with White’s (1929) original conclusion that the Hermit was deposited on broad flat floodplains.

The Coconino Sandstone

The most outstanding sedimentary features of the Coconino Sandstone are its giant cross beds. Middleton et al. (1990) reported that the sand advanced to the south, based on

cross bed orientations. The Coconino is thickest south of the Grand Canyon where it reaches a maximum of 300 m, near Pine, Arizona (McKee, 1934). It thins and disappears at the Arizona/Utah border, just north of the Grand Canyon and to the east in Monument Valley. It is about 180 m thick in the central Grand Canyon region (Middleton et al., 1990). The formation is nearly all rounded to subangular, fine grained, pure quartz (88–95%) sandstone. Accessory minerals include carbonates, feldspar, and heavy minerals (McKee, 1934). McKee (1934) also noted frosting and pitting of the grains, and that the Coconino contained noticeably finer sand in its upper part compared to the lower.

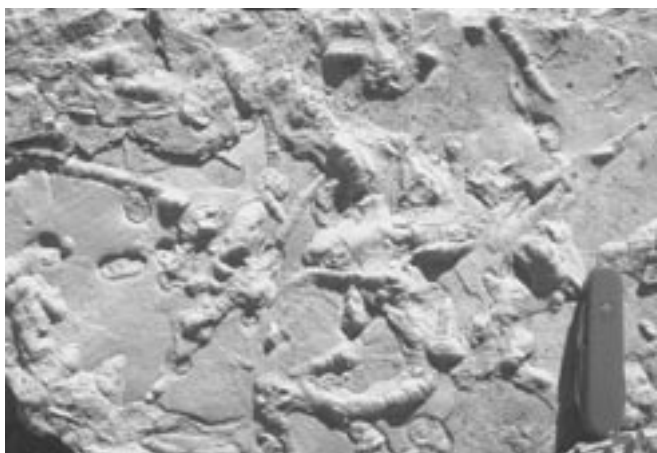


Figure 2. Burrows in the Coconino Sandstone on inclined cross bedded surfaces along the Tanner Trail. The pocket knife insignia is about 1 cm high.

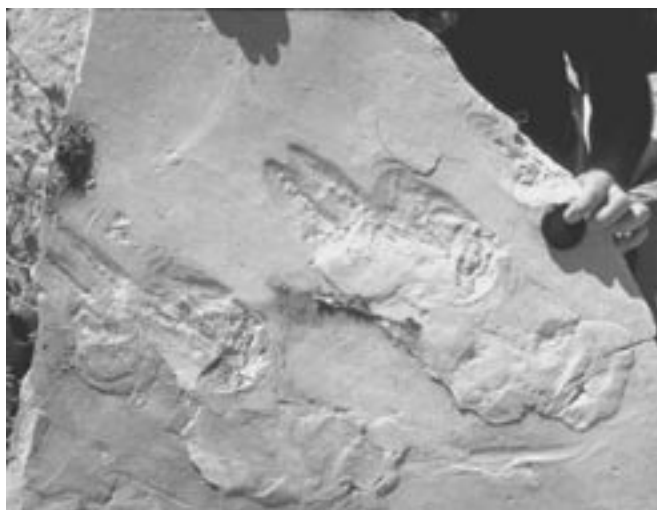


Figure 3. Three sets of large tracks from an unknown track maker near the base of the Coconino Sandstone, Tanner Trail. The lens cap is approximately 6 cm in diameter. The slab was found in float.

He correctly concluded that the pitting and frosting of the Coconino grains are evidence of wind transportation. But he also noted it did not automatically indicate the Coconino was formed in a desert. Bedding planes (laminations) within the Coconino are very clear at all locations, as well as just above the contact with the Hermit. At most locations, the Coconino sands are horizontal at the Hermit contact, but occasionally cross bedding occurs immediately above the contact.

The Coconino is well known for its burrows and trackways (Brady, 1947; Gilmore, 1925; 1926; McKee, 1934), but body fossils have yet to be found. During this research, extensive burrows were found near the base of the Coconino only along the Tanner and Bright Angel trails (Figure 2). Brady (1947) reported additional burrows in the Little Colorado River Canyon, near Seligman, and near Ash Fork,



Figure 4. Interbedded transitional contact between the Hermit Formation and the Coconino Sandstone, Tanner Trail. Typically the transition between the Hermit and Coconino is sharp, with no evidence of unconformity or returning lithologies (see Figure 5).

Arizona. The burrows along the Tanner Trail are especially interesting because they occur on numerous inclined bedding planes, but very few of the bedding planes are burrowed thoroughly enough to erase the laminations in the sandstone (seen in cross section). Several types of burrows are present; many with both vertical and horizontal components. They begin 0.5 m above the Hermit/Coconino contact and extend upwards for several meters. A few large tracks (Figure 3) were also found in pieces of float at the Tanner site. Along the Bright Angel Trail, horizontal burrows were found only on four bedding planes, extending up to inclined bedding planes near the base of the Coconino. No vertical burrows were found at this location.

The Hermit-Coconino Contact

Nearly everywhere in the Grand Canyon, the contact between the Hermit and Coconino is sharp. Many workers

have noted that no *obvious* unconformity or evidence of significant erosion exists (Baars, 1962; Blakey and Knepp, 1989; Blakey, 1990a; McKee, 1934). Along the Tanner Trail, the contact is transitional (McKee, 1934; Noble, 1922; Whitmore and Peters, 1999); a fact which has been widely ignored. At this location, in the far eastern Grand Canyon, the two formations grade back and forth three times at their boundary (Figure 4). Throughout the canyon, the contact is fairly easy to find, but at many places the top meter or so of the Hermit has been bleached, possibly by groundwater flowing out of the many springs at the contact. The contact may also be transitional at the North Bass Trail, but more field work is needed to confirm that.

East of Seligman and into the western Mogollon Rim region (south of the Grand Canyon), Blakey (1984; 1990b) observed the Schnebly Hill Formation between the Hermit and Coconino. He reported that the contact between the



Figure 5. One of the longest sand-filled cracks along the Bright Angel Trail on the South Rim. The vertical crack is near the center of the photo and is approximately 9 m long. Note how sharp the contact is between the Hermit and the Coconino and how the Coconino cross beds come directly down to the contact.

Table V

Location (see Fig. 1)	Occurrence and Features of Sand-Filled Cracks
Bright Angel Trail	Five large, unevenly-spaced cracks examined. Total length unknown due to covering of talus at cliff base. Longest estimated at ~ 10 m long and 25 cm wide. Average length estimated at >6 m. Internal bedding is massive. Possible slickensides at one crack.
Bill Hall Trail	Hermit/Coconino contact not accessible; no cracks observed from trail.
Cape Royal Overlook	Cracks observed at distance with spotting scope.
Dripping Springs	Ten large cracks examined at the Dripping Springs; spaced 1-13 m apart. Many others observed high above trail to springs. Largest crack was 10 m long and 3 cm wide. Shorter cracks ~ 2 m long; average length ~ 4 m. Widest crack was 13 cm; others much narrower. One U-shaped crack present.
Grandview Trail	Contact not observed at close range.
Hermit Trail	Contact not observable at close range, but cracks were visible at distance.
Hance Trail	Many small cracks averaging 0.4 m long; up to 1 m long. Width varies from a few mm to 15 cm. Fill includes small clasts of Hermit Fm. Cracks were greatly deformed and dipping to North. Load casts (one large, many small) present at contact.
Ken Patrick Trail	Cracks observed at distance with spotting scope from trailhead.
North Bass Trail	Five cracks observed, with average length of 1 m. Widths at median crack depth range from 4-10 cm. Cracks narrow downward to a few mm. Possible internal flow patterns visible in three cracks. Two cracks are "squiggly." Hermit/Coconino contact may be transitional, but more field work needed to confirm.
North Kaibab Trail	Ten large and several minor cracks examined. Average length was ~1.2 m. Average width was ~2 cm, ranging up to 10 cm, but many cracks were exceptionally narrow (few mm). Possible slickensides along some crack boundaries. Many narrow cracks were "squiggly." Several cracks connected to sand lenses within Hermit Fm. Cracks are unevenly spaced.
South Bass Trail	Contact accessible, but no cracks observed.
Point Imperial Overlook	Cracks observed at distance with spotting scope.
South Kaibab Trail	Seven cracks examined about 200 m east of trail, where contact is accessible. Average length of longer cracks is ~3.5 m; width ranges up to 20 cm. Total length obscured by talus and by cracks disappearing and then reappearing. Possible internal flow patterns in three cracks. Several cracks connected to sand lenses in Hermit Fm. Cracks are unevenly spaced.
Tanner Trail	Interbedded contact between Hermit and Coconino Fms. No cracks present.
Thunder River Trail	Five cracks examined. Average length is ~0.5 m, maximum is 1 m. Width ranges from a few mm to 5 cm. Cracks are "squiggly."
Vista Encantada Overlook	Cracks observed at distance with spotting scope.
Waldron Trail	Many cracks visible on cliffs high above trail.

Hermit and Schnebly Hill is also sharp, but that it lacks the sand-filled cracks so prominent in the Grand Canyon (Blakey, 1990a). The Schnebly Hill is in excess of 600 m thick near Holbrook, Arizona (southeast of the Grand Canyon).

Sand-filled cracks were found along every trail with the exception of Tanner and South Bass (Table 5). The cracks reach their maximum length and width along the Bright

Angel Trail, which descends into the canyon along the Bright Angel Fault. Here, the cracks are up to 25 cm wide and 10 m deep (Figure 5). To the east, west and north, cracks become shorter (less than 2–3 m) and narrower (1 to 10 cm). On the South Rim, cracks disappear completely to the east (beyond Hance Trail) and to the west (beyond Fossil Mountain near Havasupai Point, Noble (1922). No cracks were found along the South Bass Trail. Many cracks

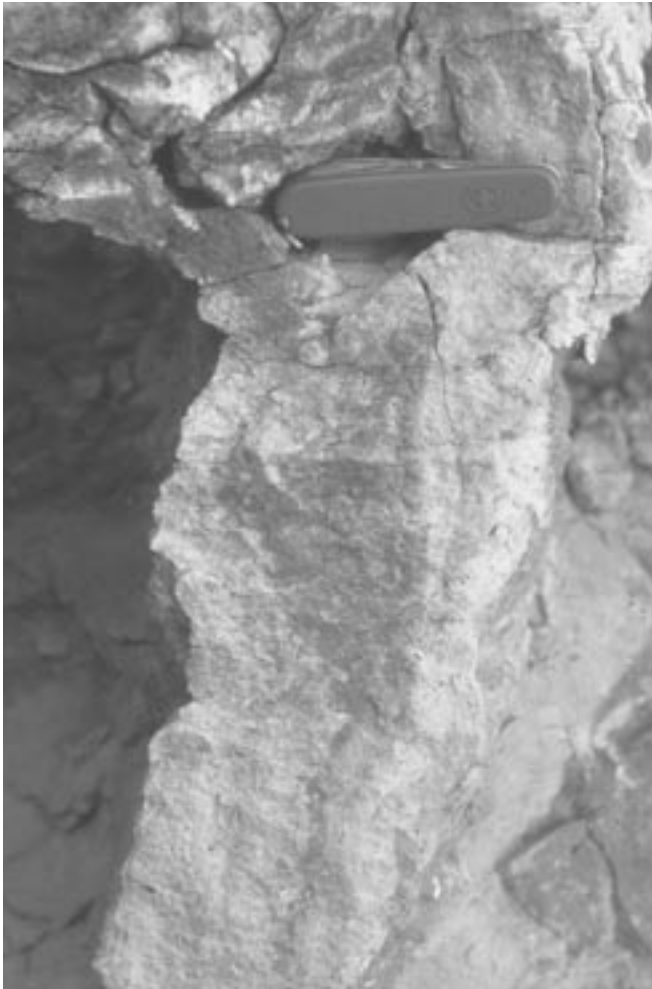


Figure 6. Short, wide sand-filled cracks along the Hance Trail, South Rim. The insignia on the pocket knife is about 1 cm long.

are long and narrow (Figure 5), but some are short and wide (Figure 6). Most are straight and vertical, but some are contorted. Along the North and South Kaibab trails, some cracks appear connected to lateral sand bodies within the Hermit (Figure 7) forming a dike and sill complex. In some cracks, narrow veins of sand branch and propagate upwards from the sides of larger cracks and sometimes two cracks are connected by a roughly horizontal sand fill (Figure 8). Most cracks narrow downward, but some noticeably narrow upward (Figure 9). Occasionally they intersect each other. At many locations, wide cracks split into narrow cracks. Some of the narrow cracks all but disappear, and then reappear (Figure 10). Some of the cracks appear to have internal structure (Figure 11), but most lack any obvious sedimentary structure. Possible slickensides were noted along and near crack walls at the Bright Angel and North Kaibab trails (Figure 12).

Load casts were found at the formation boundary along



Figure 7. A sand-filled crack that is connected to a sand body within the Hermit Formation, North Kaibab Trail. Note that the crack continues below the sand body. Note how thin the crack becomes as it propagates upward. The left side of the scale is divided into 1 cm gradations.

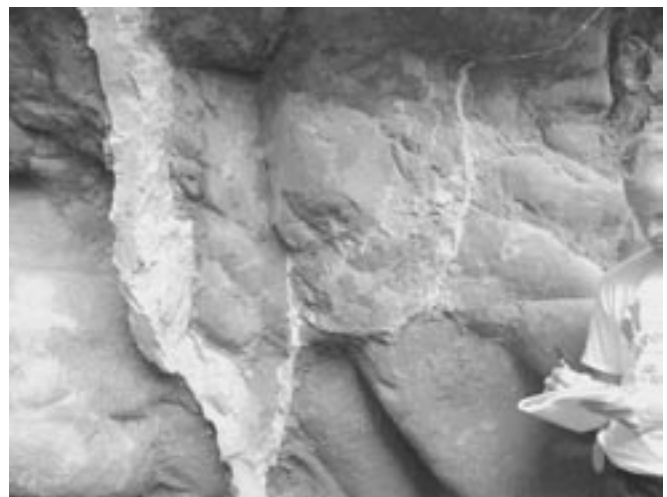


Figure 8. "U" shaped crack, Dripping Springs, South Rim. The larger crack, on the left, has a U.S. penny on it for scale (approximately 1.9 cm in diameter), just below the number "7." Note the multiple thin cracks that propagate away from the crack on the right.



Figure 9. Detail of one of the large sand-filled cracks along the Bright Angel Trail, South Rim. Note how the crack thins upward and downward.

the Hance Trail. One very large load cast (Figure 13) was seen associated with multiple small ones (Figure 14). Load casts were not found at any other locations.

Structural History of the Grand Canyon Region

The structural history of the Grand Canyon region has been summarized in numerous works (Huntoon, 1976; Huntoon et al., 1996; Lucchitta, 1974; Shoemaker et al., 1974; 1978). Uniformitarians propose that major structural activity only occurred twice in the Grand Canyon region: during the Precambrian and Cenozoic. During deposition of Paleozoic and Mesozoic sediments, the area was tectonically inactive. Two major structural trends warp and break the Paleozoic rocks of the Grand Canyon. The first is a north trending series of faults and monoclines (underlain by reverse faults) that are thought to be Laramide structures that developed during deposition of the latest Mesozoic to early Eocene. Most of the tectonic forces were compressive, although a few normal faults were active late in the history of the north trending structures.

The second set of structures that break the Paleozoic



Figure 10. Sand-filled cracks at Dripping Springs, South Rim. Note how the cracks can thin and disappear, and then reappear again. Note how cracks can widen downwards. The U.S. penny, just above the “1” on the largest crack is about 1.9 cm in diameter.

rocks, trend northeast (Figure 1). They are thought to have formed after the north trending structures. Faulting occurred mainly during the Miocene and Pliocene, although some faults remain active today (Shoemaker et al., 1974). These faults are thought to have developed primarily through tensional forces because normal faults and grabens are common along the fault zones. Included in the northeast trending structures are the Sinyala, Bright Angel, Fence, Mesa Butte, Hermit, McKee, and Eminence Faults. The largest of these fault systems is the Bright Angel with a total known length of more than 300 km. It has a vertical displacement of about 62 m on the South Rim and about 15 m on the North Rim (Huntoon et al., 1996).

Mud Cracks at Lake Lucerne

Giant playa mud cracks occur on Lake Lucerne, California (Fife, 1977) and were examined by the author. Large irregular polygonal crack patterns were found with sides up to 60 m and diameters sometimes greater than 100 m. The

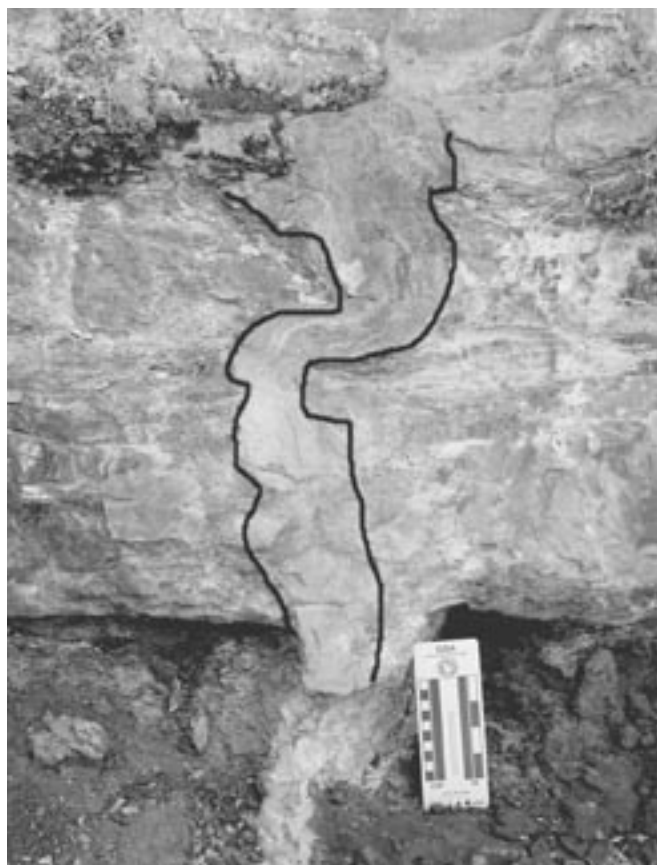


Figure 11. A sand-filled crack that shows probable flow structures along the North Bass Trail. The red-brown color of the upper part of the Hermit is often bleached to a color similar to that of the Coconino Sandstone, sometimes making crack boundaries difficult to see. The Hermit/Coconino contact is about 1 m above this photo.

cracks were up to 0.75 m wide and had unknown depths. The cracks were in the process of being filled and modified by material sloughing from crack sides into open cracks, wind-blown material, and small drainages using the cracks as stream courses. As a result, the typical “v-shape” of the mud cracks was becoming difficult to distinguish. Some of the cracks were becoming wider as a result of sloughing and stream course development. Sand dunes were present around the perimeter of the lake, but were stabilized by vegetation.

Discussion

Burrows and Trace Fossils

Many burrows have both vertical and horizontal components suggesting the burrowers traveled both vertically and horizontally through the Coconino sand. Note the circular features at the end of many of the burrows in Figure 2. It



Figure 12. The conjunction of two large sand-filled cracks along the Bright Angel Trail, South Rim. Vertical slickensides were found at the location of the arrow along the crack boundary. Note that the slickensides could not have been caused by the Bright Angel Fault, because there are no vertical breaks at the contact between the Hermit and Coconino above. The Bright Angel Fault (vertical offset of 65 m) is about 50 m to the left (east) of this outcrop.



Figure 13. A large load cast found along the Hermit/Coconino contact along the Hance Trail, South Rim. Load casts are caused when hydroplastic sediment (the Hermit) fails due to rapid loading sediment above (the Coconino). Sand-filled cracks can be seen just below the large load cast in the center of the photo.

was difficult to tell which aspect of the burrow was made first. The burrows at Tanner trail suggest the rapid accumulation of the Coconino sand. Even though some bedding planes are extensively burrowed, the inclined laminae of



Figure 14. Multiple small load casts along the Hance Trail, South Rim. Note the sand-filled cracks just below the load casts. Scale bar is 10 cm.

the Coconino are still distinct. Thus, sedimentation may have occurred so rapidly that burrowers could not completely destroy bedding before additional layers of sand were deposited. Preserved sedimentary fabric is the result of the competing processes of sedimentation and bioturbation (Bentley and Sheremet, 2003). In modern marine environments, total bioturbation and loss of sedimentary structure can happen very quickly (Dott, 1983; Rhoads, 1963; 1967).

Long trails of both invertebrate and vertebrate tracks are well preserved in the Coconino. These sharp, distinct tracks suggest rapid burial. It is difficult to imagine how these features might have formed in a dry desert dune environment. Although experimental results suggest details like this can be made in dry sand, in order to be preserved, the sand must be subsequently dampened by dew or rain and remain undisturbed until it eventually lithifies (Brady, 1939; McKee, 1947). The experiments of Brand (1979) and Brand and Tang (1991) suggest that Coconino vertebrate trackways are best explained as having formed in underwater conditions. Perhaps the invertebrate trails formed in a similar environment.

Load Casts

Load casts, ball and pillow structures, and other related soft sediment deformation features form when coarse-grained sediments are rapidly deposited on softer, unlithified finer-grained sediment. The presence of both large (Figure 13) and small load casts (Figure 14) along Hance trail suggests that, at least here, the Hermit Formation was unlithified and that the Coconino was rapidly deposited or “loaded” on top of the Hermit. If the mud crack hypothesis is cor-

rect, the Hermit plains should have been well dried and cracked when the Coconino sand arrived. In that scenario, the formation of load casts would have been unlikely.

Transitional Contact

The interbedded contact between the Hermit and Coconino at Tanner Trail clearly indicates the absence of an unconformity between the two formations, suggesting that they interfinger (Walther’s Law). Although many authors have suggested an unconformity is present (Baars, 1962; Blakey and Knepp, 1989; Blakey 1990a; McKee, 1934), there is no erosional evidence. At the Grand Canyon, their contact is exceptionally flat. The only reason some have suggested the passage of long periods of time between the two formations is the presence of the thick Schnebly Hill Formation to the south.

Sand-Filled Cracks

Mud cracks are the result of subaerial shrinkage of clay rich sediments from desiccation. Syneresis cracks are the result of subaqueous mud shrinking at the sediment-water interface. They also can form interstratally (Pratt, 1998b). Diastasis cracks (Cowan and James, 1992; Cowan et al., 2001) are generally small sand-filled cracks that form substratally and are likely due to tectonic activity. Clastic dikes, also known as sand intrusions, have been long recognized in the literature (Diller, 1889; Harms, 1965; Jolly and Lonergan, 2002; Newsom, 1903). These are generally larger features than diastasis cracks, and occur when sand becomes fluidized and is intruded into surrounding rock. Tables I–IV provide criteria that can be used to distinguish between all of these sand-filled crack types.

At Grand Canyon, there are several problems with the mud crack interpretation for the sand-filled cracks at the Hermit/Coconino contact. Playa cracks do approach the scale of the large cracks found along the Bright Angel Trail, but if wind-blown sand had filled open Hermit mud cracks, the filling would likely exhibit horizontal layering. Smoot (1981) studied sediment filled playa cracks in Nevada and California and found that the cracks had multiple fills. None of the sand-filled cracks in the Hermit exhibited multiple fillings or horizontal stratification, even though the Coconino always shows clear and well defined layering. Instead, the sand in the cracks often exhibited what appeared to be vertical flow structures (Figure 11). Sipes and Peters (2000) suggested that what appeared to be vertical flow structures may be Liesegang banding, a groundwater staining feature. Even if Liesegang banding is present, sedimentary bedding can still be present. Thin section study of the sand fill will be needed to clarify whether Liesegang banding is responsible for the vertical structures or not.

At Lake Lucerne, sloughing of the crack walls was observed. Many large fragments of crack walls had slumped into the open cracks, partially filling them. I did not observe this to any great extent in cracks I examined in the Grand Canyon. Where layering in the Hermit could be seen, it usually exhibited undeformed horizontal bedding adjacent to the cracks, except along Hance Trail. The cracks were filled with tan Coconino sand. Only occasionally could small brown pieces of Hermit mudstone be found in the sand-filled cracks. The contacts between crack walls and the Hermit Formation were always sharp. Sometimes the cracks were only a millimeter or two thick (Figures 7–10). It is hard to conceive how wind-blown sand could have filled cracks in this manner. If the mud cracks stood open on a dry floodplain, we would expect the sand-filled cracks to have at least some laminations of Hermit dust that settled into the open cracks, resulting in laminated mixtures of Coconino sand and Hermit silt filling the cracks.

On dry lake beds, mud cracks of the same order tend to all be approximately the same width and possibly the same depth. Mud cracks in the geologic record tend to have the same length and consistent spacing between them in cross section. At many of the locations studied in this project, this was not the case. Sand-filled cracks varied greatly in length and width, even those at the same location. Sipes and Peters (2000) claimed the Grand Canyon cracks have consistent depths at any one location, but this was not found to be true at the many locations examined in this study (Table 5).

Another criterion used to distinguish mud cracks in the field is that they are polygonal in shape, sometimes exhibiting several orders of polygons. In some cracks observed in this study there is a hint of polygonal structure. The largest crack along the Bright Angel Trail is actually the junction of two cracks (Figure 12). At some locations, a few cracks were nearly parallel to the rock face, creating a sheet of sand covering the Hermit. Poorly developed, smaller order, polygonal cracking was found along the South Kaibab, Bright Angel and Dripping Springs Trails on the underside of the Coconino where the Hermit had weathered away. However, where this pattern existed, it was very poorly developed in cross section and only occurred with



Figure 15. Oriented grains in a vertical sand-filled crack along the Hance Trail, South Rim. The crack edge is on the right.

very small, short cracks. This pattern could not be clearly connected to the larger sand-filled cracks. Injected clastic dikes can also have polygonal patterns (Froede, 1998; Reimnitz and Marshall, 1965; Silver and Pogue, 2002). So, even if the larger cracks are later found to be truly polygonal, it does not prove a mud crack origin.

Another criterion often used to identify mud cracks is that they are wide at the top and then narrow downwards (Smoot, 1981), although this is not always true. In this study, I observed sand-filled cracks at most sites that widened downward. Sometimes cracks thin downward, disappear, and then reappear further down and become very wide again (Figures 7, 9, and 10). At Dripping Springs, two vertical cracks (one meter apart) are connected horizontally (Figure 8). It is very difficult to explain these types of features by the filling of mud cracks by wind blown sand.

The sand-filled cracks might be better explained as clastic dikes injected during tectonic activity. Clastic dikes are known to occur abruptly during seismic

events (Bourgeois and Johnson, 2001; Diller, 1889; Dott, 1966; Flower and Ives, 1946; Jolly and Lonergan, 2002; Matsuda, 2000; Pogue, 1998; Pratt, 1998a,b; Reimnitz and Marshall, 1965; Shoulders and Cartwright, 2004; Silver and Pogue, 2002), impact events (Kenkmann et al., 2004) and sudden loading from tsunami waves (Feldl et al., 2002; Stewart, 2003). It may be no coincidence that the longest and widest cracks known are in the immediate vicinity of a 62 m offset of the Bright Angel Fault. Crack length and width decreases to the east, west, and north of this location (Figure 1). Many features of the cracks can be better explained by this interpretation: (1) sand-filled cracks connected to one another and to sand bodies within the Hermit; (2) cracks that widen downwards; (3) cracks with no apparent connection to the Coconino; (4) apparent flow structures; and (5) small clasts of Hermit mudstone within the sand-filled cracks (Figure 15). These are all better explained by the sand being injected downward into the Hermit Formation from the unlithified Coconino. Clastic dikes commonly have no discernable internal sedimentary structures and often appear massive. However, flow structures, oriented grains, oriented clasts, and grading of sedimentary grains can be present (Diller, 1889; Dott, 1966; Haff, 1944; Harms,

1965; Hiscott, 1979; Jenkins, 1925; Laird, 1970; Peterson, 1968; Waterston, 1950). Most of the sand-filled cracks in the Grand Canyon are massive in appearance, but some do contain apparent flow structures.

Slickensides have been reported associated with clastic dikes (Harms, 1965; Waterston, 1950). At Bright Angel Trail, slickensides are present along at least one of the large sand-filled cracks (Figure 12). They are vertical, but there is no evidence of faulting at the Hermit/Coconino contact. The Coconino lies perfectly flat over the Hermit. These slickensides could not have formed from vertical movement along the Bright Angel Fault (about 50 m to the east). There is not even a joint in the Coconino above the crack filling (Figure 12).

Tables I–IV show the sand-filled cracks observed in this study have more features in common with clastic dikes than with mud cracks or syneresis cracks. Note they are very similar to diastasis cracks, except for size. Diastasis cracks might be considered “mini” clastic dikes. I believe that clastic dikes are clearly the best explanation for the sand-filled cracks that penetrate into the Hermit Formation. They exhibit many characteristics of clastic dikes, including slickensides, flow patterns and “U” shapes that cannot be explained by the other crack types.

Timing of Crack Formation

If the sand-filled cracks originated from injection due to tectonic activity along the Bright Angel Fault, the timing of this event poses an interesting dilemma for conventional geology. The Bright Angel Fault was initially active in the Precambrian but remained dormant until the Cenozoic (Huntoon and Sears, 1975). For Coconino sands to be injected into the Hermit, they would have to be fluidized. In other words, the Coconino had to remain unlithified from Permian time (when it supposedly formed) until the late Cenozoic (when faulting resumed), a period of more than 200 million years!

A clastic dike interpretation is of interest to Flood geologists in three ways. First, it refutes the uniformitarian interpretation which presumes long periods of time. It is more difficult to posit giant desiccation mud cracks during the midst of the Flood, but clastic dikes are compatible with a Flood model. Second, clastic dikes are injected as fluidized sand, not dry sand. Their presence indicates the Coconino was saturated at the time of deposition. This is consistent with the burrows, trackways, and load casts found in the lower part of the Coconino. Third, it suggests the Bright Angel Fault occurred before the Coconino was fully lithified. In uniformitarian terms, this would mean that the Coconino remained unlithified during the entire Mesozoic. This is much less of a problem in the short time

frame of the biblical model, since most or all of the Mesozoic in the Colorado Plateau region was probably deposited during the Flood.

The following sequence of events is proposed for the development of the sand-filled cracks in the Grand Canyon.

- 1) The Paleozoic and Mesozoic sections of the Colorado Plateau were deposited during the Flood.
- 2) The Hermit Formation was not very permeable because of its high clay content, so hydrostatic pressures grew in the permeable Coconino sand faster than in the clay-rich Hermit. As hydrostatic pressure in each formation increased with burial, the Coconino maintained a slightly higher pressure, sealed by the top of the Hermit.
- 3) Cenozoic tectonic activity along the Bright Angel Fault (late Flood or early post-Flood) caused fluidization of the Coconino sand and ruptures at its interface with the partially consolidated Hermit Formation. Following the pressure gradient, sand was injected from the Coconino into the Hermit. Cracks may have propagated from one or more locations (not necessarily directly above each crack mouth). Crack propagation occurred by forceful injection of the Coconino sand, and continued horizontally and vertically (along zones of weakness?) until hydrostatic pressures equalized. Theoretically, the rounded, fine grained sand of the Coconino would be most susceptible to fluidization and clastic dike formation (Jolly and Lonergan, 2002) during earthquake activity. Cracking at the boundary may have been initiated by the same tensional forces responsible for the Bright Angel Fault System (it is difficult to generate cracking in compressional regimes, like the north trending structures). Where clastic dikes are long and straight, the Hermit was better lithified (e.g., along the Bright Angel Trail) and where dikes are more “squiggly,” the Hermit was only partially lithified (e.g., along the Thunder River Trail) at the time of faulting. All dikes were likely injected in more or less vertical propagation cracks, but became “squiggly” as the Hermit later was compacted (Figure 16). Compaction and dewatering may have occurred coincident with dike injection (Bourgeois and Johnson, 2001; Pratt, 1998a,b)
- 4) Erosion of the Colorado Plateau and the Grand Canyon.

Potential Problems for the Sand Intrusion Hypothesis

If cross beds from the Coconino are ever observed deep within crack mouths, this would support the mud crack



Figure 16. A “squiggly” sand-filled crack along the Thunder River Trail, North Rim. The crack probably became deformed as the Hermit compacted. Notice how the Hermit has been “bleached” on the sides of the crack, likely due to groundwater movement.

theory over the clastic dike hypothesis because the mud crack hypothesis would predict deep, open mud cracks on the Hermit surface prior to arrival of the Coconino sands. As dunes encroached over the area, some of these dune sands would then have partially filled the deep cracks. Coconino cross beds can occasionally be found directly on top of the Hermit at several locations (Tanner, Bright Angel and South Kaibab), although the Coconino more typically exhibits planar bedding just above the Hermit. So far, no cross beds have been found entering Hermit cracks. Cross beds were observed directly on top of a crack at South Kaibab Trail, but they did not enter it. If the cracks were filled from above by wind, layering transverse to the crack walls should also be present. If extensive horizontal laminations are found in cracks, it would be problematic for the clastic dike hypothesis, since this style of bedding has been reported in modern cracks that have been filled from above (Davis, 1889; Diller, 1889).

If the Coconino sands have indeed been injected down-

ward into the Hermit, some deformation of the Coconino strata should be present directly above the cracks. However, it is possible for clastic dikes to inject sand downward with little apparent deformation of pre-existing sedimentary layering (Jenkins, 1925). It is also worth noting that clastic dikes can flow and move laterally (Matsuda, 2000). If after further study, no zones of deformed Coconino are found above the cracks, it would be problematic, but not an insurmountable problem for the clastic dike hypothesis.

Conclusions

The large, sand-filled cracks that occur at the base of the Coconino Sandstone in the Grand Canyon are best interpreted as clastic dikes or sand intrusions. The mud crack origin of these features is less likely because: 1) the cracks are not regularly spaced, 2) the cracks have no horizontal layering within them, unlike the overlying Coconino, 3) many cracks widen both downwards and upwards, and 4) many of the cracks are not clearly connected to the Coconino, like a true desiccation mud crack should be. The origin of the sand-filled cracks due to the injection of fluidized Coconino sand appears probable because: 1) vertical cracks are sometimes connected to one another and to thick sand lenses deep within the Hermit, 2) what appear to be flow structures (vertical lineations) are sometimes present within the cracks, 3) many of the cracks lack internal structure, which is a common feature of sand intrusions and clastic dikes, 4) the largest cracks occur in the immediate vicinity of the greatest displacement of the Bright Angel Fault, and 5) some of the cracks are bounded by slickensides which can only be explained by sand flow. Evidence that the Coconino was water saturated at one time includes load casts, burrows, and trackways. Injection of the Coconino into the Hermit requires fluidized sand, potentially resulting from tectonic activity along the Bright Angel Fault. If found, factors which could potentially nullify the sand intrusion hypothesis are 1) cross beds which clearly penetrate deep into crack mouths, 2) horizontal layering within cracks, and 3) the absence of Coconino deformation above crack mouths. Incompletely burrowed sediments on inclined bedding planes and load casts suggest the Coconino was rapidly deposited on a soft, un lithified surface, at least at some locations. Identification of the sand-filled cracks as clastic dikes rather than giant desiccation mud cracks would be more compatible with a Flood model and eliminate the necessity of long ages required by the uniformitarian interpretation. Finally, if these features are clastic dikes, then it is likely that a short time period occurred between the deposition of the un lithified Permian section of the Grand Canyon and the later movement of the Bright Angel Fault, rather than the

proposed 200 million years that supposedly separates the deposition of the Coconino and the Cenozoic reactivation of the Bright Angel Fault.

Acknowledgments

The author would like to especially thank Cedarville University for providing a research grant to make completion of this project possible. Although Richard Peters will not likely agree with any of the conclusions of this work, he was instrumental in working with me in the early stages of this project, including time in the field. We have spent many hours together, debating the origin of these features, and his perspectives and scholarship have been provocative. Thanks Rick, I appreciate your friendship. Special thanks go to Elaine Kennedy who initially introduced me to these features in 1997. I would like to thank Richard and Caleb Whitmore, Jason and Corrie Hemm, and Dan and Colin Payton for help with additional field work in 2004. Special appreciation goes to my wife and family for graciously allowing me the time to complete this project. Without their love and support, this work would have been impossible. I have appreciated the work of the reviewers whose comments and suggestions have greatly improved this manuscript.

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Book Review

Universe by Design by Danny Faulkner

Master Books, Green Forest, AR, 2004, 143 pages, \$14.00.

Universe by Design overviews modern cosmology in which the big bang is a major aspect. Danny Faulkner addresses the big bang from a recent creation viewpoint with thought-provoking questions. He asks, "In a hundred years will anyone believe the big bang?" Given the provisional nature of scientific theories, this question is well taken. He follows with an implicit warning also posed as a question: "If not, then what is to become of Genesis if we have tied it to the big bang?" (p. 5).

Faulkner puts the big bang in historical context. By implying a beginning, the big bang theory made a clean break with the eternal universe of Greek philosophy (p. 17). But this beginning is not the Genesis 1:1 beginning. Further, universal expansion, rather than confirming the big bang, is explanatory and not predictive (p. 33). Discussing the non-conventional claims of astronomer Halton Arp regarding non-cosmological red shifts, Faulkner observes, "If Arp is correct, then it is not so clear that the universe is expanding. If the universe is not expanding, then the big bang is not a viable theory ..." (p. 81). As to light element abundances, "information concerning [these] was input in creating the [big bang] model" (p. 33).

Currently fashionable big bang corollaries are found wanting. Inflation has "no direct observational tests" (p. 43). Dark matter is not confirmed by the big bang theory, but is a free parameter in the model (p. 46). Alleged variations in COBE CBR measurements were below detection sensitivity, and WMAP CBR variations were taken to indicate a 13.7 billion-year-old universe with 4 percent of its mass existing as visible matter (p. 48). Faulkner sums up

these and other attempts to fine-tune the big bang theory: "Big-bang research of recent years has been in the direction of explaining the origin of the universe in an entirely physical, natural way without recourse to a Creator.... Those Christian apologists who fail to see this have simply failed to understand the direction that cosmology has taken in recent years" (p. 56). The big bang theory is incompatible with biblical creation.

Universe by Design warns that use of the word "God" in the writings of secular big-bang advocates should not be confused with reference to the fiat Creator of the Bible, for such advocates do not refer to anything remotely resembling the biblical God. Instead, they use God to mean an impersonal imposition of order ..." (p. 72). Rather than the big bang being compatible with biblical creation, "it is no accident that nearly all Christians who embrace the big bang also accept a 4.6-billion-year old earth," a tenet of extra-biblical concepts such as theistic evolution or "its stepchild, progressive creation" (p. 93).

Besides the big bang itself, topics discussed include quantized red shifts (pp. 82–83) and the sun's specialness: "In a biblical sense, the sun may not be a star" (p. 111). Known extrasolar planets are "hostile to any form of life" and are "a powerful witness to us that our planet is special." Like other recent astronomical discoveries, extrasolar planets imply special creation rather than challenging it.

Universe by Design is highly recommended. A reader threading his way through the maze of modern cosmological theory would be well advised to consult *Universe by Design* to align his thinking with biblical teaching.

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Book Review

The Genesis Trilogy by Kacy Barnett-Gramckow

Moody Publishers, Chicago, 2004,

Book I—384 pages, Book II—400 pages, and Book III—424 pages.

Each book \$13.00.



The Genesis Trilogy is a well written series of historical novels that remain faithful to the limited facts given in the book of Genesis.

The three books cover the time just preceding Noah's Flood to shortly after the tower of Babel. Scripture, archeology, and

Hebrew names are interwoven into a fictional account of the lives and times of our early fathers and mothers. Godly values and personal insight add depth to the series. From the beginning to the end, the reader is drawn into the adventures, struggles, and loves of Noah's family to the fourth generation. Keeping track of the many names is a struggle, but the author kindly sketches out Noah and Naomi's family tree in the second and third books of the series. These books are not only fun to read they but are also thought provoking.

The Heavens Before is the first book in the series. It is the story of Annah, a "nothing woman," and her struggle for survival in the exquisitely beautiful, violent, hate-filled pre-Flood world. It was a world where most considered the Most High God as merely a legend. Annah never spoke in the years following the tragic murder of her father. She suffered terrible abuse from her brother in the years after he murdered his father. Annah's despair led her to the river where she planned to end her life. Across the river a young man felt her distress and caught her attention. She felt him willing her to live. Shem followed the Lord's leading as he befriended her. He and his family filled her with hope as she bravely chose to trust in the Most High God regardless of peril. The time had come for Noah's sons to choose their wives. *The Heavens Before* gives an enthralling account of Noah's Flood. The book tells of adventure and survival in a sin filled world, love for fallen man, and a rescue. The book is an excellent and believable tale of our forefathers.

He Who Lifts the Skies, is the story of Nimr-Rada, the

great hunter, as he gathers the discontented from the tribes of Noah's sons, in other words those who wish to contend against the Most High God. Nimr-Rada loves power and uses violence to further his ends. He promises his people freedom and lifts them from guilt by building a temple to worship Shemish. Nimr-Rada uses the unusual beauty and rebellion of Sharah to further his ends. Her sister Karen, who is faithful to the Most High is trapped in the city and forcibly groomed to be a priestess. She is poisoned for political gain. Her wicked uncle sends her home to die, instead she is nursed to health and marries her betrothed. Ultimately, Nimr-Rada comes to reclaim Karen. Nimr-Rada has to face all of the Ancients and make an account of his life. In the course of the meeting Karen kills him to protect Seth.

A Crown in the Stars is the third book in the trilogy and describes Annah's great-great granddaughter Shohannah's capture and imprisonment in the city of rebellion, Babel. Her uncle forces her to replace her mother, Karen. She is taught to become a temple priestess for the new god Nimr-Rada. Shohannah's family and especially her mother, Karen must face nearly certain death to rescue her. This is a story of high adventure, intrigue, and loyalty to the Most High God in the face of impossible odds.

The beauty of family loyalty is shown in stark contrast to the depths that the rebellious are willing to sink. Noah, Seth and Annah are still living and struggling with twin griefs, the rebellion of many of their children and the fact that their children are aging faster than they. Their testimony is ignored as it is now, yet they never give up loving and hoping the rebels will repent. The joy they find in the faithful is deep and fulfilling. The Trilogy challenges us to remain faithful to God and never stop loving the rebellious, leaving ultimate justice to God. This book is an excellent read for those who love to ponder God's word and what the world must have been like so many years ago.

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Ashfall Fossil Beds State Park, Nebraska: A Post-Flood/Ice Age Paleoenvironment

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Abstract

Hundreds of skeletons of animals have been found in northeastern Nebraska, in an area known as Ashfall Fossil Beds State Park. The fossils are of various kinds of extinct and extant animals, including rhinoceroses, horses, camels, deer, birds, and turtles. The uniformitarian interpretation of the bone bed suggests that the animals were entombed by ash from a volcano that erupted in the region of Idaho approximately 1000 miles away during the Miocene Epoch.

However, we interpret the bone bed and associated stratigraphy as a post-Flood/Ice Age paleoenvironment that was destroyed by volcanic ash and later covered by fluvially-deposited sediments no more than a few thousand years ago. We believe that the skeletal evidences found at Ashfall Fossil Beds State Park reflect catastrophic conditions that occurred within the time frame of the young-Earth Flood model. (The names of various uniformitarian geological ages are used in this paper for reference, but we do not accept the presumed long ages and evolutionary assumptions.)

Site Location and Early Investigations

Ashfall Fossil Beds State Park (AFB) is located in Antelope County, in northeastern Nebraska. This isolated park is approximately six miles north of U.S. Highway 20 between the towns of Royal and Orchard (Figure 1) and contains a variety of unique animal and plant fossils.

During the summer of 1971, the skull with attached jaw of a juvenile rhinoceros was discovered in the wall of a ravine. Excavation of the skull revealed the entire skeleton of the animal and other complete rhinoceros skeletons were later found (Voorhies, 1992). This was the start of

what has become one of the world's best exposures of terrestrial Miocene animals. Additional excavation at the site was conducted in 1977 by the University of Nebraska State Museum. Twelve rhinoceros and three horse skeletons



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

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Accepted for publication: October 4, 2004



Figure 2. The Rhino Barn houses the megafossils that have been excavated and left in situ. Adjacent to the building is a ravine (shown in the lower part of the photograph) carved by headward erosion of a tributary of Verdigre Creek.

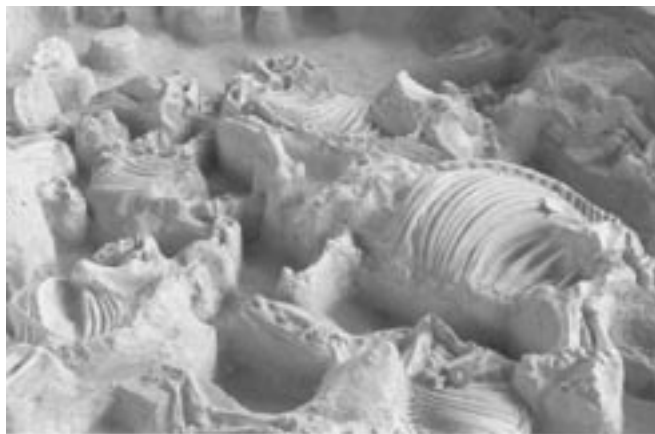


Figure 3. The large skeleton (right center) is a young adult male rhinoceros. Located in the upper center is an adult female rhinoceros.

were collected from an area of only a few square yards (Voorhies, 1978).

With funding from the National Geographic Society, extensive excavations were undertaken in 1978 and 1979. Heavy equipment was used in removing overburden from more than 700 square yards of the ash bed adjacent to the 1977 site. Several varieties of animal fossils, including additional horse and rhinoceros skeletons, as well as deer, camels, birds, and turtles were found (Voorhies, 1992).

In a cooperative effort between the University of Nebraska State Museum and the Nebraska Game and Parks Commission, this site was designated as a state park in 1991. A Visitor Center was constructed that includes a working



Figure 4. A horse skeleton (center left) is surrounded by rhinoceros skeletons.

fossil preparation laboratory and interpretive displays of fossils found at this and other nearby sites in Nebraska. A large building dubbed the “Rhino Barn” was constructed over a portion of the excavated site (Figure 2). Paleontologists working in the facility continually find more skeletons buried in the volcanic ash (Figures 3 and 4).

Geomorphology and Geology of the Area

The AFB site occurs in the Interior Plains Province, within the Great Plains subprovince, which is comprised of a broad plain with generally low relief and gently rolling hills. Ash-fall Fossil Beds State Park lies midway between the Sand Hills region of central Nebraska and the glaciated region of eastern Nebraska. The area is dissected by dendritic drainage directed northward toward the South Branch of Verdigre Creek (Voorhies, 1978). Due to the nature of the sediments, some of the valley sidewalls are nearly vertical with considerable relief (e.g., up to 100 ft) that provide access to the stratigraphy of the area without having to rely on well logs and geophysical data.

The local geologic strata consist of a number of sedimentary units reflective of fluvial transport and sorting (Table I). All of the exposed strata are interpreted as Miocene or younger. The lowest unit is the Valentine Formation, largely comprised of clastic materials fluvially transported from the uplifted Rocky Mountains. The Valentine Formation contains two members: 1) Crookston Bridge Member and 2) Devils Gulch Member. Above the Valentine Formation is the Ash Hollow Formation that contains the Cap Rock Member. The volcanic ash layer that created AFB occurs within the Cap Rock Member (Figures 5 and 6). Above the Ash Hollow Formation is the Long Pine Formation. Sedimentary features throughout these stratigraphic units



Figure 5. A diagram of the general order of fossils found in the ash layer within the Cap Rock Member at Ashfall Fossil Beds State Historical Park.

Ashfall Fossil Beds State Historical Park Stratigraphic Section			
	FORMATION	MEMBER	DESCRIPTION
1740	Long Pine Formation		Unconsolidated coarse sand and gravel with many igneous and metamorphic pebbles
1720	Ash Hollow Formation	Cap Rock Member	Well-indurated sandstone that weathers to a white color with many siliceous tubules and much disseminated volcanic ash
1700	Valentine Formation	Devils Gulch Member	Semiconsolidated poorly sorted silty, clayey sand with numerous calcareous concretions
1680			
1660	Valentine Formation	Crookston Bridge Member	Unconsolidated fine to medium grain quartz sand, mostly planar bedded with some small-scale cross-bedding and root casts and possible insect burrows
1640			

Table I. A stratigraphic section of the site of this study. Adapted from Voorhies, 1978.

suggest water transport from sources west of the site. The fossils identified in these successive layers could be interpreted as being deposited in a wet, low-lying coastal plain setting (lowest) to one of grasslands and prairies (moving up section).

Volcanic ash layers occur in all of the exposed stratigraphic units at the AFB site and are reflective of periodic volcanic eruptions. The four-foot-thick unit that comprises the fossil bone bed at the Ashfall Fossil Bed State Park is perhaps one of the thickest and lithologically consistent layers of volcanically-derived material found to date in the region. The bedding planes of the ash we observed beneath the skeletons on display in the Rhino Barn appeared laterally continuous and displayed minimal disturbance (Figure 7). In places, the layered volcanic ash exhibits ripple-marked bedding suggested by uniformitarian scientists to reflect deposition in relatively quiescent water (Voorhies, 1978). However, the morphology and topography of the site appear to indicate that water transport is a better means of understanding how the ripple marks were formed.

Paleontological Discoveries at Ashfall Fossil Beds

Several hundred animals died at this site, apparently due to the resultant ashfall from a volcanic event that occurred approximately 1000 miles away. Twelve of the seventeen species of vertebrates found in the volcanic ash layer are mammals, while the remaining animals are birds and reptiles (Ashfall Fossil Beds State Historical Park, 2003). Of special interest is the extinct barrel-bodied rhinoceros (*Teleoceras major*). A typical fossil skeleton of one of these creatures has large premaxillary bone, upper incisors, hypsodont teeth, and evidence of their having possessed nasal horns when alive (Voorhies, 1978). With short legs and a girth measuring about the same as their length of nearly 10 feet, these rhinos must have looked much like hippopotamuses.

Five of the eight known genera of late Miocene (Clarendonian) horses were discovered at this site. Three species of camelids have been excavated, including the limbs of a giant camel. The skeletons of several deer that were apparently trampled and disarticulated (*Longirostromeryx*) have also been recovered (Voorhies, 1978). All of these creatures are thought to be grassland



Figure 6. The Cap Rock Member of the Ash Hollow Formation in cross-section. The lowest marker is positioned near the upper level of the ash bed. The Rhino Barn is only a short distance to the right of this scene.

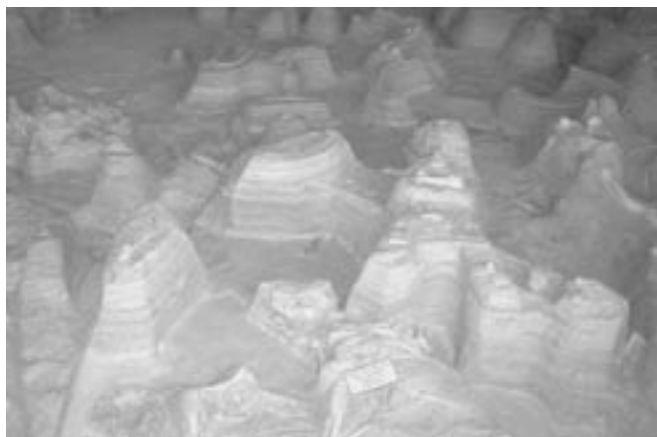


Figure 7. Inside the Rhino Barn are fossil bones of large mammals remaining in situ on pedestals after being excavated from the volcanic ash that buried them. Uniform horizontal layering of the ash can be seen in the sides of the ash pedestals.

Figure 8. A photomicrograph of volcanic ash from Ashfall Fossil Beds that also includes a diatom, the rectangular, pencil-shaped feature in the center. The sharp edges of the ash particles would be damaging to fragile lung tissue when inhaled. Magnification = 600x. Photomicrograph by Mr. John Kilbourn.



grazers. Three species of birds have also been found: the crowned crane, secretary bird, and rail. Additionally, two species of turtles have also been recovered in the fossil menagerie: pond turtles and the giant tortoise (Ashfall Fossil Beds State Historical Park, 2003). Two carnivores (canids) have been documented at the site by skeletal remains: the raccoon-dog (*Cynarctus*) and the fox-sized dog (*Leptocyon*). Although actual fossils of larger carnivores have not been discovered, uniformitarian scientists speculate that these animals were present in this paleoenvironment because of large coprolites that were found and bite impressions that were visible on a few horse bones (Voorhies, 1978).

Characteristics of Fossils Found at the Site

The excellent condition and extraordinary preservation of many of the fossilized remains of animals at this site have generated widespread interest among geoscientists and paleontologists. Most of the large mammalian specimens are fully articulated and three-dimensional in their burial expression. This is in sharp contrast to fossil graveyards such as Agate Springs, Nebraska, and the La Brea Tar pits (Weston, 2002a; 2002b; 2003), where typically, the bones of the many different animals are usually broken, jumbled, and deposited together in considerable disarray.

The excellent preservation at the Ashfall Fossil Bed site is due to rapid and complete burial of the specimens. Shortly after their deaths, the creatures were buried in a fine-grained volcanic ash and were not subjected to the usual decay and disintegration processes. Although many of the specimens are preserved in exceptional detail, their bones reflect minimal permineralization. Bones still exhibit voids that were not yet permeated and filled (Voorhies, 1978).

Evidences Found at the Site Indicate Water was Present in the Paleoenvironment

The varieties of florae and faunae excavated at Ashfall Fossil Beds suggest a fluvial/lacustrine setting. The best evidence to support this interpretation comes from the skeletal remains of herons, turtle shells, and freshwater diatoms, as reported by Voorhies (1981) (Figure 8).

Scientists studying the site have proposed that the rhinoceros (*T. major*) probably spent much of its life in the water. Mead (2000) compares *T. major* to being ecologically similar to the extant *Hippopotamus amphibius* of Africa. In analyzing fossil *T. major* teeth excavated at AFB for oxygen isotope compositions, Clementz determined that the data indicate the rhinos were probably semi-aquatic (Stephens,



Figure 9. A fossil pelvis of an adult female rhinoceros containing bones of an unborn calf. The descriptive information indicates "...Marie's disease, the respiratory condition, that caused the death of the mother and all other mammals found in the ash bed."

2000). If these proposals are accurate, *T. major* may have gone into pools of water like many large extant grazers still do to escape the heat of the day, parasites, and bothersome insects, or simply to relieve their legs and feet from their massive body weight.

No fish fossils have been found in the volcanic ash. However, fish and other fossils do occur in a silty, clayey sand layer below the sandstone strata on which the ash bed is deposited (Voorhies, n.d.). Small silicified plant fossils were noticed during cleaning of the *T. major* skulls. Because these seed fossils were thought to be the possible remnants of the rhinos' food, huge volumes of ash were examined to determine whether the plant material was ingested by the



Figure 10. A fossil bone excavated from the ash bed for visitors to examine. According to the sign, the "rough, light-colored bone is symptomatic of lung disease that killed the animals."

living rhinos or had later become introduced to the ash. The researchers determined that the plant seed fossils were from inside the skeletons, leading them to conclude that this was probably associated with food eaten by the rhinos shortly before they died (Voorhies, 1978).

An authority on fossil grasses, Joseph R. Thomasson, identified the plant seed remains as three extinct species: *Berriochloa communis*, *B. nova*, and *B. primaeva*. The fossil seeds, or floral bracts, are exquisitely well preserved with cellular structures easily observed using scanning electron microscopy. This information was viewed as conclusive evidence that *T. major* was a grassland grazer (Voorhies, 1978). The presence of grass is an indicator of year-round availability of moisture because grasses do not proliferate in a dry or cyclic, wet-dry environment (Howe, G.A., 2003, personal communication). Grazing rhinoceros herds would have required widespread supplies of grass for their existence.

A Uniformitarian Interpretation of the Ashfall Event

The animals at AFB were overcome by a disastrous volcanic ash cloud. Researchers at the site concluded that a respiratory disease initiated by the ash was ultimately responsible for the deaths of the animals. On some of the museum specimens and accompanying descriptive notes are found these comments:

- On a specimen of an adult female rhino pelvis: Bones of the unborn [rhinos] do not show symptoms of Marie's Disease, the respiratory condition that caused the death of the mother and all other mammals found in the ash bed (Figure 9) [Brackets added].
- On an individual bone: Rough, light-colored bone is symptomatic of lung disease that killed the animals (Figure 10).
- On the skull of a rhino: It shows clear evidence of the excess bone growth caused by suffocation over a period of weeks (hypertrophic pulmonary osteodystrophy) (Figure 11).

Voorhies (1992), principle investigator of the site, stated that:

Every fossil mammal so far discovered at the site has abnormal patches of highly porous superficial bone on various parts of its skeleton, especially on the lower jaw and the shafts of the major limb bones and ribs. Veterinarians have reported very similar growths on animals that have died of lung failure.

Other Speculations on Causes Leading to the Deaths of Animals at the Site

While we do not doubt that the bone disease was apparently present in many of the animals, we question whether this disease was a significant factor, much less a primary factor in their death. Hypertrophic osteodystrophy probably had little to no effect on the death of the animals and could have developed in their bodies for months

before the ashfall. (Hypertrophic osteodystrophy is a more accepted term in veterinary science for this disease previously called by several names, including Marie's disease and hypertrophic pulmonary osteodystrophy. Marie's disease, or more properly called Marie-Bamberger syndrome, is the name given to the human form of this disease which varies in symptomatology from that of animals.) Other factors, such as hunger due to diminishing food supplies, fright, rapid change of the animals' ecological stability, as well as breathing ash into their lungs, would have produced further stress and likely contributed to the death of the animals. All of the animals would have been exposed at varying levels to the volcanic ash. Apparently, additional ash clouds followed from subsequent short-spaced eruptive volcanic events. Once the initial ash cloud settled on the land surface, the animals would have continued to breathe ash particles.

If the rhinos routinely went into water, they would have had much greater protection from the ash than all the other grazers. Perhaps that is why so many are found in the ash-filled basin at AFB. If the rhinos were migrating to find available exposed grasses on the ash-covered terrain, the pool of water at AFB would have provided a welcome respite to them. They could have used the water to help clear their eyes, throats, and noses of the ash.

How Long Did the Animals Possibly Survive after the Deadly Ashfall?

Voorhies (1978) proposed that the rhinos died "...over a very short period of time—surely less than a month..." Later, Voorhies (1992) also suggested that "the larger animals



Figure 11. A skull of a young female rhinoceros removed from the ash bed. This specimen is said to show "...clear evidence of excess bone growth caused by suffocation over a period of weeks (hypertrophic pulmonary osteodystrophy)."

died more slowly, over a period of a few days to a few weeks." The reference, Ashfall Fossil Beds State Historical Park-The Ashfall Story (2003), states that the smaller animals died first (due to smaller lung capacities) and perhaps within three to five weeks the last of the rhinos perished. On our visits to the site, park guides related that the horses, camels, and deer probably died within 1–2 weeks while the rhinos expired within about a month. These various sources offer similar

assessments of the time between the ashfall and the actual deaths of the animals, all of which is based on the order of burial in the basin. According to each interpretation, death came rather quickly to all kinds of animals now found as fossils at AFB. We agree that the animals at AFB would have died over a short time period resulting from exposure to vast volumes of volcanic ash in their environment. Perhaps even a shorter time frame for each of the animals' deaths will be determined through information gained from ongoing studies.

An Interpretation Within the Creation/Flood Framework

Our interpretation of the site begins with the uplift and erosion of the Rocky Mountains during the Flood. We believe that the mountains rose in elevation as the lithosphere was affected by powerful diastrophic and isostatic forces while the cataclysmic Flood impacted the planet.

Runoff of millions of cubic miles of energetic water at the end of the Flood would have caused major erosion and modification of newly emerging and uplifting land surfaces and mountains (Akridge, 1998; 2000; Whitcomb and Morris, 1961; Williams, 2002; 2003; Williams and Howe, 1996; Williams et al., 1997). As the mountains rose to the west of present-day Nebraska, erosional processes would have supplied vast volumes of sedimentary material that were transported eastward across the area at first by sheet erosion and then followed by fluvial processes. Water transport of sediments was greatly enhanced by gravitational assistance as the land surface decreased in elevation on its easterly course from the Rockies. From water sources beginning

as far away as the Rockies, a decrease of about two miles of elevation is experienced on the way to AFB. From as close as the western boundary of Nebraska, the elevation declines at a nearly linear rate to a loss of approximately 3000 feet at AFB.

Uniformitarian geoscientists acknowledge an acceleration of stream erosion in the later Tertiary with subsequent transport of silt, sand, larger gravels and cobbles eastward across Nebraska (Carlson, 1993). This is indicative of much greater volumes of energetic water involved in what we propose to be the lower Ice Age Timeframe (Froede, 1995; 1998). While we adopt much of the present geologic interpretation, we do not accept the assumptions of uniformitarian chronology.

The Valentine Formation contains fossils of alligators, salamanders, and fish among many other kinds of animal and plant fossils (Voorhies, n.d.; 1971). The presence of these kinds of animals suggests that water and warm weather were prevalent for the propagation of great numbers of complex aquatic and water-dependent life-forms. One can surmise that abundant rainfall supplied sufficient quantities of water for the maintenance of streams and bodies of water necessary to provide habitat for these animals. The upper portion of the Valentine Formation contains sediments that indicate a less wet climate (Voorhies, n.d.).

For many years following the Flood, water continued to shape the surface of the planet. Copious amounts of rain that fell during warmer times after the Flood would eventually turn into frozen precipitation as the Earth's climate cooled, forming continental ice sheets (Oard, 1990) that extended into the northeastern part of Nebraska and along its northern border (Trimble, 1990). Between the end of the Flood and the ensuing Ice Age, environmental conditions must have become sufficiently stable (albeit wetter than at present) in northeastern Nebraska to allow population of the land with abundant animals and plants. During this time, lush grasslands and perhaps even forested areas would have developed and supplied food for a variety of animals. Just above the Valentine Formation are the fossils of AFB contained in the Cap Rock Member of the Ash Hollow Formation. In contrast to the fossils in the Valentine Formation, the fossils at AFB indicate that the climate was drying and likely frost-free (Voorhies, n.d.).

A Drying Climate Brought Apparent Changes to the Paleoenvironment of the Site

From the fossil flora and fauna found laterally in the Ash Hollow Formation, the paleoenvironment appears to have been one of broad areas of grassland punctuated with oc-

casional trees, lakes and undergrowth. The climate would have been moderate and supportive of herds of grazers that inhabited the grassed savannas. It was during this period that the climate remained moderate in temperature but precipitation generally decreased. In this post-Flood/Ice Age period, much of the Floodwater contained in the formerly saturated ground was flushed from the surficial aquifers.

Fluvial channels would have formed immediately following the Flood when overland flow of surficial water was initiated. This resulted in the formation of creeks and streams that likely contained pools or deep depressions along the course of their channels as demonstrated in modern streams. These pools and depressions likely served as water sources for the grazing animals. This is how we envision the AFB area, with a pool that was supplied by an ephemeral stream. Perhaps only rarely did the stream become completely dry. The ripple-marked bedding planes found in the ash indicate that there was water movement. Because the ash is relatively unmixed and laminated, we propose that this was likely a fluvial setting.

As many extant animals still do, herds during this time in the post-Flood environment would have lived and remained near food and water sources. In a drying climate, a dependable water source would have become a place for animals to congregate. Migrating herds would have stopped at pools of water to supply their needs. The fossilized pond turtles, frogs, cranes, rails and diatoms at the site, along with the presence of large numbers of *T. major* rhinos and numerous other mammals, indicate the availability of a viable water source.

The Beginning of the End

From a supervolcanic explosion, estimated to be at least a hundred times greater than that of Mt. St. Helens (Voorhies, 1981), a huge cloud of volcanic ash drifted eastward and covered much of northern Nebraska. Across this large area, the ash has been found to vary in thickness from a few inches to about 12 feet (Voorhies, 1978). Studies at the AFB site have chemically traced the ash to a now-extinct volcanic caldera located in southwestern Idaho. The caldera is called the Bruneau-Jarbridge Eruptive Center and is about 1000 miles west of AFB (Ashfall Fossil Beds State Historical Park, 2003; USGS, 2003).

What May Have Happened at Ashfall Fossil Beds: Evidence from the Ash Layer

The vertical succession of fossil skeletons within the volcanic ash layer suggests a progression of death and burial from

the smallest and most delicate life-forms to those considered more robust and able to survive for some time following the loss of food and water sources.

Turtles and birds are found at the bottom of the ash layer along with many footprints of hoofed animals and rhinos. The smashed and disarticulated remains of some of the smaller animals indicate that some of the larger animals lived longer and apparently trampled the animals that died first. At the middle of the fossil graveyard are found camels and horses followed by rhinos at the highest level of burial (Voorhies, 1992).

We envision that just before the ash arrived at AFB, a variety of animals were in the immediate area of the pool of water. Many of the animals would have experienced sudden disabling effects as the dense ash cloud rolled into the area. The thick, airborne ash cloud would have seriously impaired normal breathing and choked many of the animals. Birds would have been immediately grounded once the ash cloud arrived. Some close to the water source would have sought its safety until their respiratory systems were overcome by the ash particles. Birds would have died quickly, perhaps within hours, because of their unique pulmonary anatomy that is overly sensitive to airborne solid and gaseous pollutants.

In a surreal scene of darkening skies and ash rapidly covering their grassed savannas, the horses, camels, deer, and rhinos would have sought a water source. The falling ash would have covered much of the grazers' food supply, possibly leaving only the random tops of larger grasses visible. It would be certain that animals grazing on sparse vegetation in newly deposited, fine-grained ash would inhale much of it into their respiratory systems. The loss of an adequate food supply coupled with the inhalation of the ash particles as they grazed would soon weaken the animals.

If the rhinos were semi-aquatic as Clementz's oxygen isotopic analysis suggests (Stephens, 2000) and Mead's (2000) assessment of their probable ecology indicates, they could have temporarily survived on vegetation that may have surrounded the pool. By their sheer size, formidable horns, sharp tusks, and probable aggressiveness, rhinos could have kept the much smaller horses, camels, and deer from getting to the vegetation around the edges of the pool. Because of their weakened condition, many of the lesser animals died and were buried by ash, forming the mid-layer of fossil bones found in the ash layer today.

It is also possible that the smaller and mid-sized animals reached the pool in staggered time frames before the rhinos arrived. Later entrants reaching the pool would have trampled already dead and dying animals, disarticulating the remains. After a short time, most had all succumbed before the rhinos arrived. The rhinos could have been last to reach

the pool, its temporary safety offering only a slightly longer reprieve from death. The rhinos would have caused further disarticulation of the dead as they entered the ash-laden pool. Living a short time longer than the others would have placed them slightly higher in the ash covering.

Scientists have speculated that predators may have arrived at the scene in time to scavenge any exposed animal remains. The ash would not have been as great a respiratory problem to the carnivores as it was to the grazers. However, most of the excavated larger animals show minimal or no evidence that suggests scavenging occurred. The trampling of the bones by the hoofed animals and rhinos before they died would probably have caused most of the disarticulation noted in some of the smaller animals found in the middle layer of the ash deposit. Airfall and windblown ash continued to fill the depression containing the pool of water until it covered the dead and dying rhinos and other victims to a depth of up to about ten feet.

Proposed Evidence for a Post-Flood Setting at Ashfall Fossil Beds

Uniformitarian geoscientists date the AFB as Miocene based "...on precise measurements of radioactive isotopes in volcanic ash layers that occur in the fossil-bearing rocks..." (Voorhies, n.d.). (See Woodmorappe, 1999, for problems associated with radiometric dating.) However, we observed many evidences that point to a recent occurrence within the post-Flood history of the Earth. After the Floodwater subsided and animals populated this area of AFB, the Earth continued to undergo internal and external changes brought about by disequilibrium from the effects of the Flood. The Rocky Mountains had already risen in this post-Flood environment, channeling water and eroded sediments eastward toward AFB.

Because of moderate weather, available water, and a plentiful supply of food, the plains were fruitful with fecund herds of grazers and other kinds of animals. Volcanic activity and even an occasional supervolcanic event would have caused disruption to these environments.

Such a volcanic event buried this part of Nebraska under a heavy covering of volcanic ash, ultimately entombing many of the animals at AFB. The mostly-articulated and three-dimensional preservation of these macrofossils indicates rapid burial resulting from catastrophic conditions. After being covered, the animals were left relatively undisturbed in unconsolidated ash while further sedimentation covered the site to at least 40-50 feet in depth (Voorhies, 1978). The additional overburden of sediment covering this region offers what we view as further evidence of continued fluvial activity in this post-ashfall environment.

Post-Flood/Ice Age Deposits

The Cap Rock Member containing AFB is composed mostly of post-Flood, water-transported sediments. The Cap Rock is a rather heterogeneous body that varies laterally with abrupt changes in lithological expression. Although sandstone prevails in the Cap Rock, lenses of volcanic ash, siltstone, claystone, diatomite, and conglomerate are found that are all derived from local sources (Voorhies, 1978). This lithology is what would be predicted in a post-Flood/Ice Age setting with fluvially transported sedimentary materials, including eolian ash from volcanic sources. Many of the sediments remain unlithified. If the strata had been deposited in the Flood, we would expect deeper burial, less heterogeneity and more advanced lithification.

The minimal permineralization and fragility of the fossil bones indicate probable recency of deposition within a post-Flood setting. Minerals dissolved from volcanic ash into groundwater provide an excellent agent for permineralization and the petrification of organic material (Williams, 1993; Williams and Howe, 1993). However, the shallowness of burial of these fossil bones and the drying climate of this area since the Flood have impeded the permineralization of the bones. Ravines were carved into the area around AFB by headward erosion of tributaries from Verdigre Creek. One of these ravines is immediately adjacent to the fossil site (Figure 2). It is probable that rainwater was quickly diverted into the ravine from the surface of the ground above the bones before the site was excavated. This allowed minimal time for mineral dissolution and transport to accomplish permineralization of the bones. The fine volcanic ash layer may have also prevented much water from penetrating into the bone layers, further hampering the permineralization process.

Another consideration for the recent formation of AFB is the actual open voids remaining in the fossil bones that are yet unfilled by permineralizing agents (Voorhies, 1978). If up to 10 million years had elapsed since burial, more than adequate time should have been available for the complete infilling and replacement of the bones by diagenetic processes. However, the voids in the bones seem to indicate a much shorter period of elapsed time after burial.

Conclusion

Ashfall Fossil Beds State Park is a unique place to examine a wide variety of some of the best-preserved, three-dimensional and fully-articulated post-Flood/Ice Age fossilized animal skeletons. The initial burial of the animals in a fine-grained, unconsolidated volcanic ash provides an excellent working medium for excavation and restoration of the fossils for study and scientific evaluation.

While uniformitarian scientists have assigned the site an age of about 10 million years and associated it with the Miocene Epoch, physical evidences found at Ashfall Fossil Beds favor an origin in the recent, post-Flood/Ice Age time frame. Some of these evidences are: the 1) shallow burial of the fossils, 2) incomplete permineralization of the bones, 3) lithology of the site, 4) cross-sectional profile of the underlying strata of Nebraska, and 5) evidence of major volcanic activity associated with post-Flood disequilibrium of the Earth's lithosphere. We hope that with increased understanding of sites such as this one, that the post-Flood/Ice Age world will also be better understood.

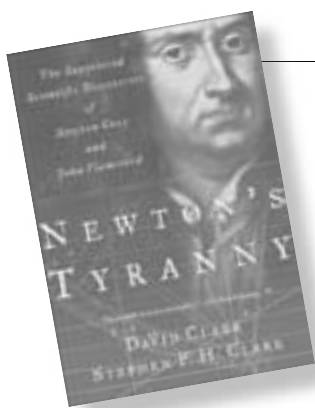
Acknowledgements

This study would have been nearly impossible without the help of many generous people who gladly and willingly gave of their time and expertise. Dr. George Howe shared helpful information about environmental conditions necessary to provide and sustain the grasses needed for grazing herds of large mammals. Mr. John Kilbourn, forensics scientist, made the included photomicrograph of volcanic ash found at the site of this study. We are indebted to Dr. Roy R. Pool, Clinical Professor of Pathology, who provided invaluable assistance in our understanding of the disease said to have affected the animals at AFB. Biologist Debbie Whitten, Instructor, Veterinary Department of Snead State Community College, assisted by furnishing excellent resource material for this study. Dr. Emmett L. Williams gave helpful suggestions in an early draft of the paper. Our wives, Elizabeth and Susan, have aided in countless ways over the extended time frame needed to accomplish this task. Their faithfulness, longsuffering, and loving, prayerful support have provided the needed impetus to keep the authors encouraged and motivated throughout this study. We are appreciative of the anonymous reviewers who gave of their time and helpful suggestions. Any mistakes that may remain are solely the authors'. A special thanks is extended to the many donors to the Creation Research Society Research Fund, interest from which financed a portion of this study.

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Book Review

Newton's Tyranny by David Clark and Stephen Clark

W.H. Freeman and Company, New York, 2001. 188 pages, \$14.00.

Many creationists hold a high view of Isaac Newton. This scientific genius readily accepted the authority of scriptures

and readily acknowledged his Creator. Newton clearly demonstrates that science and biblical truth are entirely compatible. Now comes a book which by its very title is an attack on Isaac Newton's character. Scarcely a single mention is made of Newton's science contributions

without an accompanying negative dig. Isaac Newton is described as cantankerous and scheming (p. 27) with uncontrolled ambition and flagrant paranoia (p. 26). He is also an astrologer, occultist, alchemist, and tyrannical dictator (p. 142).

It is well known that Isaac Newton had major conflicts with Robert Hooke and Gottfried Leibniz concerning credit for science and mathematical insights. Newton also had Arian and non-trinitarian theological tendencies. Still, does

he deserve the nonstop criticism expressed in this book? Why is there no mention of Newton's generosity whereby he financially helped relatives and friends in need? Why is Newton's faith glossed over as religious extremism (p. 62)?

A further example of the author's low view of Newton involves the famous statement concerning discovery, "If I had been able to see farther, it was only because I stood on the shoulders of giants." The traditional (and correct) view is that Newton was honoring science pioneers including Descartes, Kepler, and also Galileo who died the year Newton was born. The book, however, suggests that Newton was making a sarcastic remark about science competitors who were below him in their intellectual and physical stature. This malicious *revision* of history is without basis.

The author's rally around John Flamsteed and Stephen Gray, two men who tangled with Newton. Flamsteed gathered astronomy data which he refused to share with Newton. Newton later "stole" the data to work out his

gravity theory (p. 13). As "Astronomer Royal" employed by England, Flamsteed's measurements were not his private property, the viewpoint of Newton. However, there was great potential value in this data which might help solve the ongoing problem of finding one's longitude at sea. The data was valuable and one can see Flamsteed's rationale in keeping it confidential. Gray is a fascinating, unknown, amateur scientist in the spirit of Michael Faraday. Gray apparently worked out the rules for electrostatics and electrical conduction fifty years before they became widely known.

This book rightly documents the achievements of John Flamsteed and Stephen Gray while presenting a very biased, negative portrait of Isaac Newton. The authors claim that there has been a 250 year conspiracy to eulogize a basically evil man (p. 141). Certainly every scientist, past and present, has flaws but Isaac Newton deserves much better treatment than given by father and son authors Clark. They have collected a few facts and a lot of negative speculation.

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Book Review

Issues in Creation Number 1: A Creationist Review and Preliminary Analysis of the History, Geology, Climate, and Biology of the Galápagos Islands by Todd Charles Wood

Wipf and Stock Publishers, Eugene, Oregon, 2005, 241 pages. \$32.00.

This book is the first of an anticipated series of monographs inspired and supported by the Center for Origins Research (CORE) at Bryan College in Dayton, Tennessee. In this volume Wood opens a new vista upon a landscape of creationist understanding of Galápagos data, material which evolutionists often offer as incontrovertible evidence for evolution. Now we have available a creationist perspective which constitutes a comprehensive coverage, even though somewhat preliminary, for a variety of significantly important Galápagos organisms and environs.

The contents cover the history of the 121 volcanic islands straddling the equator 600 miles west of Ecuador. In 1535 Europeans accidentally discovered this archipelago. Topics following the history include Darwin and the Galapagos, geology and climate, biology including biogeography, and an appendix on multidimensional scaling in baraminology. The word *baraminology* is explained in the biology chapter. There is an impressive 32 pages of references, and 5-page

index. The book contains 45 figures and 6 tables.

The major portion of the monograph is concerned with the baraminological status of the giant tortoises, iguanids weevils, finches, peleceniforms, penguins, hawks, and composites. Wood found little evidence of selection, but some forms showed evidence of pre-adaption. He believes that the Galápagos is an ideal location for testing creationist concepts rather than evolution. He states that "the biology and geology of the islands are consistent with a young-earth creationist model of earth and life history." (Abstract)

CORE *Issues*, which is peer reviewed, was created for publishing monographs in a variety of fields including philosophy, theology, physics, geology, biology, archaeology, and linguistics. Scholars interested in writing future monographs are encouraged to contact the CORE *Issues* Editor, Kurt Wise, at Bryan College.

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Of Cosmic Proportions

Christos Daskalakis*

Abstract

The weaknesses of the Standard Cosmological Model (the Big Bang) are discussed and a model based on a center oriented relativistic expansion (CORE) is introduced. By first reviewing the fundamentals of the Special and General Theories of Relativity the CORE model is shown to be perfectly compatible with Biblical creation. Unlike some earlier models, it rejects the notion of expanded space, and requires no dark energy. Hubble's Law is discussed and the Hubble Constant derived theoretically is shown to be in agreement with the observed value.

Introduction

It is one of the great tragedies of modern science that ideology often stands in the way of legitimate scientific inquiry. This unfortunate circumstance is by no means unique to our own age but is made especially tragic because we seem to have learned little from the prejudices of the past.

It was over two thousand years ago that the great astronomer and mathematician Aristarchus of Samos first proposed a heliocentric solar system. Not only was this revolutionary idea met with scorn and ridicule, but Aristarchus himself was denounced for impiety. Centuries later Galileo Galilei had a similar experience for supporting the same idea of heliocentrism. The cast of characters was different but the intolerance was the same.

The field of cosmology today offers an interesting modern parallel. Cosmology's Standard Model known colloquially as the "Big Bang" is built more on ideology than it is on science. Most people would be surprised to hear that, but most people are not aware of the assumptions that serve as the very foundation of the Standard Model. If they were, I suspect they would hold the theory in significantly less esteem.

Perhaps the greatest of these assumptions is what used to be called the *cosmological principle* but today is more often referred to as the *copernican principle* (named after Nicolaus Copernicus, the famed Polish astronomer who reintroduced Aristarchus' idea of heliocentrism). It holds that there are no privileged observers in the universe and that the universe is homogeneous. What does this mean? When we observe the universe on a large scale from the Earth it appears isotropic, that is, the matter distribution and the cosmic microwave background (CMB) appear pretty much the same in every direction. Two possible explanations for this are 1) the Earth is at or near the center of the universe, and 2) the universe is homogeneous, that is no matter where you are in the universe it would appear isotropic. The universe would therefore have no center and no boundaries. Since under the copernican principle there can be no privileged observers in the universe the first explanation is dismissed out of hand, and as a result the universe must be homogeneous.

It is true that isotropy could be due to homogeneity, but it cannot be said that homogeneity is a necessary result of isotropy. The claim that the universe is homogeneous therefore is not based on observation, but rather on speculation. In addition, it is this speculation that serves as the very cornerstone of the Standard Model.

When most people think of the "Big Bang," they think of matter exploding from a central point into pre-existing space. This seems logical enough, but it is only a popular

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Accepted for publication: May 9, 2005

misconception of the Standard Model. What the Standard Model actually says is that the universe never had a center and that the expansion it is undergoing is not an expansion of matter in pre-existing space, but rather an expansion of space itself which creates a kind of illusion of matter expanding out into space. It also states that not only is the universe boundless, but it was always boundless even when it was many times smaller than it is today. Proponents of the Standard Model believe the universe was both smaller and boundless at the same time. As a matter of fact the Standard Model holds that the universe was boundless at the instant of the “Big Bang” and has been getting bigger ever since! This seems counter to all reason and logic, but it is another cornerstone of the Standard Model.

Another serious problem with homogeneity is the problem of horizons. This problem arises because the universe began at a specific point in time. We know this to be true because of the expansion of the universe and the dark night sky. If the universe were eternal and infinite the night sky would be white instead of black. Every square inch of the night sky would be filled with starlight and the sky would be as bright as the surface of the sun. But the sky is dark at night. This is Olbers’ famous paradox, and the logical conclusion is that we can only see those stars and galaxies whose light has had enough time to reach the Earth. Coupled with this of course is the possibility that the universe not only is of finite age but could also be of limited size. However, since an edge to the universe would contradict the principle of homogeneity, most cosmologists will not even consider this possibility. So what does this have to do with horizons? Well, since the Standard Model holds that the universe is without boundary but of finite age it has created a very interesting problem for itself, it has painted itself into a corner. If we can only see those objects whose light has had enough time to reach us, and if we assume a constant speed of light, logic would dictate that the universe is divided into a number of disconnected regions each limited by a horizon. Beyond the horizon there can be no interaction, visible or otherwise, with another region. The horizon is defined by the age of the universe as well as the history of its expansion, and no matter how far back in time you go, you will always be inside a horizon. Even at the very instant of the “Big Bang” the universe would be divided into a number of disconnected regions. Their horizons would be much smaller but just as real.

In effect the Standard Model is saying that the universe as a whole never had a common past. There is no point in time when the entire universe could have interacted and thus homogeneity seems to defy a physical explanation. However, the Standard Model is the only way cosmologists can hold on to the copernican principle. Once you allow for

a center you must allow for privileged observers and come up with a new explanation for isotropy. Notions like purpose and intelligent design start to creep in and the whole ideology behind the model collapses. These theoretical contortions cannot go on forever. With each new discovery, the Standard Model will require an ever-increasing dose of imagination to sustain itself.

This does not mean that all cosmologists walk in lockstep and are incapable of independent thought. Cosmologists tend to be highly intelligent people with a sincere desire to understand the universe. But the ideological pressure within the community to conform to the Standard Model must be great, and as a result new ideas are always introduced within the context of the Standard Model. There is no other explanation for their devotion to a theory that is so flawed on so many levels. It seems that any new model that does not conform to the ideology of the Standard Model is just not taken seriously. The lessons from Aristarchus and Galileo still do not seem to have been totally learned.

There are other models, however, that explain the phenomena that have been observed.

The New Cosmos

In 1887, an American physicist named Albert Michelson and a chemistry professor named Edward Morley set out to measure the effect of the Earth’s motion on the speed of light. At that time physicists believed that space was filled with an invisible substance called ether. They had no other way to explain how light, which appeared to move in waves, could travel through the vacuum of space. Michelson and Morley believed that by measuring the effect of the Earth’s motion on the speed of light, they could then measure the absolute motion of the Earth with respect to the ether. What they found was completely unexpected: The speed of light appeared to be unaffected by the motion of the Earth.

Picture for a moment two spaceships, A and B, moving through space parallel to each other in opposite directions, both traveling at 40,000 mph. An astronaut in spaceship B calculates that spaceship A rushed passed his window at 80,000 mph. The sum of the speeds of the two ships. Now let’s replace spaceship A with a beam of light moving through space parallel to spaceship B in the opposite direction. Our astronaut wants to calculate the speed at which the beam rushes passed his window. He knows that he is traveling at 40,000 mph and the beam of light is traveling at 186,000 miles/second. He assumes that when the beam rushes passed his window he should calculate a speed equal to the sum of his own speed and the speed of light. To his astonishment the beam of light rushes passed his window

at 186,000 miles/second. This is expressed mathematically as follows:

$$\frac{a+b}{1+\frac{ab}{c^2}} \quad (1)$$

where a and b are the two velocities and c is the velocity of light. (In the second example $a=c$).

The ability of light to travel at a constant speed regardless of the speed of the source and regardless of the speed of an observer was puzzling, to say the least. It was as if light were immune to the laws of physics. Many theories were put forward to explain the Michelson-Morley results, but none of them were able to pass muster. None of them, that is, until a young German scientist named Albert Einstein published his Special Theory of Relativity (STR) in 1905. Put simply, what the STR said was that space and time are relative; they are dependent on the observer. Space and time can expand and contract depending on who is doing the measuring and what is being measured. But not only can space and time no longer be viewed as absolute according to the STR, they can no longer be understood as distinct from each other. Space and time are woven together in what is referred to as space-time. The speed of light, however, is the same for all observers everywhere in the universe regardless of their relative motions. In addition to its constancy the speed of light (according to the STR) can never be exceeded. This

can be seen by applying the Lorentz factor:

$$\frac{1}{\left(1-\frac{v^2}{c^2}\right)^{1/2}} \quad (2)$$

Named after the Dutch physicist Hendrik Lorentz, it is derived from the Pythagorean Theorem as follows (Einstein, 1961):

Assume two reference systems K and K' in relative motion with velocity v along parallel x -axes. Let t represent time and assume a point P_1 (where x, x' , and t all equal 0) as the origin of a light beam traveling along the y -axis of K' , y' , to point P_2 , and let c represent the constant speed of light. An observer at rest relative to K and an observer at rest relative to K' will observe distances traveled by the beam that vary by a factor of

$$\sqrt{1-\frac{v^2}{c^2}}$$

This has many implications. For example, by multiplying the rest mass of an object by the Lorentz factor we see that as the object approaches the speed of light its relativistic mass becomes enormous, and when light speed is reached

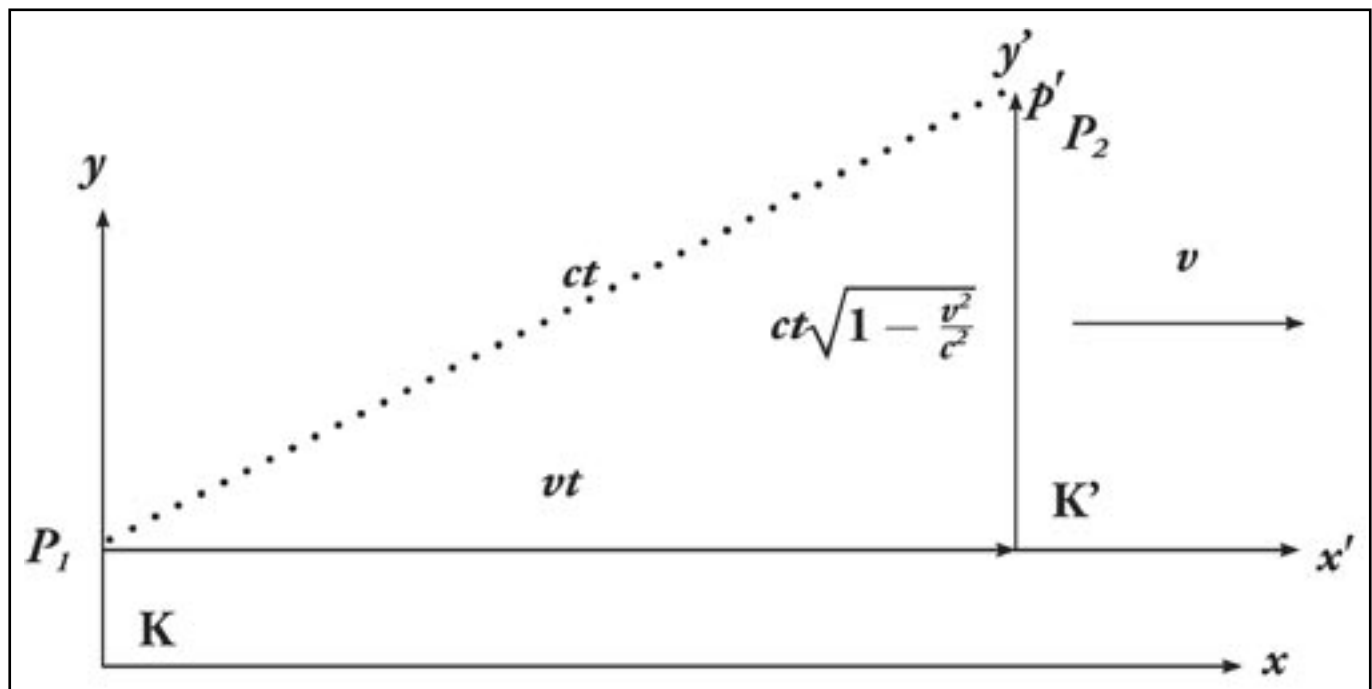


Figure 1. The primed and unprimed reference frames leading to the Lorentz factor.

the object has acquired an infinite mass. To accelerate an infinite mass beyond the speed of light would require more than an infinite amount of energy and this, of course, is impossible. By inverting the formula, we see that the object would contract at the same rate by which its mass increases. So when light speed is reached, the object would have contracted to a length of zero. It's as if it ceased to exist. Time would be affected by the Lorentz factor as well, so that when the speed of light is exceeded time would begin to move backwards, which raises a number of philosophical paradoxes. Therefore, the speed of light according to the STR is a universal barrier that cannot be exceeded and is the same for all observers. The absolutes of time and space were replaced by the absolute value of the speed of light. This is true for all electromagnetic radiation as given by Maxwell's

$$c = \frac{1}{\sqrt{\epsilon_0 \mu_0}} \quad (3)$$

where velocity is dependent only on the electric permittivity (ϵ_0) and magnetic permeability (μ_0) of free space and is therefore independent of wavelength and frequency.

There was one problem with the STR, however, and that was gravity. Gravity seems to have an instantaneous effect. How can it be said that the speed of light cannot be exceeded if gravity acts in this way? In 1916 Einstein addressed this problem in his General Theory of Relativity (GTR). It was a radical departure from the classical Newtonian concept of gravity. Newton described gravity as a force of attraction between two objects which is proportional to the size of their masses. It is opposed by inertia in a tug of war in which gravity exerts greater force on more massive objects (Gardner, 1997). In this way he was able to explain Galileo's discovery that objects of different weights fall with the same velocity. In the GTR Einstein introduced what is known as the *equivalence principle*. It was a bold statement which claimed that the force of gravity does not exist. Gravity is not opposed by inertia, gravity *is* inertia. The GTR says that it was not the force of gravity that caused Newton's apple to fall to the ground. Newton's apple fell due to inertia operating in a Non-Euclidean space-time. Gravitation therefore is explained as massive objects curving the space-time that surrounds them. This process is propagated at light speed so according to Einstein gravitation does not contradict the STR.

Relativity underwent its first real test in 1919. A group of astronomers set out to measure the position of stars that would be situated near the disc of the sun during a solar eclipse. The idea was to see if the light from these stars

would be deflected in such a way as to be consistent with Einstein's equations for the curvature of space-time around the sun. Their findings confirmed Einstein's predictions (in actuality, the results were claimed to be in agreement with GTR, but the resolution of the film emulsions was insufficient to make the claim. However, later experiments confirmed the theory with much greater resolution). Many experiments have been conducted since then to test various aspects of relativity. An electron was accelerated to speeds approaching light and the increase in its mass was measured in accordance with $E=mc^2$. Muons (heavier relatives of the electron), have also been accelerated to speeds approaching light but this time not to measure their mass but to measure their half-life. Muons have a fixed half-life (lifespan before they decay into electrons) of about 2 microseconds. However their half-life was extended to over 60 microseconds as a result of their high-speed acceleration (Calder, 1979).

Other astronomical experiments have also been carried out. One such experiment in 1955 measured the speed of light from both ends of the rotating sun. The result once again confirmed that the speed of light is not affected by the speed of its source. The entire field of Nuclear Energy can also be seen in part as a monument to relativity and to its most famous equation. In short, relativity is one of the most tested and confirmed theories in all of physics.

But, how is this related to cosmology? The importance of relativity will become more apparent as I explain the details of my cosmological model. First, however, it is necessary to consider the enormous size of the cosmos and how this has presented problems for those who believe in a young universe.

The Greek astronomer Aristarchus was probably the first person to have some understanding of the enormous size of the universe. The following formula is a good indication of how Aristarchus viewed the cosmos:

$$d = \frac{60 \left(\frac{c}{2\pi} \right)}{(\cos 89.95)(\sin \theta / 2)} \quad (4)$$

Where d is stellar distance, c is the circumference of the Earth, and θ is stellar parallax. Of course he lived before the existence of trigonometric tables, and stellar parallax would not be observed until 1837, but the relationship expressed mathematically above is one he understood perfectly (see the translation of Aristarchus by Heath, 1913). It led him to conclude that the Sun was many times larger than the Earth and he became the first to propose a heliocentric solar system. Also, since he was unable to detect a stellar parallax he concluded that the stars were an unfathomable distance from the Earth. This thinking was well ahead of its time!

In 1919, when Einstein's GTR received its first experimental confirmation, the universe was thought to be coextensive with the Milky Way. In the mid-1920's an American astronomer named Edwin Hubble would change that by discovering the existence of other galaxies. This discovery led to the most drastic revision in how man viewed the universe since the time of Copernicus. By 1929 Hubble also discovered that these galaxies are receding from the Earth (according to their redshift) at speeds that are proportional to their distance thus confirming the theory put forward seven years earlier by the Russian cosmologist Alexander Friedmann. This relationship is expressed in *Hubble's Law* ($v = d H_0$) where v is velocity, d is galactic distance, and H_0 is the Hubble Constant (more on this later). The implication is clear. If galaxies are moving away from the Earth at speeds proportional to their distance then at some point in the past they must all come together. Therefore the expansion of the universe must be the result of some great explosive event, a "big bang." This was the birth of the Standard Model. It was also the first astronomical evidence that the universe was created *ex nihilo* as Genesis claims. In discussing his theory of an expanding universe Friedmann writes: "... it also becomes possible to speak about the creation of the world from nothing" (Tropp, 1993, p. 157). In addition, the radial motion of galaxies away from the Earth suggests the Milky Way occupies the very center of the universe. Proponents of the Standard Model are quick to point out that galactic recession is due to the expansion of space itself and not due to the actual motion of galaxies. However, there is no independent support for this claim; it is purely an ideological assertion. An example of this bias comes from *Echo of the Big Bang* (Lemonick, 2003). In discussing the relationship between distance and redshift the author writes: "This relationship, which would eventually be known as Hubble's Law, suggested one of two things: either the Milky Way was at the center of the universe, with every other galaxy speeding away from it—a preposterous idea—or the entire universe was expanding uniformly, growing at a constant rate in all directions at once; still very hard to swallow, but at least in keeping with the Copernican principle that says we don't occupy a unique position" (p. 24). Preposterous idea? Unfortunately, it is more important for some to conform to the philosophy of the Copernican principle than to try to understand the true nature of the cosmos.

As long as the universe was thought to be coextensive with the Milky Way the travel time of light was not a major issue for those who believe in a young universe. The diameter of the Milky Way was measured in the thousands of light years and the universe was believed to be thousands of years old. The discovery of other galaxies however, galaxies

that are millions and even billions of light years away raised serious questions about the age of the universe. The ability to see these galaxies means the universe would have to be billions of years old. For those who believe in a young universe this seems to be an insurmountable obstacle. Or is it?

The CORE of the Universe

In 1994 Dr. D. Russell Humphreys proposed a new cosmological model which in my opinion is one of the great landmarks in the history of cosmology. Termed "white-hole cosmology" it holds that the universe was once a giant white-hole (Humphreys, 1994). Though others had suggested this possibility before him (Gribbin, 1977), Humphreys was the first to pursue its implications. For those not familiar with the term white-hole it is basically a black-hole in reverse. Rather than having the effect of collapsing it has the effect of expelling matter. The equations of the GTR allow for the existence of both phenomena. In "white-hole cosmology" the universe is bounded and of finite size and therefore would have a physical center. This is the fundamental difference between "white-hole cosmology" and the Standard Model. The Standard Model assumes the universe has no edge and no center (the infamous copernican principle). But this assumption is based solely on ideology. It has nothing to do with science. By discarding this assumption an entirely different cosmological model emerges, one which Humphreys shows is completely compatible with Biblical creation.

Thanks to the work of Edwin Hubble in the 1920's we have evidence that the universe is expanding. Proponents of the Standard Model explain this by claiming that space itself is expanding, causing galaxies to appear to be receding from a central point, in this case the Earth. Every point in a homogeneous universe would appear to be the central point of recession however because the universe has no physical center. To understand this better picture two points on an inflating balloon. Each point would see itself at the center of the balloon's surface and see the other point receding from it, but in reality the balloon's surface has no actual center. If the arbitrary assumption of homogeneity is set aside, the isotropy and expansion that we observe paint a very different picture of the universe: a picture that has the Earth at or near the center of the cosmos.

One major implication of a center oriented cosmos given the expansion that has been observed is that at some point in the past the entire universe must have been inside its Schwarzschild radius (named after the German astronomer Karl Schwarzschild). This is the radius of the event horizon of a black-hole, and denotes the point of no return.

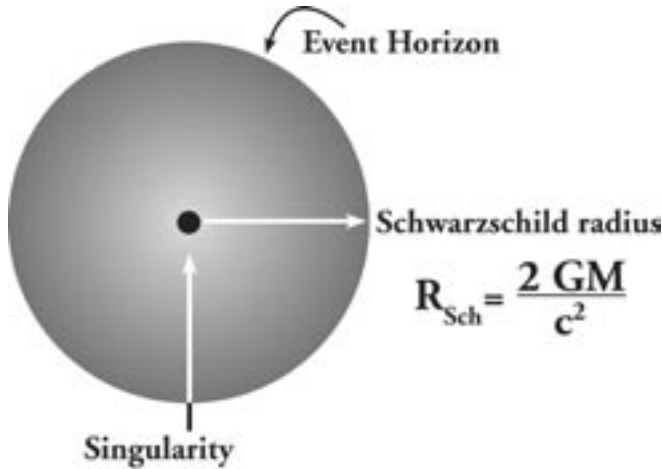


Figure 2. If a black hole is at the center, then there exists a radius larger than the black hole called the Schwarzschild radius. The event horizon has this radius.

Once inside the event horizon of a black hole nothing can escape, not even light. Taking Newton's formula for escape velocity: where G is the gravitational constant, M is mass, and R is radius, and solving for radius when the velocity is equal to the speed of light c , you get the Schwarzschild radius R_{sch} :

$$v_{esc} = \sqrt{\frac{2GM}{R}} \quad (5)$$

If the entire universe was once inside its Schwarzschild radius then it must have expanded out of a white-hole singularity. Earth, being at the center of such a universe, would have experienced an enormous gravitational time dilation with respect to the rest of the universe. Humphreys' model assumes a time dilation so great that light from distant galaxies could have traveled billions of light years to the Earth within a timescale that is consistent with Genesis. So from a reference point in a distant galaxy, billions of years would have transpired since the universe began to expand, but from the reference point of the Earth that same expansion would have begun only thousands of years ago. But which reference point is correct? According to Relativity both reference points are equally correct.

The General Relativity result for gravitational time dilation may be obtained mathematically by inserting the formula for escape velocity into the Lorentz factor. The result is:

$$T = \frac{T_0}{\sqrt{1 - \frac{2GM}{Rc^2}}} \quad (6)$$

where T is the time interval measured by a clock far away from the gravitational source. Therefore when escape velocity is equal to the speed of light (at the event horizon) there is an infinite time dilation. Time would stand still. Unlike a black-hole whose event horizon continues to grow as more matter falls inward, the event horizon of a white-hole is constantly shrinking as matter expands outward. When the Schwarzschild radius reaches zero the white-hole ceases to exist. All that is left is matter expanding away from a central point. This is the universe we live in today.

When Dr. Humphreys proposed his theory in 1994 he accounted for the observed Hubble Constant (which is actually only constant at a specific point in time) and the CMB by acknowledging an expansion of space. He cites Genesis 1:6–8 as justification. But this passage can also be understood as describing the expansion of matter out of the singularity. According to this interpretation, there is no need for an expansion of space. Classical dynamics alone can account for the Hubble Constant and the CMB. In addition, recent observations of type Ia supernovae, which suggest an accelerating universe can be seen as the natural result of a finite spherical cosmos with no need for any dark energy.

A white-hole is characterized by gravitation running in reverse. To express this mathematically one can rewrite the formula for gravitational acceleration in terms of the density of a sphere. Given the following:

$$D = \frac{M}{V}, \quad V = \frac{4}{3}\pi r^3, \quad g = \frac{GM}{r^2} \quad (7)$$

where D is density, V is the volume of a sphere, M is mass, r is radius, g is gravitational acceleration, and G is the gravitational constant, then g can be rewritten as:

$$g = k\bar{\rho}r, \quad k = \frac{4\pi G}{3}, \quad \bar{\rho} = \rho_0 \frac{r_0^3}{r^3} \quad (8)$$

where ρ_0 is the density of a spherical body with radius r_0 , and $\bar{\rho}$ is the average density of an object with discontinuous mass and radius r .

Matter initially ejected out of the white-hole would be traveling at an enormous speed, but as the event horizon decreases in size the velocity of matter being ejected would

decrease proportionately. So when the white-hole ceases to exist, all matter would be traveling at a speed that is proportional to its distance from the cosmic center. This is the Hubble Constant (H). The value of H resulting from gravitation can be derived as follows:

Let

$$v^2 = k\bar{\rho} r^2 \quad \text{so} \quad v = (k\bar{\rho})^{1/2} r \quad \text{and}$$

$$H = \sqrt{\frac{4}{3} \pi \bar{\rho} G}$$

where v is velocity and r (radius) is understood as galactic distance. This result was first obtained by the British astrophysicists Edward Milne and William McCrea (North, 1965). In 1934, they successfully demonstrated that the dynamics of the universe could be expressed in Newtonian terms. However, by assuming homogeneity, the Milne-McCrea model displayed a number of flaws. Their attempt to describe a universal expansion that was independent of any gravitational influence while upholding the Copernican principle (similar to the negative curvature version of the Standard Model) was shown to be inconsistent with Newtonian mechanics. But by allowing for gravity, as the equations demand, and setting aside the Copernican principle, the problems of the Milne-McCrea model can be avoided.

In the CORE model, the greater the distance of a galaxy from the cosmic center, the greater its velocity when compared to other galaxies that are closer to the cosmic center. This holds true for any given point in time but does not mean that velocity increases as a galaxy travels to ever-greater distances. On the contrary, the value of v here will constantly decrease with time. By using a current estimation for the average density of matter in the universe ($1.9 \times 10^{-29} \text{ g/cm}^3$) one arrives at a value for H (approx. 71 km/sec/Mpc) that is consistent with the observations.

When the CMB was discovered in 1964 it was hailed as being supporting evidence for the Standard Model. To some degree this is true. But it is also true that it is equally supportive of other models as well. Homogeneity based on the copernican principle is the very foundation of the Standard Model, but the CMB offers no support for this principle. All it shows is that the universe is isotropic from our vantage point. Contrary to claims of some “Big Bang” proponents, isotropy and homogeneity are not synonymous.

All serious cosmological models need to account for two fundamental phenomena concerning the CMB: (1)

its isotropy and (2) the blackbody nature of its spectrum. The isotropy of the CMB can be explained by the Earth’s location in the universe. As for its blackbody spectrum, both my model and the Standard Model agree that in the past the universe was much hotter and denser, to the point of thermal equilibrium. The fundamental disagreement is in the nature of the cosmic expansion. If the universe was once inside its Schwarzschild radius, then as the event horizon collapses and matter is initially ejected out of the singularity the spectrum of the radiation emitted should conform to that of a blackbody i.e. cover a range of wavelengths the peak of which is determined by the temperature of the emitter. Ordinarily this temperature should be great, but photons would be radiated at lower energy levels due to the extreme velocity of their source. In this case they would display a redshift of roughly 1000 and be radiated in the microwave region of the electromagnetic spectrum. This redshifting could theoretically result in an observed temperature of roughly 2.725 Kelvin. Redshift can be defined as the displacement of spectral lines toward the longer wavelength (“red”) end of the electromagnetic spectrum due to the Doppler effect. In the case of a blackbody, however, there would be no spectral lines, so redshift would be determined by the peak wavelength of the blackbody curve. Redshift (z) is expressed mathematically as $z = \Delta\lambda/\lambda$ where λ is wavelength. It can be measured as a fraction of the speed of light by:

$$\frac{v}{c} = \frac{(z+1)^2 - 1}{(z+1)^2 + 1} \quad (9)$$

where v is velocity and c is the speed of light.

Recent observations of type Ia supernovae have begun to show the fundamental flaws of the Standard Model. Type Ia supernovae are very powerful astronomical tools called “standard candles.” Because these supernovae have a known intrinsic brightness they can be used by astronomers to calculate cosmic distances. In 1998 two independent teams of astronomers observing type Ia supernovae in distant galaxies obtained the same startling results. They found that the observed supernovae, and therefore their host galaxies, were much further from the Earth than their redshifts would suggest. Their conclusion was that the universe must be expanding at an accelerating rate since given the Hubble relation between distance and redshift an accelerating expansion would result in a universe that was considerably older than one would otherwise think. But what can be causing this acceleration? This is where the Standard Model begins to break down. Cosmologists say that a mysterious unknown force, which they call “dark

energy,” must permeate the universe. This is just Einstein’s *cosmological constant* with a fancy new name. In addressing the cosmological implications of the GTR in 1917 Einstein invented the idea of a cosmological constant, a hypothetical force unknown to science which he used to support his belief in a static universe. In the 1920’s when Edwin Hubble showed that the universe is expanding, Einstein admitted that the cosmological constant was the greatest blunder of his career. Today secular cosmologists have no way to reconcile the type Ia supernovae data with a homogeneous universe other than to repeat Einstein’s blunder. But in a finite, spherical, Pseudo-Euclidean universe (not to be confused with the positive curvature Non-Euclidean version of the Standard Model), the supernovae data shows that Hubble’s Law is only valid up to a certain distance from the cosmic center, due to the universe’s finite size. An empty sphere of Pseudo-Euclidean space would be defined by the Minkowski metric in spherical coordinates: $ds^2 = dt^2 + dr^2 + r^2(d\theta^2 + \sin^2\theta d\phi^2)$. This is just an ordinary three-dimensional space where ϕ and θ represent “longitude” and “latitude” respectively (see Figure 3) with an additional dimension of time.

However, the spacetime surrounding a spherically symmetric mass, or in the case of our universe, a radially expanding sphere of matter, would be defined by the Schwarzschild metric:

$$ds^2 = -\left(1 - \frac{R_{sch}}{r}\right)dt^2 + \frac{dr^2}{1 - \frac{R_{sch}}{r}} + r^2(d\theta^2 + \sin^2\theta d\phi^2) \quad (10)$$

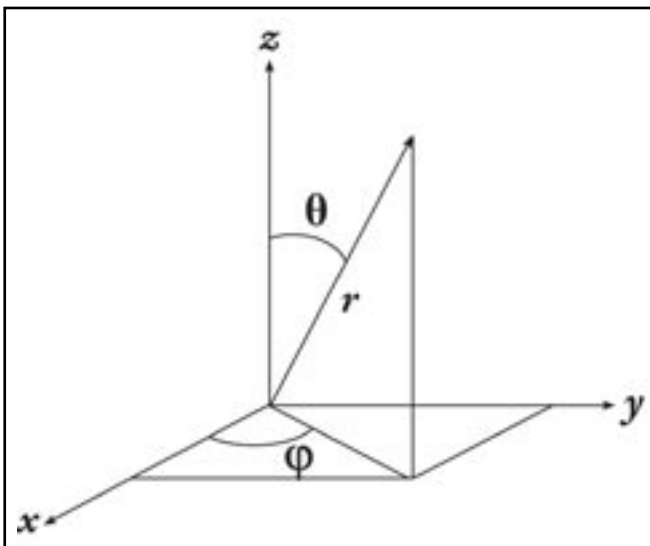


Figure 3. Spherical coordinates r , θ , ϕ .

where R_{sch} is the Schwarzschild radius described earlier.

Friedmann’s equation for the critical density of the universe ($\rho_c = 3H^2/8\pi G$) would yield a ratio of 2 between average density and critical density ($\Omega = \bar{\rho}/\rho_c$) in this case, given the average density of matter ($\bar{\rho}$) in the universe is $1.9 \times 10^{-29} \text{ g/cm}^3$ and the Hubble constant is 71 km/sec/Mpc. In a homogeneous Non-Euclidean model where $\Omega=2$ one would expect these distant supernovae to appear brighter than their redshifts would suggest. However, in an inhomogeneous Pseudo-Euclidean model one would expect that as a galaxy approaches the edge of the universe its redshift would naturally make it appear closer than it actually is. The reason for this is that as the sphere of matter continues to expand and the value of r increases, the Schwarzschild metric will increasingly resemble the Minkowski metric. In an unbounded cosmos this transformation of the spacetime outside the matter sphere would be expected to continue at a constant rate. However, once you impose a physical boundary on the universe, that expectation is no longer valid. As a result those galaxies near the edge of the sphere would be decelerating at a greater rate than one would expect if there were no such cosmic boundary. If you believe in homogeneity therefore the observations are interpreted as evidence of an accelerating universe. But in reality it is deceleration that is causing the phenomenon. As with the horizon problem, the absence of any explanation for a cosmic acceleration reveals the weakness of the copernican principle.

In his classic work *The Realm of the Nebulae*, Edwin Hubble states that if galactic redshifts are actual velocity shifts then one would have to conclude that we are at the center of a finite spherical universe (Hubble, 1936). As a scientist Hubble correctly acknowledges that the data allows for this possibility. It should be noted that in astronomy all spectral shifts are generally interpreted as representing radial velocity, except, of course, for galactic redshifts. Secular cosmology had to come up with another explanation for galactic redshifts in order to avoid the unpleasant conclusion that the Earth occupies a unique position in the cosmos. Hubble (1936) goes on to say “...if the interpretation as velocity shifts is abandoned, we find in the redshifts a hitherto unrecognized principle” (p. 185). Unrecognized principles and mysterious forces are the only way the “Big Bang” theory can sustain itself. This illustrates beyond doubt that it is ideology, not science, that drives the Standard Model.

Two striking characteristics of a center oriented relativistic expansion (CORE) is (1) how well it fits both the Biblical account of creation and the scientific data and (2) its theological symbolism. To illustrate these points it will be useful to look at the chronology of creation.

Genesis 1:1–2

God creates a sphere of space-time with a finite amount of matter and energy within it. As a result of gravitation the mass-energy of the universe begins to localize and fall towards a central point. As matter continues to fall inward the entire universe will eventually be inside its Schwarzschild radius forming a black-hole. All is dark. In the absence of any further intervention, the universe will fall into a singularity and be crushed out of existence.

Genesis 1:3–8

God turns the black-hole into a white-hole. Matter begins to ascend away from the singularity. The event horizon collapses. Light is introduced into the darkness.

Thus creation itself can be seen as being analogous to man's fall followed by his redemption in Christ.

Summary

The CORE theory presented here is just that: a theory. It is a possible explanation for the astronomical phenomena that have been observed. However, unlike the Standard Cosmological Model it does not rely on mysterious forces and unrecognized principles to account for those phenomena. Rather, it is based on fundamental natural laws like gravitation and the Doppler effect. Also, the value of the Hubble Constant determined theoretically may be shown to be in agreement with the observed value.

It is clear that the Standard Model is the product of an ideology. Its underlying principles have no basis in science

and as it grows increasingly untenable attempts to keep it viable are increasingly artificial and fantastic. Though some will say that belief in an all-powerful intelligent Creator is also an ideology one need only observe the natural world that surrounds us to see that this is more of a conclusion than an ideology.

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Book Review

Darwin and Design: Does Evolution Have Purpose?
by Michael Ruse

Harvard University Press, Cambridge, MA. 2003, 371 pages, \$30.00.



Prolific writer and speaker Michael Ruse, an evolutionist and Professor of Philosophy at Florida State University,

announces that he is a committed naturalist, no gods or supernatural powers, thank you (p. ix). Evolution is “Progress rather than Providence” (p. 134). “The Darwinian revolution is over and Darwin won” (p. 330). The message of the book is clear and persistent: “Evolution has been proven true, and is widely accepted

as such. God did not intervene miraculously to make each species separately” (p. 333). Ruse believes “that selective forces can generate genuine complexity” (p. 326). Evolution works through natural selection (p. 8) which in a sense becomes for him a god. Evolution is “the only game in town” (p. 280), an ideology, or secular religion, replacing Christianity (p. 134).

Ruse surveys authors and issues dating back 2,000 years and then in Chapter 5 reaches the 19th century and publication of the “world-shattering” 1859 evolution book by

his hero, Charles Darwin. Darwin's spiritual journey was from theism (Christianity) to deism to agnosticism. "Darwin became an evolutionist as much because of his religious beliefs as despite them" (p. 124). Then follow chapters dealing with important personages and positions pertinent in the penetration of evolutionary thinking into the scientific community. Ruse summarizes his position which is the same as that held today by a majority of the scientific community, "There is no reason to think that biology calls for special life forces over and above the usual processes of physics and chemistry" (p. 268).

Nature is conceived as having selected the living forms best adapted as they stagger toward complexity. Ruse employs the following analogy to illustrate the process of evolution:

However random the process, on average organisms seem to be able to evolve only in the direction of more complexity, not less. It is like the drunkard on a sidewalk bounded by a wall on one side and the gutter on the other. The drunkard can never go through the wall but eventually his random stagger will land him in the gutter. Perhaps that is all one sees in the course of history—a random stagger towards complexity (pp. 207–208).

In considering this illustrative example, I expect that critics (including myself) of Ruse's philosophy, very readily would be inclined to ask if a staggering drunkard is on a path to a better life.

For Ruse, observed *design* in nature is as it was for Darwin, *apparent* or design-like (pp. 268–269). Design should be thought of as a metaphor (pp. 274–278, 287, 289). The "designer" is a selection which therefore becomes a substitute for God. Ruse argues for a "theology of nature" (p. 335), a religion without God. However if what Ruse says is true and God does not exist, we well might ask why recognition of the supernatural is a universal characteristic found in all human cultures. In fact, along with behavior patterns including prayer to influence the supernatural, recognition of the "divine" could be the only cultural attribute consistently found within all cultures of people. According to evolutionists, belief in the supernatural would be a feature resulting from some "blind variation" chosen by natural selection for its survival value. If evolution were assumed to be true, then hunger and thirst also would have been selected during the long evolutionary process. Since there are means to satisfy human needs such as food for hunger, water for thirst, marriage for the sex drive, etc., also a supernatural (God) must exist to satisfy the basic human need for God. Ruse has some strong opinions, but to his credit he also tries to be conciliatory, for example, pulling passionate atheist-evolutionist Richard Dawkins and the Christian design theorist Michael Behe together by saying

that they both enjoy nature (p. 334).

Darwin and Design, published in 2003 has no references for that year, four for 2002, 11 for 2001, and the rest are older. Ruse's entire book lacks references to pertinent strictly scientific anti-evolutionary books by a spectrum of authors including L. S. Berg (1922), A.H. Clark (1930), H. Nilsson (1953), G.I. Kerkut (1960), M. Denton (1986), and J. Wells (2000). Also ignored is other quite pertinent scholarly creation literature, for instance material from the Victoria Institute in England and the Evolution Protest Movement (now the Creation Science Movement), both of which published anti-evolutionary scientific information and conclusions during the first half of the 20th century. Nothing is mentioned from any of the latter 20th century creation scientific societies or the presence of more than 100 more popular creation groups.

Ruse refers to the Scopes creation-evolution trial of 1925 and then jumps to some of the post-1990 writings of anti-evolutionist Phillip Johnson and of design theorists Michael Behe and William Dembski, all of whom he considers people involved in "turning back the clock." Also, among the late 20th century influential North American creation scientists, Henry Morris is mentioned briefly, but F.L. Marsh, J.W. Klotz, D. Gish, and dozens of others all are ignored.

The only origins question should not be, "How *could* evolution happen?" But rather we should ask, "Did it happen?" Certainly we can conceive that it did, and we can "design" computer programs to show how it possibly could have happened. But today most scientists are carrying out their studies based on the *assumption* of evolution. Modern creationists, however, prefer a scientific model involving multiple origins rather than a single one consistent with Darwinian thinking.

Ruse's book has 19 pages of "Sources and Suggested Reading" and an 11-page index. Some scientific material is outdated. For example "horse evolution" (pp. 204, 300) now is believed, as Stephen J. Gould and others have said, to be more bush-like than it was thought to be several decades ago. This also is true in physical anthropology. Regarding nucleic acids, ideas about "junk" (pp. 200–201) rapidly are being discarded as useful functions are discovered. The main value of *Darwin and Design* may be for the reader to comprehend the mindset of a convinced Darwinist and his integration and evaluation of the various resources that have supported his position.

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Notes from the Panorama of Science

Was Lucy Bipedal?

In the alleged process of humans evolving from primates, evolutionists have considered the most important event to be the evolution of bipedal locomotion. This event is even more important than the enlargement of the brain or the fabrication of stone tools. In fact, in many evolutionary scenarios, bipedalism is thought to be the cause of the enlargement of the brain and stone tool making.

The discovery of “Lucy” (*Australopithecus afarensis*) in 1973 by Carl Johanson’s team, and the discovery of the Laetoli Footprints in 1978 by Mary Leakey’s team, both dated at more than three million years, was welcome confirmation to evolutionists of the early evolution of bipedalism. They based their case on the fact that *A. afarensis* fossils were also found at Laetoli, and that the only fossil reconstruction of the *A. afarensis* foot was arched, and hence compatible with the Laetoli Footprints. Thus, for over twenty years, we have been told, both in the scientific and in the popular literature, that Lucy was bipedal and that she is what our evolutionary ancestor at that time looked like—or close to it.

Finally, a report in the August 2005 *Scientific American* suggests that there might be a problem. William E. H. Harcourt-Smith (American Museum of Natural History) and Charles E. Hilton (Western Michigan University) challenge Lucy’s bipedality. They claim that the fossil reconstruction

of the *A. afarensis* foot is based on a mixture of fossils, some from the 3.2 million year old *A. afarensis* collection, and some from the 1.8 million year old *Homo habilis* collection. Specifically, they claim that one of the bones, the navicular, used to determine that the *A. afarensis* foot was arched, actually was a *Homo habilis* fossil foot bone, not an *A. afarensis* foot bone.

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Presenting their findings at the seventy-fourth Annual Meeting of the American Association of Physical Anthropologists in Milwaukee, April 6–9, 2005, these researchers state again what has been known for years—that the Laetoli Footprints are virtually indistinguishable from modern arched footprints made by humans who are habitually unshod.

Harcourt-Smith and Hilton then studied the naviculars of *A. afarensis*, *H. habilis*, chimpanzees, and gorillas. The measurements of the *H. habilis* navicular were within the modern human range. The *A. afarensis* navicular, on the other hand, was very much like that of the flat-footed apes, meaning that it was very unlikely that *A. afarensis* had an arched foot, as humans have. They conclude that “*A. afarensis* almost certainly did not walk like us or, by extension, like the hominids at Laetoli.”¹

My personal file of scientific articles on *A. afarensis* bipedality is very thick. Yet, in over twenty years, to my knowledge, no evolutionist until now has mentioned that the relationship between *A. afarensis* foot, the Laetoli Footprints, and thus the “proof” of *A. afarensis* bipedality was based upon a faulty reconstruction. It is hard for me, an outsider, to know whether or not this is a case of outright deception. Was this matter known by only a very few who were involved in the reconstruction of Lucy’s foot? It is certainly a striking example of the failure of evolutionists to inform the public regarding the actual state of the evidence

1. Wong, Kate, 2005. Footprints to Fill. *Scientific American*, August, p. 18-19.
2. Lubenow, Marvin L. 2004. *Bones of Contention: A Creationist Assessment of Human Fossils* (2nd edition). Baker Book House, Grand Rapids, MI. (See Chapters 1 through 5.)

in the most important “alleged event” of human evolution. I have documented elsewhere many other cases of shabby scholarship or outright deception by evolutionists.²

It is significant that bipedalism authority, C. Owen Lovejoy (Kent State University) does not dispute the fact that the *A. afarensis* fossil foot reconstruction consists of bones from several different species. In spite of this problem, he defends Lucy’s bipedality by saying that even flat-footed modern humans can walk normally.

Harcourt-Smith and Hilton call for a new fossil foot reconstruction based only on *A. afarensis* fossils in order to determine whether or not *A. afarensis* was truly bipedal. If

not, they suggest two other possibilities: (1) that a fossil species known as *Australopithecus anamensis* made the Laetoli Footprints, even though we have no fossil foot bones of this species, or (2) that the Laetoli Footprints were made by a species yet undiscovered.

For evolutionists, it is just a short step from science to science-fiction.

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A Vegetarian Crocodile

I have previously discussed what can be called the “Isaiah Model”—Brown, 1983. This involves a future ecosystem based on Isaiah 11:6–9. Adding to this lion and lamb scenario is the discovery of a fossil vegetarian crocodile in Madagascar (Anonymous, 2000, p. 21). Its teeth were like those of the plant-eating iguana lizards. This vegetarian crocodile had a pug face and its tail was rounded, like the tail of a bulldog. The length of this fossil was 1.2 meters.

The original crocodiles around at the time of the fall of mankind may have been vegetarians, like this one. The fossil shows us that some creatures can undergo a change from the vegetarian lifestyle to the carnivore or back again—something that surely fits with the Isaiah model where the lion and the lamb will lie down together.

Acknowledgments

I thank George Howe for editorial assistance and computer typing.

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A View of Fossil *Homo sapiens* from “Far Back” in Africa

A recent discovery of a skull from Africa adds support to the view that *Homo sapiens* was the original type of man. This skull from Herto is dated at 160,000 years before present (BP) on the time scale generally used by evolutionists (Randerson, 2003, pp. 4–5). Having a brain capacity larger than our own, it may thus have a history going back to 200,000 years.

Another fine fossil specimen is found at the theoretical 260,000 year “time” from Florisbad in Africa, and is described as approaching that of modern man (Gore, 1997, p. 99). It may thus be within the wide range of skulls making up *H. sapiens*. This Florisbad skull may also be assumed to have had a previous history, possibly taking it back to 300,000 years BP in evolutionary dating. But at this point in their time speculations, however, there is nothing that might have given rise to this sapiens specimen, because it is too advanced.

Likewise in Europe and elsewhere a number of *H. sapiens* skulls are found at the 300,000 year marker, one example of which is the Steinheim skull from Germany. There are also wonderful spears at the evolutionists’ 400,000 year mark (Dennell, 1997, pp. 767–768)—sapiens are the only individuals that have ever been assumed to have used such spears! There is thus a good prospect of *H. sapiens* from around 500,000 years BP but we wonder if evolutionists will ever “allow” these specimens to be that “old.” When the skull discovered in Petralona, Greece was placed at 700,000 evolutionary years BP, for example, there were objections (Poulianos, 1981, pp. 287–288).

Since the Flood and the possible water canopy would have affected the dating technologies, it is difficult to determine which skulls are really the oldest and hence the “original” humans. Nonetheless, we can demonstrate in these supposedly ancient skulls from Africa and elsewhere that something is wrong with the view of evolutionary progression in the history of man throughout time.

On occasion, however, the evolutionists have not been slow to change their views on dates (upward or downward) as needed. Skulls such as those of Steinheim and Swanscombe were moved from 300,000 years to 200,000 years BP—a change which can be documented by looking at various publications over a period of years. A skull called the V2 from Hungary, which incidentally had a very large brain capacity, was originally dated at 350,000 years. Twenty-five years later it was re-dated at only 150,000 years BP (Stringer

and Gamble, 1993, p. 150). The Ngandong skulls from Java were first dated at around 300,000 years BP, yet about 60 years later they were changed to be as young as 27,000 years old (Lewin, 1996, p. 16). In the upward direction, on the other hand, The Broken Hill skull from Africa was first dated at 200,000 years BP and later was moved to 300,000 years. This is but a sample of the dating changes that have been made.

Currently there is no other man-like fossil “close enough” in the evolutionary time scale to have yielded modern man at the 300,000 year mark. And if there ever were the prospect of a good *Homo sapiens* specimen found at or before the 500,000 year BP mark, this would be the end of the evolutionary view of man, in its present form, because earlier than 500,000 years would be much farther back than the “time” of the best potential *H. erectus* ancestors for *H. sapiens*.

The current analysis of fossil skulls shows *H. sapiens* as an independent line as far back as 300,000 evolutionary years and we await the prospect of their being found even farther back than 500,000 years BP. The view from Africa and elsewhere indeed looks bright for the creationist.

Acknowledgments

I thank George Howe for constructive comments on this note and for computer typing.

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Letters to the Editor

More Failures For Long Age Potassium/Argon (K/Ar) Dating

Scientists in past decades have pointed out major failures of the K/Ar method to date volcanic materials. Old ages ranging from several hundred thousand to several million and even 2.96 billion years have been obtained for historical volcanic eruptions from: 1) Mt. St. Helens lava dome of 1986, from 0.3 to 2.7 million, 3 samples (Austin, 1996), 2) Mt. Ngauruhoe, Central North Island, New Zealand of 1949, 1954 and 1975, from <0.27 to 3.5 million, 11 samples (Snelling, 1999), and 3) 1800–1801 Hawaiian magma at 1.41 and 1.60 million (Austin, 1994; Dalrymple, 1968); xenoliths within the magma gave a wide variety of ages up to 2.96 billion years for Hawaii (Funkhouser, 1968).

Regarding the anomalous dates for volcanic minerals a European mineral professional, Dr. Marie Clare Van Oosterwyck, worked in the Belgian Congo and then in the Belgian Museum of Natural History laboratory. She is well qualified to define the problems. She advised research leadership as early as 1975 that the ages obtained by K/Ar for our alleged African ancestors were 'not' absolute ages and were meaningless. As she wrote: "I am a professional mineralogist, specialized in silicates, having essentially worked on African material. I was requested at that time (~1975) by a world-famous geochronologist to give my advice about the origin of the anomalous ages which are so frequently found in geochronological works. My answer was very simple: Since the radioactive elements are imprisoned in definite crystal lattices, they were likely influenced by factors evidenced in crystal genesis and alteration which were essentially: (a) temperature (b) solutions, 'hydrothermal conditions' (c) chemical composition and (d) granulometry—the same kind of elements being evidenced for the samples delivering anomalous ages ... In addition, if the heaps of data collected during the numerous interdisciplinary missions to Africa and

more specifically East Africa, completely failed in evidencing the expected 'emergence process' (of man), they brought on the other hand impressive evidences about the occurrence of a Big Flood which had covered the whole Earth at a time not far from the present one" (Van Oosterwyck, 1999 p.1). Thus, because the variability within crystals,

due to the above factors, is common knowledge among mineralogists she offered to demonstrate her case by laboratory experiments. However, she not only was refused permission to do so, she also lost her rights to perform research in the lab and actually was required to turn in her lab key.

Another researcher, Sedimentologist Guy Berthault of France, has shown by flask and flume studies (Berthault, 1988, 1995, 2002, 2002, 2004; Julien et al., 1993) that sediments in moving waters deposit

simultaneously in a vertical and horizontal manner. As Julien et al. (1993) concluded: "In summary these experiments demonstrate that stratification of heterogeneous sand mixtures can result from: segregation for lamination, non-uniform flow for graded beds, and desiccation for joints. Therefore superposed strata are not necessarily identified to successive sedimentary layers" (p. 659). Likewise fossils in a top stratum could have been older than ones in a lower stratum due to sediment sorting.

Field work substantiates the lab research. This has been shown by coring in the Bay of Naples (Walther, 1894); in a Colorado flood catastrophe (McKee, 1965); by paleohydrologic studies of the Grand Canyon (Austin, 1999); the Crimean Peninsula (Lalomov, 2002), and the laminar strata of the Mt. St. Helens mudslides (Austin, 1994). Andrew Snelling in an article in AiG's web site entitled, "Sedimentation experiments: nature finally catches up," has observed that *Nature* published two articles (Fineberg, 1997; Makse

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et.al., 1997) that reported the same sedimentology phenomena but did not acknowledge the much earlier research of Guy Berthault and Julien published in the *Bulletin Societe Geologie* and by *Creation Ex Nihilo Technical Journal*.

Scientists who suspect catastrophic events as the cause of many geologic formations have studied the evidences in many regions and basins and have presented their data in *CRSQ*, *The International Conference on Creationsim*, and other journals which conflict with uniformitarian geology and/or K/Ar data. Currently, several Paleochronology Group members are reviewing Radiocarbon (RC) Journal data in preparation for several articles in *CRSQ* regarding their own RC dating of unusual fossils. We were thus surprised to discover that there were additional anomalous K/Ar dates for catastrophes in Australia and Hawaii; we learned that these researchers associated with the Smithsonian Institute, Washington D.C. and the U.S. Geologic Survey respectively did not allow themselves to be misled by so-called “absolute ages.” They resorted to intense field geology (stratigraphy) of australite (tektite) occurrences and RC dating (in one case) to obtain more realistic dates. The K/Ar ages obviously made no sense to the Australian and Hawaiian teams so these geologists backed by prestigious science organizations were careful not to rely on such a method.

Scientists who believe in Intelligent Design; and, who discovered human-like footprints with dinosaur footprints, have RC dated dinosaur bone fragments and carbonized wood when materials for K/Ar dating were unavailable in the strata (Morris, 1980; Fields et al., 1990; Baugh and Wilson, 1991). They obtained RC ages of 12,800; 37,480 +2950/-2140; 37,420 +6120 -3430; 45,920 +/-5550/-3250 and >49,900 RC years which is consistent with fossils from the flood period—a real age of ~5350 BP (years before the present) (Brown, 1992).

The first case in point appeared in an issue the Smithsonian's *Radiocarbon Journal* dealing with a study of tektites in Victoria, Australia (Lake Torrens and Lake Eyre regions) called australites (Lovering and Mason, 1970). The K/Ar dates for tektites ranged from 700,000 B.P. to 860,000 years BP. The K/Ar dating of tektites from Indonesia, Thailand, Indochina and Philippines agreed. Fission-track dating ranged from 30,000 to 800,000 BP and was interpreted as consistent with K/Ar ages. Younger ages for fission tracks were ascribed to partial annealing of fission tracks by reheating on the earth's surface. Team members RC dated charcoal and calcareous nodules as they were found with australites (Gill, 1965).

Their conclusion with regards the RC dates and field study was as follows: “Although [RC] ages were inconsistent, field work on geology of australite occurrences favored the

‘younger’ radiocarbon age. C-14 age of charcoal believed associated with australites, as well as geologic evidence, indicated age between last glacial and 6000–7000 BP ... RC ages of calcareous nodules from soil horizon in which australites were found, scatter around 13,000 +/- 3000 BP” (Lovering and Mason, 1970, p. 9 & 11).

Thus, the tektites fell between 6,000 and ~13,000 RC years BP. But, based the formula for correlating RC dates to real dates the projected actual dates were ~ 4,600–5,100 years BP, or shortly after the flood. The flood year in the formula is designated as 5,350 years BP (Brown, 1986, 1992). It is interesting to note that K/Ar direct dating of tektites from cores in the Chesapeake Bay Impact gave 35.5 million years (Spencer and Oard, 2004); had carbon datable material such as wood or shell fragments been RC dated from the cores they might have discovered a much more believable age.

A second case was in Hawaii (Moore and Moore, 1984) in a report entitled, “Deposit from a giant wave on the island of Lanai, Hawaii.” K/Ar dates for Basalt of 1.25 million years on Lanai Island and 0.4 million years on other Hawaiian islands containing similar conglomerates as the Hulopoe Gravel on Lanai (limestone boulders with gravel) were determined. But, by geological studies of the strata the deposits of limestone boulders with gravel were determined to have been deposited at the height of 326 meters (1,069 feet) above sea level by a ‘giant wave’ only 100,000 years BP. This date is far removed from the alleged age of the K/Ar dates of 0.4–1.25 million years for nearby basalt. It is unfortunate that they chose not to/or could not RC date some of the shells or other fossil material associated with the conglomerates; had they done so they might have come closer to the real age. Thus without RC dating and just having an uniformitarian paradigm to work with these scientists still detected by stratigraphy a younger age than K/Ar provided for basalt.

In analyzing the cause of such a ‘gigantic wave’ Moore and Moore (1984) suggest: “Because of the great run-up of the wave, it was probably not a seismic sea wave [like the tsunami that hit Indonesia etc. on December 26, 2004] caused by a subsea earthquake. Run-up of the highest recorded tsunami reached only 17 meters (56 feet) above sea level in Pololu Valley on the Island of Hawaii in 1946 (McDonald, 1947)” (p 1314). Accordingly, the authors believe the cause of such a high wave of 326 meters (1,069 feet) could have been: “Either the impact of a meteorite on the sea surface or a shallow submarine volcanic explosion could have generated the Hulopoe wave. We believe, however, that a more likely explanation is a rapid down slope movement of subsea landslide on the Hawaiian Ridge, which is among the steepest and highest landforms on earth. The occur-

rence of several major subsea landslides of various ages, possibly triggered by local earthquakes, indicates that the Hawaiian Ridge is a site of repeated slope failure (Moore, 1964). An even higher wave resulted when a landslide in a confined fjord in Alaska in 1958 produced a run-up of 524 meters (1,718 feet), the highest on record (Miller, 1960)” (Moore and Moore, 1984, p. 1314). A Mt. St. Helens mud slide in 1980 caused Spirit Lake waters to surge upwards and stripped the trees right off slopes as high as 850 feet (Austin, 1986).

The wave heights for these short term catastrophic watery events must pale into insignificance when compared to the cataclysm noted in Genesis 7:11–12, “In the six hundredth year of Noah’s life, on the seventeenth day of the second month, on that very day all the fountains of the great deep burst forth, and the floodgates of the heavens were opened. And rain fell on the earth forty days and forty nights.” These single watery events with their huge waves moved boulders and broke up rock and knocked down trees but the great flood deposited sediments many 1000’s of feet thick in the earth’s basins with the cataclysm lasting many months.

Conclusions and Recommendations

- Geologic events dated to millions of years by methods such as K/Ar are in reality thousands of years old. Australites may have been part of a post flood event that could have included an asteroid impact that tilted the earth. (Setterfield, 1983).
- Uniformitarian stratigraphy dating used in the above two cases are still inaccurate. This is cause for concern with regards a true understanding of historical geology.
- The formula for correlating RC dates with real ages (Brown, 1992) appears to give a more reasonable age for arrival of the tektites.
- There is now sufficient documented failures for the K/Ar radiometric dating method to suggest that when both basalt and burnt or carbonized wood are available, it makes good sense to K/Ar (and Ar/Ar as well) date the basalt and RC date the fossils. Such data will build a very strong case against old age radiometric methods as the two dates would be quite divergent. We thus encourage scientists to look for RC datable fossils associated with regional geologic events then correlate these dates with the Brown formula.
- If the ‘giant wave’ was a post-flood event associated with the infall of australites near Australia there could be several other causes: (a) Asteroid impactation (Setterfield, 1983). (b) Uplift of a large mountain mass like the Himalayas (Marchel, 1996, 1997) or (c) Asteroid and uplifts occurring simultaneously. But we probably will never know much more than we know now unless someone recovers RC datable fossils on the slopes of Lanai Island and in the same horizon with/or below the Hulopoe Gravel.
- The uniformitarianists in their determination to show that K/Ar dating supports human evolution and millions of years for sedimentary deposition deceived the world and themselves by refusing to perform proposed lab experiments in 1975.
- There is a need for a ‘grand unification study’ (summary paper perhaps) of all regional basins so far restudied by creation scientists to see how each fits into the big picture of a universal flood and post flood geologic events. It is very clear that sedimentology research by lab and flume experiments and by observations in the field have demonstrated that the sedimentary principles on which the geologic column is based appear to have little value to true science.
- I agree with Humphrey’s (2004) suggestion that RC dating is a friend of creation. There thus appears to be a need for CRS to set a goal for developing an AMS lab for C-14 research. Samples could be sent to other labs when needed, particularly during the calibration period.

I am indebted to several Paleo Group members for suggesting improvements to this letter report and several Kolbe Center advisory board members for their encouragement in this endeavor.

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Minutes of the 2005 Creation Research Society Board of Directors Meeting

On Thursday, 2 June 2005, a meeting of the Board of Directors (BOD) was held at the Hampton Inn, Bozeman, Montana, from 1900 hours to 2000 hours to plan for the committee meetings on Friday. On Friday, 3 June 2005, between the hours 0800 and 1530 the VACRC, Publication, Membership, Quarterly, Finance, Internet, Research and Constitution/Bylaws/Advanced Planning Committees each met separately for approximately one hour to plan for the closed business meeting.

On Friday, 3 June 2005, the closed business meeting of the BOD was called to order at 1530 hours, Present: T. Aufdemberge, E. Chaffin, D. DeYoung, D. Faulkner, R. Humphreys, G. Howe, D. Kaufmann, G. Locklair, M. Oard, D. Rodabaugh, R. Samec, G. Wolfrom. Not able to attend: J. Reed.

Employees K. Anderson and H. Giesecke were invited guests. The minutes of the 2004 BOD meeting were accepted with the following correction and addition: A motion was passed to increase the fee for regular categories (voting, sustaining, student, senior and subscriber) by \$3.00 per

year, effective for the membership year beginning June 1, 2005.

Recording Secretary Kaufmann reported that the following were elected to a three year term to the BOD: T. Aufdemberge, D. Faulkner, G. Howe, M. Oard, D. Rodabaugh.



Left to right: Dave Rodabaugh, George Howe, Ron Samec, Mike Oard, Gene Chaffin, Dave Kaufmann, Ted Aufdemberge, Hank Giesecke*, Kevin Anderson*, Glen Wolfrom, Russ Humphreys, Danny Faulkner, Gary Locklair, and Don DeYoung
Not present: John Reed

* Kevin Anderson (Director of the Van Andel Creation Research Center) and Hank Giesecke (Head of Development) are professional staff members located at the VACRC, Chino Valley, AZ, location and are not board members.

The lab committee report by DeYoung stated there are three full-time CRS staff at the Van Andel Creation Research Center. Kevin Anderson is Director. Hank Giesecke has been given a title change from assistant director to Head of Development. Diane Anderson is administrative assistant. The laboratory building is well-used and showing some wear. In the next two years the roof, paint, and heating/cooling will need attention. The lab committee of the BOD,

charged with oversight of the Research Center operations, has been meeting periodically by conference call.

The internet committee (chair:Locklair) reported increased activity at the CRS web site and on the CRSnet listserv. Both tools are working well and providing a benefit to the society. The CRS web site is averaging more than 30,000 sessions per month while the CRSnet has more than 125 active participants. The web site continues to attract new members to the society and shows a steady increase in revenue from online book sales. The committee discussed the possibility of including .pdf files of selected CRS book chapters on the web site. The committee reported the first sub-group of CRSnet, CRSgene, is being formed as an invitation-only discussion area related to genetics and origins. The committee proposed a \$2000 expense budget which included a \$500 update to the web site store software.

The RATE committee report by Humphreys stated that the project is completed with an upcoming published technical book.

Chaffin reported that the research committee reviewed the research projects which have already been approved.



Visible faces from top right to left: Don DeYoung, Dave Kaufmann, George Howe, Gene Chaffin, Ted Aufdemberge



above left: Visible faces from top left to right: Mike Oard, Danny Faulkner, Ron Samec, Russ Humphreys, Kevin Anderson*, Glen Wolfrom
back of heads from left to right: Dave Rodabaugh, Hank Giesecke*



above right: Left to right: Russ Humphreys, Glen Wolfrom, Gary Locklair, Dave Rodabaugh

A budget was developed based on expected expenditures. A new quarterly review process for evaluation and approval of projects was discussed and approved.

The publications committee report by Oard stated that one book was published in 2005, *A Road Guide to Yellowstone National Park*.

The meeting was adjourned at 1800 hours.

On Saturday, 4 June, the closed business meeting was resumed at 0800 hours with devotion and prayer led by M. Oard

The Treasurer and the Finance Committee took steps to alleviate the cash flow problem experienced by the CRS professional staff during calendar year 2004.

The Treasurer and Finance Committee devised steps to ensure bookkeeping performed by CRS professional staff and budgeting performed by the CRS BOD were synchronized.

Each committee chairman will be responsible and accountable for his budget. The CRS professional staff will provide the Treasurer and Finance Committee chairman with detailed monthly reports of income and expenses relative to board approved line items.

The CRS professional staff requested that the CRS adopt a fiscal year for financial reporting running from July 1 to June 30. The BOD authorized this change.

The BOD approved an expense budget of \$339,400 for fiscal year July 1, 2005–June 30 2006.

The finance committee report by Aufdemberge stated that our investments totaled \$475,165 with an estimated annual income of \$23,125.

The membership report by Wolfrom was given as follows: total membership for 2004/05 was 1687 (688 voting, 695 sustaining, 300 subscriber and 4 students). This is a decrease of 23 total from the 2003/04 membership year.

However, it was encouraging to realize a net increase of 14 voting members. Voting membership is at its highest level in the past ten years.

The membership committee report by Kaufmann resulted in the following actions. It was passed to send a special letter to "Friends of the CRS" with a free copy of *Creation Mat-*

ters encouraging them to join CRS. It was passed to offer a special membership of \$28 per year for USA members and \$35 per year for

foreign members at the Mega Conference at Liberty University in July. Free CRSQ's and flyers will be distributed to attendees.

The CRS Quarterly committee report by Howe noted the following. K. Anderson, all section editors, L. Lester, C. Blandon and R. Mullins will remain in service for the year 2005/2006. Editor Anderson gave a report on current procedures and steps to be followed by section editors. We need new section editors to handle paleontology, molecular biology and Hebrew Bible exegesis areas.

The constitution committee reported that no changes were made this year to the constitution or bylaws.

It was passed to nominate the following persons for the BOD election in 2006: M. Armitage, E. Chaffin, J. Reed and G. Wolfrom.

The following officers were elected for 2005/2006: President, D. DeYoung; Vice President, E. Chaffin; Recording Secretary, D. Kaufmann; Treasurer, G. Locklair; Membership Secretary, G. Wolfrom; Financial Secretary, T. Aufdemberge.

It was passed to hold the 2006 BOD meeting at the University of South Carolina at Lancaster, South Carolina, June 8 to 10, 2006.

The meeting was adjourned at 1130 hours.

Respectfully submitted,
David A. Kaufmann, Recording Secretary

Instructions to Authors

Submission

Submit an original plus two copies of each manuscript to the editor of the *Creation Research Society Quarterly* (see the inside front cover for address). Concurrent submission of an electronic version (Word, WordPerfect, or Rich Text Format) of the manuscript text and graphics is also encouraged. The manuscript and graphics will not be returned to authors unless a stamped, self-addressed envelope accompanies submission. Manuscripts containing more than 30 pages are discouraged. An author who determines that the topic cannot be adequately covered within this number of pages is encouraged to submit separate papers that can be serialized.

All submitted manuscripts will be reviewed by two or more technical referees. However, each section editor of the *Quarterly* has final authority regarding the acceptance of a manuscript for publication. While some manuscripts may be accepted with little or no modification, typically editors will seek specific revisions of the manuscript before acceptance. Authors will then be asked to submit revisions based upon comments made by the referees. In these instances, authors are encouraged to submit a detailed letter explaining changes made in the revision, and, if necessary, give reasons for not incorporating specific changes suggested by the editor or reviewer. If an author believes the rejection of a manuscript was not justified, an appeal may be made to the *Quarterly* editor (details of appeal process at the Society's web site, www.creationresearch.org).

Authors who are unsure of proper English usage should have their manuscripts checked by someone proficient in the English language. Also, authors should endeavor to make certain the manuscript (particularly the references) conforms to the style and format of the *Quarterly*. Manuscripts may be rejected on the basis of poor English or lack of conformity to the proper format.

The *Quarterly* is a journal of original writings, and only under unusual circumstances will previously published material be reprinted. Questions regarding this should be submitted to the Editor (CRSQ_editor@creationresearch.org) prior to submitting any previously published material. In addition, manuscripts submitted to the *Quarterly* should not be concurrently submitted to another journal. Violation of this will result in immediate rejection of the submitted manuscript. Also, if an author uses copyrighted photographs or other material, a release from the copyright holder should be submitted.

Appearance

Manuscripts shall be computer-printed or neatly typed. Lines should be double-spaced, including figure legends, table footnotes, and references. All pages should be sequentially numbered. Upon acceptance of the manuscript for publication, an electronic version is requested (Word, WordPerfect, or Rich Text Format), with the graphics in separate electronic files. However, if submission of an electronic final version is not possible for the author, then a cleanly printed or typed copy is acceptable.

Submitted manuscripts should have the following organizational format:

1. Title page. This page should contain the title of the manuscript, the author's name, and all relevant contact information (including mailing address, telephone number, fax number, and e-mail address). If the manuscript is submitted by multiple authors, one author should serve as the corresponding author, and this should be noted on the title page.

2. Abstract page. This is page 1 of the manuscript, and should contain the article title at the top, followed by the abstract for the article. Abstracts should be between 75 and 200 words in length and present an overview of the material discussed in the article, including all major conclusions. Use of abbreviations and references in the abstract should be avoided. This page should also contain at least five key words appropriate for identifying this article via a computer search.

3. Introduction. The introduction should provide sufficient background information to allow the reader to understand the relevance and significance of the article for creation science.

4. Body of the text. Two types of headings are typically used by the *CRSQ*. A major heading consists of a large font bold print that is centered in column, and is used for each major change of focus or topic. A minor heading consists of a regular font bold print that is flush to the left margin, and is used following a major heading and helps to organize points within each major topic. Do not split words with hyphens, or use all capital letters for any words. Also, do not use bold type, except for headings (italics can be occasionally used to draw distinction to specific words). Italics should not be used for foreign words in common usage, e.g., "et al.", "ibid.", "ca." and "ad infinitum." Previously published literature should be cited using the author's last name(s) and the year of publication (ex. Smith, 2003; Smith and Jones, 2003). If the citation has more than two authors, only the first author's

name should appear (ex. Smith et al., 2003). Contributing authors should examine this issue of the *CRSQ* or consult the society's web site for specific examples as well as a more detailed explanation of manuscript preparation. Frequently used terms can be abbreviated by placing abbreviations in parentheses following the first usage of the term in the text, for example, polyacrylamide electrophoresis (PAGE) or catastrophic plate tectonics (CPT). Only the abbreviation need be used afterward. If numerous abbreviations are used, authors should consider providing a list of abbreviations. Also, because of the variable usage of the terms "microevolution" and "macroevolution," authors should clearly define how they are specifically using these terms. Use of the term "creationism" should be avoided. All figures and tables should be cited in the body of the text, and be numbered in the sequential order that they appear in the text (figures and tables are numbered separately with Arabic and Roman numerals, respectively).

5. Summary. A summary paragraph(s) is often useful for readers. The summary should provide the reader an overview of the material just presented, and often helps the reader to summarize the salient points and conclusions the author has made throughout the text.

6. References. Authors should take extra measures to be certain that all references cited within the text are documented in the reference section. These references should be formatted in the current *CRSQ* style. (When the *Quarterly* appears in the references multiple times, then an abbreviation to *CRSQ* is acceptable.) The examples below cover the most common types of references:

Robinson, D.A., and D.P. Cavanaugh. 1998. A quantitative approach to baraminology with examples from the catarrhine primates. *CRSQ* 34:196–208.

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

Margulis, L. 1971a. The origin of plant and animal cells. *American Scientific* 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, T.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.

7. Tables. All tables cited in the text should be individually placed in numerical order following the reference section, and not embedded in the text. Each table should have a header statement that serves as a title for that table (see a current issue of the *Quarterly* for specific examples). Use tabs, rather than multiple spaces, in aligning columns within a

table. Tables should be composed with *14-point type* to insure proper appearance in the columns of the *CRSQ*.

8. Figures. All figures cited in the text should be individually placed in numerical order, and placed after the tables. Do not embed figures in the text. Each figure should contain a legend that provides sufficient description to enable the reader to understand the basic concepts of the figure without needing to refer to the text. Legends should be on a separate page from the figure. All figures and drawings should be of high quality (hand-drawn illustrations and lettering should be professionally done). Patterns, not shading, should be used to distinguish areas within graphs or other figures. Unacceptable illustrations will result in rejection of the manuscript. Authors are also strongly encouraged to submit an electronic version (.cdr, .cpt, .gif, .jpg, and .tif formats) of all figures in individual files that are separate from the electronic file containing the text and tables.

Special Sections

Letters to the Editor:

Submission of letters regarding topics relevant to the society or creation science is encouraged. Submission of letters commenting upon articles published in the *Quarterly* will be published two issues after the article's original publication date. Authors will be given an opportunity for a concurrent response. No further letters referring to a specific *Quarterly* article will be published. Following this period, individuals who desire to write additional responses/comments (particularly critical comments) regarding a specific *Quarterly* article are encouraged to submit their own articles to the *Quarterly* for review and publication.

Editor's Forum:

Occasionally, the editor will invite individuals to submit differing opinions on specific topics relevant to the *Quarterly*. Each author will have opportunity to present a position paper (1000 words), and one response (500 words) to the differing position paper. In all matters, the editor will have final and complete editorial control. Topics for these forums will be solely at the editor's discretion, but suggestions of topics are welcome.

Book Reviews:

All book reviews should be submitted to the book review editor, who will determine the acceptability of each submitted review. Book reviews should be limited to 1000 words. Following the style of reviews printed in this issue, all book reviews should contain the following information: book title, author, publisher, publication date, number of pages, and retail cost. Reviews should endeavor to present the salient points of the book that are relevant to the issues of creation/evolution. Typically, such points are accompanied by the reviewer's analysis of the book's content, clarity, and relevance to the creation issue.

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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.

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Creation Research Society

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

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

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

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

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

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

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

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

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