

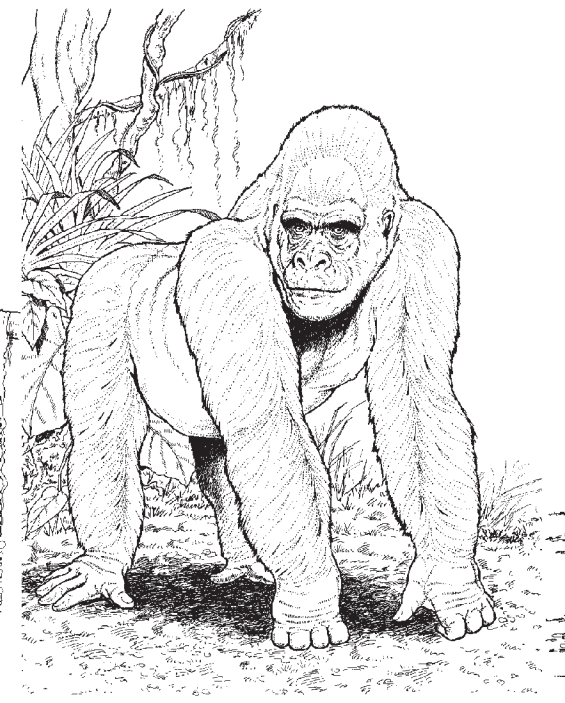
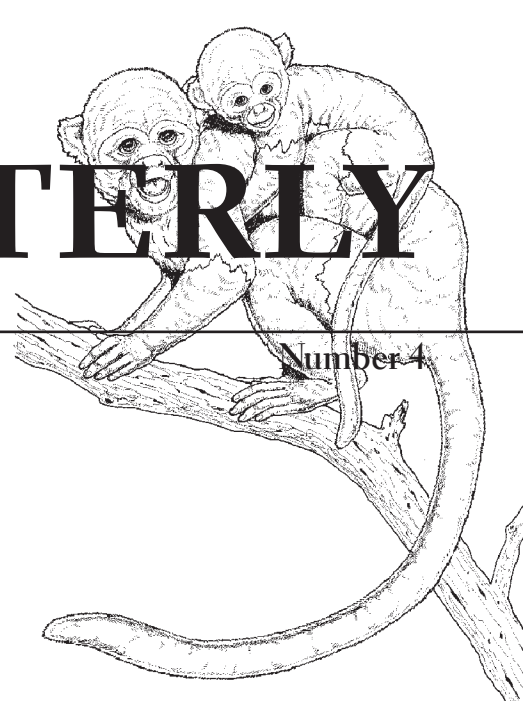
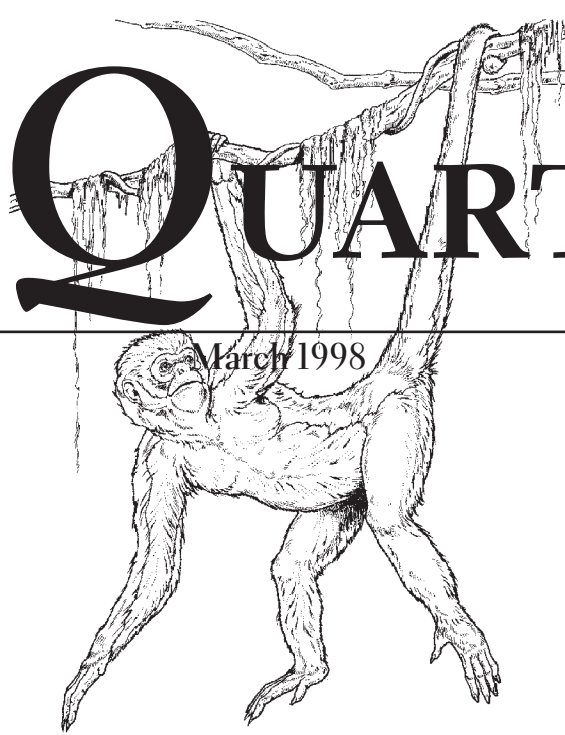
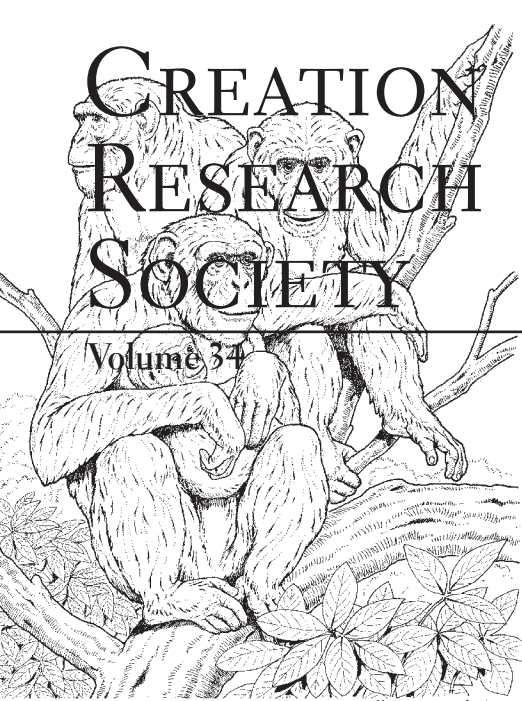
CREATION RESEARCH SOCIETY

Volume 34

QUARTERLY

March 1998

Number 4



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Front Cover

On page 196 Ashley Robinson and David Cavanaugh use monkeys and apes as examples for baraminology (the study of the created kinds). This collection of pictures is from *Monkeys & Apes* (1996) by John Green, Dover Publications, by permission of ArtToday.

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Photo essay by Emmett L. Williams.

The *Creation Research Society Quarterly* is published by the Creation Research Society, P. O. Box 8263, St. Joseph, MO 64508, and it is indexed in the *Christian Periodical Index*.

Send papers on all subjects to the Editor: Eugene F. Chaffin, 715 Tazewell Ave., Bluefield, VA 24605. Send book reviews to the Book Review Editor: Don B. DeYoung, 200 Seminary Dr., Winona Lake IN 46590.

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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

Creation Research Society

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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 1100 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as the outstanding publication in the field. In 1996 the CRSQ was joined by the newsletter *Creation Matters* as a source of information of interest to creationists.

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

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

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

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

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

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

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

In Memoriam Richard D. Lumsden April 6, 1938 – January 12, 1997

Dr. Lumsden was a native of New Orleans, Louisiana and lived in that city most of his life. He received a B.S. in zoology and a M.S. in biology from Tulane University. Dick obtained training in cell biology and electron microscopy at Harvard and was granted a Ph.D. in biology specializing in cell biology, biochemistry and parasitology from Rice University in 1965. Later he was trained in medical pathology at the Tulane School of Medicine.

Dick had a phenomenal academic and professional career including being Director of the Cell Biology Laboratory at Tulane as well as Dean of the Graduate School at the same university. He was a professor in the School of Public Health and Tropical Medicine and taught anatomy in the School of Medicine at Tulane. His last teaching positions were at the Institute for Creation Research and The Master's College.

Once Lumsden completed his doctorate work and returned to Tulane, he was promoted to full professor within seven years. This rapid advancement was a remarkable achievement, showing the incredible respect his colleagues had for his teaching and research. During this period fundamental discoveries about the structure of parasites and how these cellular structures might function in order to permit the parasite to remain in spite of the host's immune resistance and other defensive responses were being made in Dick's laboratories. He was a pioneer investigator in the area

of ultrastructural and functional aspects of the host-parasite interface and he mentored 17 doctoral and 10 post-doctoral students in this field of study.

His writing skills and technical knowledge were superb, thus he served on the editorial board of several journals such as *Experimental Parasitology*, *Journal of Parasitology*, *Zeitschrift für Parasitenkunde*, *Parasitology Research*, and *Creation Research Society Quarterly*. Likewise, he was a peer reviewer for several technical societies and publishers and was editor of *Therapeia* from 1988 to 1992.

Dr. Lumsden authored over 80 technical papers and several textbooks. He was a recipient of a Career Development Award from the National Institute of Health and the Henry Baldwin Ward Medal of American Society of Parasitologists. He was awarded some 20 scholarships, fellowships and research grants from governmental agencies and private foundations. At the time of his death, he was working on a research project on ultrastructural and cytochemical studies of some arthropod defensive glands for the Creation Research Society.

In addition to his publishing achievements Dick was a compelling speaker. He lectured in seminars and conferences throughout the world. His depth of knowledge and public speaking ability enabled him to present difficult material in an understandable fashion. When Dick spoke at the City of Kenner, Louisiana sixth annual Mayor's prayer breakfast in 1990, Joe McKeever of the First Baptist Church of Kenner drew a cartoon of the event showing a bearded Lumsden speaking from the podium with a man sitting at the speaker's table telling another man to his left that Dr. Lumsden "looks like an old testament prophet... sounds like a new testament evangelist... sort of like Simon Peter with Jonas Salk's credentials!"

Upon becoming a Christian, Dr. Lumsden was drawn into the creation-evolution controversy. He immediately began to use his great mind and communication skills to defend creationism pointing out the inconsistencies of the evolutionary philosophy. From 1989 until his death, he wrote and lectured on scientific creationist topics and was elected to the Board of Directors of the Creation Research Society in 1994. Dick Lumsden was a brilliant Southern gentleman with many talents and a humble creationist who dedicated his last years in service to the Creator. Dick is survived by his wife, Gaynell, four children and one grandchild.

Emmett L. Williams



President's Remarks

There have been changes in the personnel of the editorial committee. Gene Chaffin continues as Editor of the *Quarterly*. Dr. George F. Howe will assist Dr. Chaffin as Biology Associate Editor. Dr. John K. Reed will assume the responsibility of Geology Associate Editor. Dr. Lane Lester is now the Managing Editor of the *Quarterly*. The style of the *Quarterly* will be modernized under Lane's leadership. I am delighted that these men, along with Don DeYoung, Book Review Editor, and other members of the editorial committee, will work to further improve the quality of the *Quarterly*.

Over the past several years, we have realized that the quality control measures of our printer were not sufficient. Although the same printer had worked with us for almost 34 years, we knew that a change was needed. Dr. Lester will use a new printer and have access to their facilities which will greatly improve our control over the final product. With the support of our members, authors, and peer reviewers, we hope to continue to serve the Creator and promote the creation model of science through the publication of the *Creation Research Society Quarterly*.

Emmett L. Williams

A Quantitative Approach to Baraminology With Examples from the Catarrhine Primates

D. Ashley Robinson and David P. Cavanaugh*

Abstract

Quantitative methods for identifying holobaramins have yet to be introduced into the field of baraminology. In this report we examine some quantitative methods which may be applied to a variety of biological data to empirically estimate the identity of holobaramins. Organismal relationships are based on a measure of dissimilarity called baraminic distance. A set of diagnostic statistics is described that allows the researcher to assess the completeness, variation, resolving power, and associations within a data set. Bootstrapped dendrograms are constructed to identify clusters of organisms, which are subsequently evaluated for phylogenetic discontinuity by comparing baraminic distance

variation, and by correlating sets of baraminic distances. Using this approach both related monobaraminic groups and unrelated apobaraminic groups can be identified. The described methods are illustrated using data from humans and nonhuman primates, a group assumed by baraminologists to be polybaraminic. We have found that baraminic distances based on hemoglobin amino acid sequences, 12S-rRNA sequences, and chromosomal data were largely ineffective for identifying the Human holobaramin. Baraminic distances based on ecological and morphological characters, however, were quite reliable for distinguishing humans from nonhuman primates.

Introduction

The identification of specially created groups of organisms requires a panel of theoretically-defined membership criteria to detect phylogenetic discontinuity. Criteria such as the ability to hybridize are used to lump species into related monobaramins. In contrast, criteria such as morphological and paleontological gaps are used to split species into phylogenetically unrelated apobaramins. Successively refining the monobaraminic and apobaraminic boundaries converges on a taxon called the holobaramin. This unit is defined as a complete set of organisms related by common descent, and is an estimate of a created biological unit (ReMine, 1990; Wise, 1990; 1992; Robinson, 1997). In this paper we examine some multivariate statistical procedures, along with standard phenetic and cladistic procedures, and illustrate how these quantitative methods might be applied to baraminic membership criteria to detect phylogenetic discontinuity. The methods should also provide baraminologists with a tool for characterizing the relative performance of different membership criteria. The catarrhine primates have been selected for analysis because valid baraminic methodology must be capable of distinguishing between biologically similar yet phylogenetically distinct species such as humans and nonhuman primates.

Quantitative Baraminology

Phenetic and Cladistic Methodology Applied

Phenetics and cladistics represent the two major quantitative methodologies used in modern biosystematics. Wide interest in biosystematics earlier this century led to a reintroduction and extensive development of both disciplines. Michel Adanson, a creationist and contemporary of Linnaeus, is often credited for founding phenetic taxonomy, while Robert Sokal and Peter Sneath reintroduced it in the 1950s (Sokal and Sneath, 1963). Phenetics uses a measure of biological similarity, often summarized by a resemblance coefficient, as a basis for classification. Since phenetic methods classify by similarity only, they are not expected to generate evolutionary classifications (Sneath and Sokal, 1973). Baraminologists have also suggested that similarity alone does not necessarily imply ancestry (Wise, 1990). It would seem phenetic methods are thus intrinsically favorable to a typological view of nature (see Sokal, 1962).

In general, however, properly weighted similarity has been shown to be a reliable basis for inferring phylogenetic relationships (Mayr, 1969). Species that are highly similar are often related. Within the context of baraminology we would therefore expect that species highly dissimilar are often unrelated. We suggest that a number of baraminic membership criteria including the ecological, morphological, and molecular criteria can be examined quantitatively by measuring discontinuity in terms of dissimilarity.

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Received 27 January 1997; Revised 10 November 1997

Cladistic methods were thought to be first used by Plato (Panchen, 1992), and were introduced to biosystematics in 1950 by William Hennig (Hennig, 1950). This approach focuses on the branching patterns of individual characters, according to parsimony or compatibility considerations (Felsenstein, 1982), and generates an inherently evolutionary classification. Wise (1992) suggested that baraminologists utilize cladistic procedures to infer intraholobaraminic relationships. Cladistics further provides the best method for examining the homoplasy and synapomorphy membership criteria.

Phenetic and cladistic methodologies should be considered complementary. Phenetic techniques are ideal for detecting general biological gaps, whereas cladistic methods allows focus on specific character details. Although most of the methods described in this paper are phenetic, we have used cladistic methods to investigate the homoplasy criterion and to compare the hierarchical patterns generated by standard phenetic and cladistic clustering algorithms.

Selecting Organisms

In order to define the baraminology of a group of organisms it is necessary to identify both monobaraminic relationships uniting the group and apobaraminic divisions separating the group from other species. We recommend that taxonomy, or preferably a hypothesized phylogeny, be utilized as a guide for selecting organisms in studies of baraminology. Taxonomic and hypothesized monophyletic groups are most likely to contain all the members of a monobaraminic group.

The selection of outgroups is necessary to test for apobaraminic divisions separating the group of interest from the rest of the biota. Outgroups should represent the nearest taxonomic or hypothesized monophyletic neighbor to the group of interest. For example, if the group of interest formed a monobaraminic family, then it would be preferable to select members of the superfamily to which the family belonged as an outgroup. The discovery of a phylogenetic gap separating a monobaraminic family from its apobaraminic superfamily would fully resolve the holobaraminic identity of the family. In cases where the researcher discovers the outgroup is monobaraminic with the group of interest it would be necessary to select an additional outgroup, taxonomically more distant, and reconduct the analysis. The selection of similar outgroups also improves the comparability of a data set. For example, it would be unwarranted to select turtles as an outgroup for studies of primate baraminology because much of their biology is not comparable.

Selecting and Coding Characters

Holobaramins are defined polythetically because emphasis is placed on using multiple criteria for identification, as opposed to monothetic identification which uses a single criterion such as the ability to hybridize. With the exception of the Scriptural criterion no single data set is sufficient to

define the holobaramin. Moreover, it is not known which features of an organism are reliable for determining their baraminic affinity. During the development of baraminology it is therefore desirable to evaluate the performance of a wide variety of biological data for resolving baraminic relationships. Creation biologists have long theorized that specially created *min* contain a recognizable set of morphological, physiological, and genetic characters (Marsh, 1971; 1976). A representative sample of a species' biology is therefore expected to provide baraminically informative data.

Membership criteria as defined by ReMine (1990) and Wise (1990; 1992) refer to broad classes of evidence. We use the term criterion in that general sense, and use the conventional term character to represent the actual datum collected by an investigator. For example, body weight, mandibular shape, and the number of lumbar vertebrae are considered different characters of the morphological criterion. Biosystematic characters exist as discrete or continuous variables. Discrete variables with a finite number of character states such as present or absent are often used in biosystematic studies. Multistate characters such as tan, stripped, or spotted fur would also be categorized as discrete variables because the number of possible character states are limited. Discrete variables are coded by simply assigning a number to a particular character state. For example, the presence or absence of a tail can be coded as 1 and 0 respectively. Since the phenetic measure of resemblance used in this paper is based on the number of mismatched characters (described below), it is not necessary to code the data in a logically ordered manner. The magnitude of the difference between character state 1 and 0 is the same as the difference between state 1 and 8 since both are mismatches. The second type of character used in biosystematics are continuous variables. Such characters can theoretically occupy an infinite number of states such as 124.7 mm and 64.9 kg. Continuous variables are generally subject to clinal variation. For example, body size is a continuous variable that commonly differs according to an environmental gradient. In order to avoid error due to clinal variation it is important to obtain a representative sample of the character from different places on the gradient. Practical comparisons among continuous variables can be made when the data are re-coded as discrete variables. The present study employs Sturges' rule (Daniel, 1995) to assign continuous variables a limited number of character states based on the range of variation present in a character. The number of character states are calculated as:

$$K = 1 + 3.322 (\log n) \quad (1)$$

where n equals the number of values in the data set. The width of a character state is given as:

$$W = R/K \quad (2)$$

where R equals the range of the continuous variable (maximum value – minimum value).

It is ideal that characters selected for biosystematic studies represent statistically independent information. For ex-

ample, using both the presence or absence of folivory and the percent of foliage in the diet as different characters does not provide independent evidence of relationship because the latter is clearly dependent on the former. Baraminologists have reason to suspect that organisms are too well designed to consider many characters absolutely independent of each other. Note the analogies given in Scripture such as I Corinthians 12:12-26 suggest that no morphological characters within a given individual are absolutely independent. Moreover, passages such as Psalms 139:13, 15 suggest that the biological structures within an individual are knit or woven together by the Creator. The revealed fact that all individuals have ultimately originated from a common Creator further suggests some degree of dependence, albeit immeasurable in many cases, between the biological characters of all organisms. For example, human behavior resulting in environmental pollution can effect the ecology and even morphology of aquatic insects. Including correlated characters in biosystematic studies will accentuate the overall relationships implied by the characters. We believe all attempts to quantitate baraminic relationships between species will inherently suffer, in a statistical sense, from the inability to select absolutely independent characters for comparison.

The Coefficient of Baraminic Distance

The proportion of character mismatches is used as a basis for evaluating organismal relationships. The coefficient of baraminic distance is calculated as:

$$d_{ij} = \frac{m_{ij}}{n_{ij}} \quad (3)$$

where m is the number of mismatched characters between the i th and j th organism, and n is the number of compared characters. Characters that are not directly comparable between two organisms such as inapplicable and missing data should be excluded from the calculation. This equation is the complementary form of the simple matching coefficient introduced by Sokal and Michener (1958), and has been used successfully in numerous biological contexts.

As a coefficient, baraminic distance represents an estimate of a true biological distance (D_{ij}). The true distance would theoretically measure the deviation in the plan used by the Creator when originally designing specially created *min*. Biological variation caused by deterministic and stochastic processes, plus incomplete sampling of baraminically informative characters, would cause the coefficient to differ from the true distance.

Characters can be weighted during the calculation of baraminic distances. During the development of baraminology we recommend that all characters be given equal weight. In other words, all characters contribute 0 (match) or 1 (mismatch) to the baraminic distance numerator. Such a natural weighting scheme allows the data to dictate the classification (see Sneath and Sokal, 1973). In artificial weighting schemes the value of a desired weight substitutes for the

character mismatch. After it is learned which characters are more reliable for identifying holobaramins it might be advisable to give these characters greater weight. Such a *posteriori* weighting schemes are commonly used in biosystematics (Mayr, 1969). It should be noted, however, that when a large number of characters are analyzed phenetically, artificial weighting has little impact on the resulting classification unless the weights are extreme (Sneath and Sokal, 1973). An example of baraminic distance calculations has been provided in Figure 1.

Taxon	Character*				
	A	B	C	D	E
1	0	0	2	0	0
2	0	0	1	2	0
3	1	0	2	3	1
4	1	1	0	0	?
5	2	1	1	1	0

*Characters A, B, and C form criterion I;
Characters D and F form criterion II.

	1	2	3	4	5
1	-	2/5	3/5	3/4	4/5
2	0.400	-	4/5	4/4	3/5
3	0.600	0.800	-	3/4	5/5
4	0.750	1.000	0.750	-	3/4
5	0.800	0.600	1.000	0.750	-

	1	2	3	4	5
1	-	1.5/5	2/5	3/4	3.5/5
2	0.300	-	3/5	3.5/4	2.5/5
3	0.400	0.600	-	2.5/4	4/5
4	0.750	0.875	0.625	-	2.5/4
5	0.700	0.500	0.800	0.625	-

Figure 1. Example of the baraminic distance calculations. Panel A represents a hypothetical data matrix composed of taxon rows and character columns. Panel B depicts a pairwise baraminic distance matrix (lower diagonal) and mismatch matrix (upper diagonal). Artificially weighted baraminic distances, where criterion II is given half the weight of criterion I, are presented in Panel C.

Diagnostic Statistics

A set of statistics has been compiled to summarize the completeness, variation, resolving power, and associations within a given data set. As mentioned by Wise (1992) the accuracy of a baraminic hypothesis is dependent on the reliability of the data used to determine that relationship. Diagnostic statistics might therefore be useful in choosing between competing hypotheses that are based on data sets of different quality.

Character relevance (a) measures the completeness of a data set and is given as:

$$a_i = x/n \quad (4)$$

where x is the number of organisms to which character i is applicable, and n is the total number of organisms (Sneath and Sokal, 1973). Criterial relevance (A) represents the average of all a values for a given criterion. We recommend, rather arbitrarily, that a 95% or greater relevance be obtained in the combined data set since lower values are indicative of missing and/or inapplicable data.

Character diversity (c) measures the variation within a data set and is calculated as:

$$c = 1 - \sum x_i^2 \frac{n}{n-1} \quad (5)$$

where x is the frequency of the i th character state, n is the number of organisms, and $n/(n-1)$ is a correction for small samples (Selander et al., 1986). Criterial diversity (C) is calculated as the average of all c values for a given criterion. Character diversity is an estimate of the probability that two randomly selected organisms will have dissimilar character states for a given character, while criterial diversity estimates the probability of a mismatch using the average character of a criterion. The average baraminic distance (d_{avg}) offers an alternative method for measuring variation.

Baraminic signal (SI) is a chi-square statistic (Daniel, 1995) adapted here for use with character mismatch matrices. The statistic can be used to assess the resolving power of a data set and is calculated as:

$$SI = \sum \frac{(d_o - d_e)^2}{d_e} \quad (6)$$

The observed distance (d_o) is simply the number of pairwise mismatches (m_{ij}) between two organisms. Note that the number of mismatches between different pairs of species can be based on different numbers of total compared characters depending on the relevance of the data set. The expected distance (d_e) between each pair of organisms is obtained as the product of the marginal total of character mismatches (i.e. sum of the rows) for the i th and j th organism, divided by the total number of character mismatches (i.e. sum of row marginal sums) within the data set. Baraminic signal can be tested with a null hypothesis of homogeneity using $[(n^2 - n)/2] - 2n$ degrees of freedom, where n equals the number of species. The justification for the degrees of freedom are as follows: (1) Since one-half of a square symmetric distance matrix is redundant, $(n^2 - n)/2$ degrees of freedom are lost. (2) Since the diagonal of a distance matrix repre-

sents the distance from an organism to itself (i.e. zero distance), n degrees of freedom are lost. (3) Since the rows of the distance matrix are summed, n degrees of freedom are lost. Note that the column sums would equal the row sums and have been dropped from the calculation. The corresponding degrees of freedom are therefore not lost as would be the case in a normal contingency table. Species that represent a homogeneous group without statistically significant baraminic signal present exhibit similar baraminic distances and low chi-square values. Two or more groups of organisms well separated on the basis of baraminic distances display large chi-square values.

The Pearson product-moment correlation coefficient (r) (Daniel, 1995) can be used to investigate the associations between different criteria. Statistically significant positive correlations between baraminic distances calculated from different biological data sets suggest the data sets detect similar relationships. Correlations between ordered sets of pairwise baraminic distances calculated for each criteria are tested with a null hypothesis of no correlation. Since the pairs of a given distance matrix are not statistically independent, it is not strictly valid to estimate the significance of criterial correlation coefficients in a classical manner. Mantel (1967) provided a solution to this problem by comparing the cross-products of analogous cells in two matrices by the expected value calculated from random permutations. The Bonferroni correction calculated as $(0.05/n)$, where n equals the number of pairwise comparisons, was used to establish a probability level ($P.0009$ in this study) for rejecting the null hypothesis of no correlation (Douglas and Endler, 1982). An example of the diagnostic statistics calculations has been provided in Figure 2.

Identifying Baraminic Units

A protocol for identifying baraminic units is here proposed. The first step identifies subgroups of organisms using standard cluster analyses. Alternatively, taxonomy or a hypothesized phylogeny can be used to define subgroups for comparison. The second step evaluates the subgroups for phylogenetic discontinuity by comparing baraminic distance variation and correlating sets of baraminic distances. Baraminic distance variation analyses can involve intra-group versus intergroup comparisons and/or intragroup versus control group comparisons.

Cluster analysis has proven to be an especially useful multivariate method in systematics for hypothesizing the hierarchical arrangement of living creatures. Since a nested hierarchy can be constructed for any given collection of objects, a dendrogram does not necessarily imply its components are evolutionarily related. The fact that a creationist, Linnaeus, developed the current hierarchical system of biological classification indicates that macroevolutionary theory is unnecessary in biosystematics (ReMine, 1993), and that biological hierarchy is compatible with a creationist view of nature.

One caveat of inferring biological hierarchy from distances is that unequal rates of evolution can produce am-

biguous results (Felsenstein, 1982). We therefore utilize the neighbor-joining algorithm (Saitou and Nei, 1987), which generates a single most parsimonious tree free from the assumption that taxa have evolved at a constant rate. We recommend that bootstrapping (Felsenstein, 1985), a process whereby significant clusters of species are recovered after repeated randomization and reanalysis of the data, be utilized to place confidence limits on the branching patterns within a dendrogram. Since a bootstrap-supported cluster of species may often be divisible into numerous holobaramins, baraminologists must include an additional step of testing clusters for phylogenetic discontinuity. It is much simpler to assume all creatures are related, as macroevolutionists do, and disregard the challenges associated with defining phylogenetically isolated groups of organisms.

Comparisons of baraminic distance variation provides one method for detecting possible phylogenetic discontinuity. For groups yielding more than 30 comparisons, a standard confidence interval for a population mean (Daniel, 1995) can be constructed as:

$$d \pm z \frac{s}{\sqrt{n}} \quad (7)$$

where d equals the average baraminic distance of the group, z represents the desired reliability coefficient, s equals the standard deviation, and n denotes the number of comparisons. Comparisons of less than 30 should replace z with the corresponding critical value from the t distribution.

Two different types of baraminic distance variation analyses can be performed. One type of analysis compares intragroup with intergroup baraminic distance variation. Overlapping confidence intervals suggest the intragroup baraminic distance variation is not significantly different than the intergroup baraminic distance variation, and may indicate a monobaraminic relationship uniting the groups. A gap between the intragroup and intergroup confidence intervals indicates the range of baraminic distance variation is significantly different, which may support an apobaraminic division between the groups.

Baraminic distance variation can also be used to detect putative similarity thresholds. This type of analysis determines whether intragroup baraminic distance variation is greater or less than that occurring within a control group. Previous creationist work has suggested that one family within the Catarrhini, the Cercopithecidae or old world monkeys, form a basic type on the basis of hybridization (Hartwig-Scherer, 1993). If similarity thresholds exist within the Catarrhini, then the variation between humans and nonhuman primates (the control group) should be greater than the variation occurring within a related monobaraminic group such as the Cercopithecidae (the intragroup).

Baraminic units can be separately elucidated with a correlation analysis of the baraminic distances of each pair of organisms. Since this analysis is not a matrix-level comparison (as is the case for the criterial correlation analysis), the significance of Pearson product-moment correlation coefficients can be estimated in a classical manner with $n - 2$ degrees of freedom, where n equals the number of species.

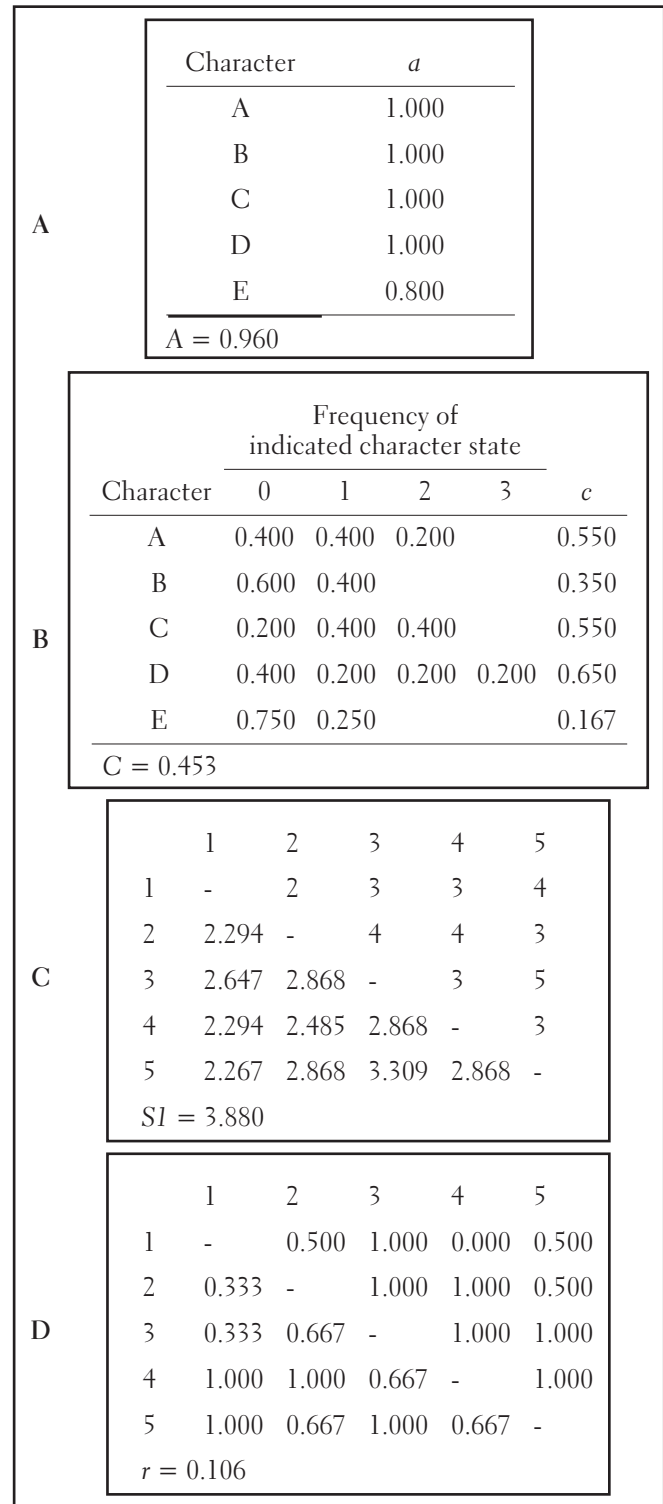


Figure 2. Example of the diagnostic statistics calculations using the unweighted data matrix of Figure 1. Panels A and B represent relevance and diversity calculations respectively. Panel C illustrates baraminic signal calculations with expected (lower diagonal) and observed (upper diagonal) character mismatches. Panel D provides a pairwise matrix of baraminic distances based on criterion I (lower diagonal) and criterion II (upper diagonal) with the corresponding product-moment correlation coefficient.

Positive correlations indicate the compared organisms share a similar set of distances that differ from other organisms by a similar magnitude. This condition may therefore be diagnostic of a monobaraminic relationship. In contrast, negative correlations indicate the compared species contain antithetical patterns of baraminic distances. Taxa similar to species X would be dissimilar to species Y and vice versa, which suggests species X and Y may be classified as apobaraminic. The baraminic relationship between organisms with uncorrelated baraminic distances is considered unresolved, but a monobaraminic affinity or apobaraminic discontinuity can be cautiously hypothesized with well supported trends.

Although correlations of baraminic distances can greatly aid holobaraminic identification, one caution is advised. The ability to define a positive or negative correlation is dependent on the species selected for analysis. By including and excluding various taxa the geometric relationships defined by their baraminic distances can change, the resolution and specificity of the analysis can be altered, the sign of the correlation coefficient can vary, and thus the baraminic classification of the organisms can differ. An example of the organismal correlation analysis can be seen in Figure 3.

Materials and Methods

We selected 204 characters (Appendix I) representing 11 species (Table I) within the Catarrhini infraorder. The complete data matrix is available upon request. A variety and quantity of biological data was selected with the intent of maximizing criterial relevance (A). Only polymorphic characters were included in the analysis because invariable attributes are not useful for distinguishing organisms. We categorized the data into four general criteria including ecological, morphological, chromosomal, and molecular char-

acters. Since Scriptures clearly imply that humans were specially created (Genesis 1:26-27, 2:7, 22), and thus phylogenetically distinct from other organisms, we utilize the human-nonhuman primate relationship as a control.

The CLUSTAL W program (Thompson, Higgins, and Gibson, 1994) was used to align the molecular sequence data. Calculations of baraminic distance, relevance, diversity, and signal were accomplished with a Macintosh computer program developed by the first author. The MANTEL 3.0 program of the R package (Legendre and Vaudor, 1991) was used to perform Mantel's test for estimating the significance of criterial correlations. The DATA DESK 3.0 statistical package (Odesta Corporation, Northbrook, Illinois) was used for the organismal correlation analyses. A neighbor-joining dendrogram (Saitou and Nei, 1987) based on baraminic distances was generated using the NEIGHBOR program of the PHYLIP 3.54 computer package (Felsenstein, 1989). The PAUP 3.1.1 computer program (Swofford, 1993) was used for the cladistic analysis. All characters were unordered and unweighted. A 50% majority rule consensus tree was constructed using the heuristic search option, random addition of taxa, MAXTREES set to 100, and TBR branch swapping parameters. Both the phenetic and cladistic dendrograms were statistically evaluated with 200 bootstrap iterations.

Results

Evaluation of Criteria

The combined data set was applicable to an average of 95.5% of the species (Table II). The more relevant criteria tended to contain more characters. For example, there was little missing data among the 139 molecular characters, whereas the 18 ecological characters were only applicable among an average of 78.8% of the organisms. Species differed on average among 43.9% of their characters with a 34.8% probability of a mismatch at the average character. The more diverse criteria tended to contain the least number of characters and vice versa, which may suggest the data most often collected was simple rather than complex variables. The probability of a mismatch between two organisms ranged from 62.7% when comparing the four chro-

Table I. List of species included in this study.

Taxon	Common Name	Code
Infraorder Catarrhini		
Superfamily Cercopithecoidea		
Family Cercopithecidae		
<i>Macaca mulatta</i>	macaque	Mmu
<i>Cercocebus torquatus</i>	mangabey	Cto
<i>Papio cynocephalus</i>	baboon	Pcy
<i>Mandrillus sphinx</i>	mandrill	Msp
<i>Cercopithecus aethiops</i>	green monkey	Cae
Superfamily Hominoidea		
Family Hylobatidae		
<i>Hylobates lar</i>	gibbon	Hla
Family Pongidae		
<i>Pongo pygmaeus</i>	orangutan	Ppy
<i>Pan paniscus</i>	pygmy chimpanzee	Ppa
<i>Pan troglodytes</i>	chimpanzee	Ptr
<i>Gorilla gorilla</i>	gorilla	Ggo
Family Hominidae		
<i>Homo sapiens</i>	human	Hsa

Table II. Summary of data used to characterize the catarrhine primates.

Criteria	No. of Characters	Diagnostic Statistics			
		A	C	d_{avg}	SI
Combined	204	0.955	0.348	0.439	743.471**
Ecological	18	0.788	0.465	0.514	60.276*
Morphological	43	0.915	0.419	0.505	262.172**
Chromosomal	4	0.886	0.627	0.715	25.105
Molecular	139	0.990	0.303	0.404	548.333**

* $P < 0.005$

** $P < 0.0005$

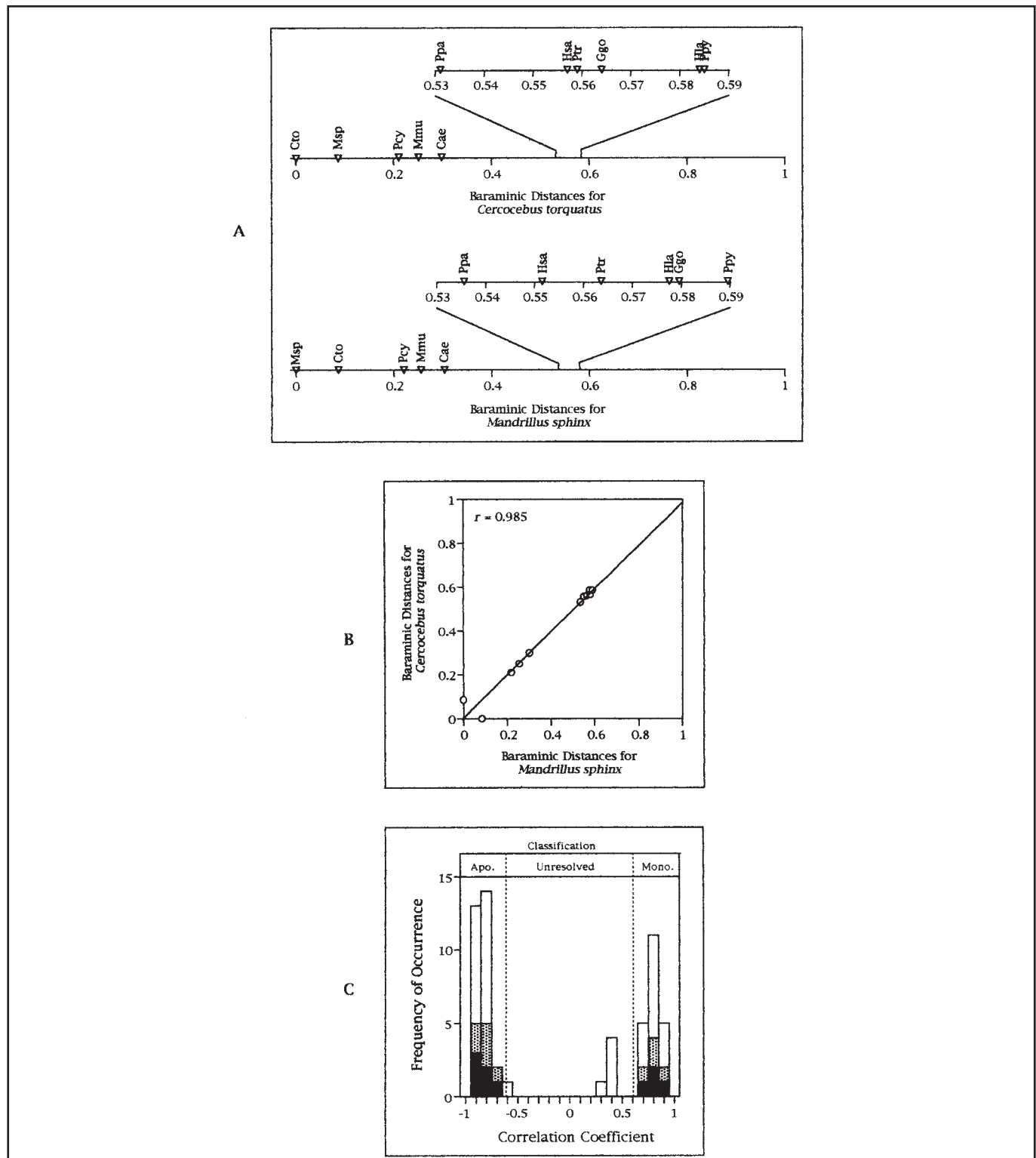


Figure 3. Example of the organismal correlation analysis. Panel A represents the baraminic distances of two cercopithecoid species with other catarrhine primates. Panel B illustrates the significant positive correlation between their baraminic distances. Panel C summarizes all baraminic distance correlations within the catarrhine primates. The dotted lines denote critical values for a 95% probability that the correlation is not zero. Black bars represent *Mandrillus sphinx* data, spotted bars denote *Cercopithecus torquatus* data, and white bars represent data for the remaining catarrhine primates. The two cercopithecoid species are positively correlated with the other cercopithecids confirming their monobaraminic relationship (Hartwig-Scherer, 1993), and negatively correlated with all other examined species suggesting an apobaraminic relationship.

mosomal characters to 30.3% when comparing the molecular data. The combined data set contained a highly significant ($P < 0.0005$) level of baraminic signal, which suggested a heterogeneous assemblage of organisms was sampled. Baraminic signal was also significantly present among the ecological, morphological, and molecular data. Note that criteria with only modest baraminic signal can be combined to increase the net signal. This is one justification for analyzing a composite data matrix (given that the characters are baraminically informative) and generating a systematic hypothesis based on the total evidence available. It should be further noted that an inverse relationship existed between criterial diversity and signal. Among the more diverse criteria it is possible that a larger number of character states resulted in an increased proportion of noise. The baraminic distances calculated from the morphological characters were significantly associated ($P < 0.0009$) with the distances calculated from ecological, chromosomal, and molecular characters (Table III). The ecological baraminic distances were also correlated with the chromosomal baraminic distances. These results demonstrate the nonindependence of widely different characters from phylogenetically distinct species such as humans and nonhuman primates.

Table III. Product-moment correlation matrix of baraminic distances calculated for each pair of criteria.

	Ecological	Morphological	Chromosomal	Molecular
Ecological	—			
Morphological	0.857*	—		
Chromosomal	0.429*	0.581*	—	
Molecular	0.391	0.603*	0.344	—

* $P < 0.0009$

Cluster Analyses

Congruence existed between the phenetic and cladistic dendrograms (Figure 4). The Cercopithecoid monobaramin was supported with 100% bootstrap support in both analyses. Furthermore, the relative branching order of the old world monkeys was stable in both analyses. Phenetic clustering algorithms such as the neighbor-joining method can therefore be as useful as cladistics for defining intraholobaraminic relationships. The gibbon was distinguished from the cercopithecids and pongids on both dendrograms. Within the pongids the only topological discrepancy related to the position of the orangutan. Note that only minimal bootstrap support separated humans from the pongids (Figure 4). Three groups corresponding to the cercopithecoid, hylobatid, and pongid clusters were selected for subsequent comparisons with the humans.

Baraminic Distance Variation Analyses

A pairwise matrix of baraminic distances has been compiled in Table IV. The distances ranged from 1.6% between

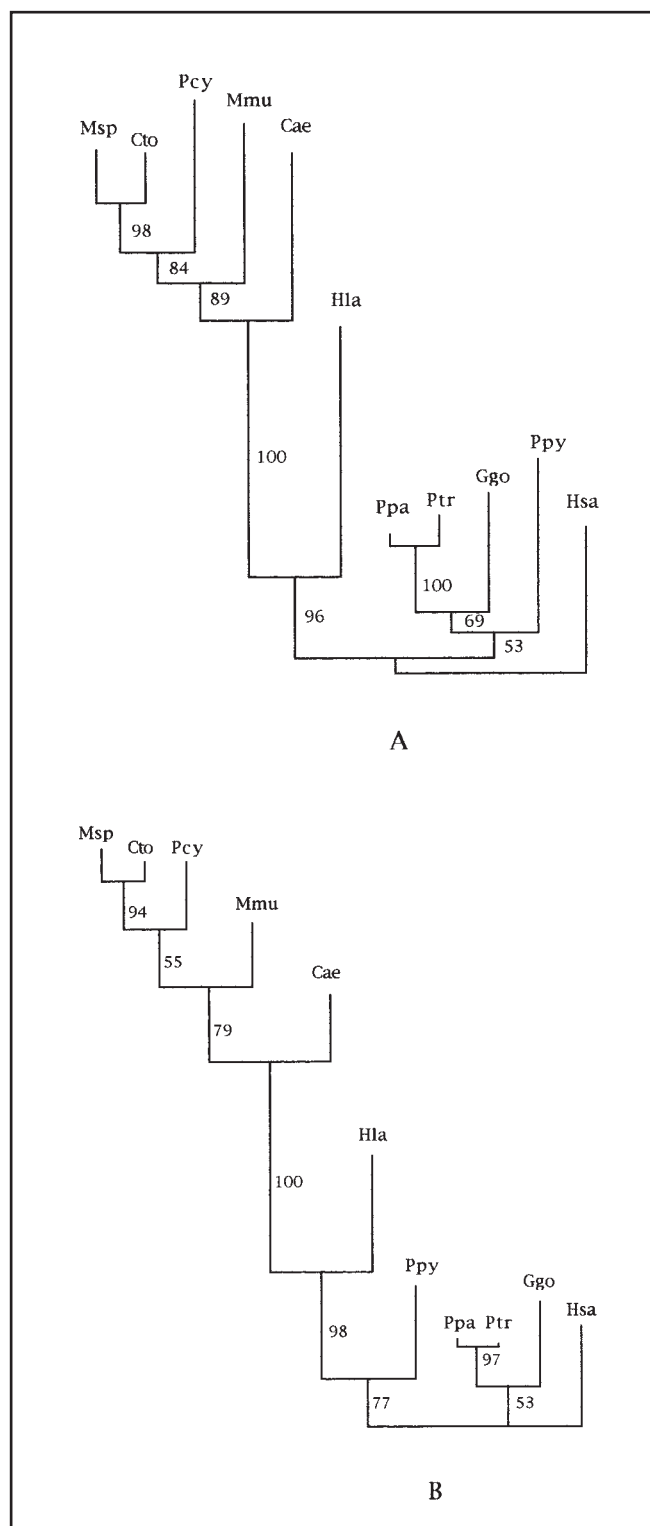


Figure 4. Outgroup-rooted neighbor-joining (A) and cladistic (B) dendrograms. Bootstrap values supporting branches with at least 50% confidence are presented.

the two chimpanzee species, to 63.6% between the gibbon and macaque. The average distance between humans and nonhuman primates was 43.3%. The combined data set was insensitive to a putative similarity threshold (an intragroup

Table IV. Baraminic distance matrix listing the proportion (lower diagonal) and number (upper diagonal) of character mismatches.

	Mmu	Cto	Pcy	Msp	Cae	Hia	Ppy	Ppa	Ptr	Ggo	Hsa
Mmu	–	47/188	53/189	48/188	58/193	119/187	125/202	99/186	114/202	123/202	114/192
Cto	0.25	–	39/186	16/187	56/188	101/173	110/188	95/179	105/188	106/188	102/183
Pcy	0.280	0.210	–	41/186	64/187	108/174	117/189	103/178	114/189	118/189	112/183
Msp	0.255	0.086	0.220	–	57/188	100/173	111/188	96/179	106/188	109/188	101/183
Cae	0.301	0.298	0.342	0.303	–	100/178	119/194	95/180	107/194	114/194	103/185
Hia	0.636	0.584	0.621	0.578	0.562	–	76/188	67/171	82/188	79/188	76/178
Ppy	0.619	0.585	0.619	0.590	0.613	0.404	–	41/187	52/204	53/204	64/194
Ppa	0.532	0.531	0.579	0.536	0.528	0.392	0.219	–	3/187	26/187	35/182
Ptr	0.564	0.559	0.603	0.564	0.552	0.436	0.255	0.016	–	38/204	44/194
Ggo	0.609	0.564	0.624	0.580	0.588	0.420	0.260	0.139	0.186	–	55/194
Hsa	0.594	0.557	0.612	0.552	0.557	0.427	0.330	0.192	0.227	0.284	–

versus control group comparison) since the range of baraminic distance variation between humans and pongids overlapped with that found in the Cercopithecoid monobaramin (Table V). For example, the average intracercopithecoid baraminic distance was 23.3% with a 95% confidence interval of 30.0% to 16.6%. The average human-pongoid baraminic distance was 25.8% with a 95% confidence interval of 35.5% to 16.1%. Since these intervals overlapped, the differences between humans and pongids did not differ significantly from that found within a monobaramin. Because the combined data set was influenced mainly by the molecular data, it was not surprising that the hemoglobin amino acid sequences and the 12S-rRNA sequences were also incapable of distinguishing humans on the basis of baraminic distance variation. The chromosomal data also failed to mark humans as distinct. A phyletic division between humans and nonhuman primates was, however, strongly supported by the variation in morphological and ecological baraminic distances. These criteria defined gaps in baraminic distances of 20.4% and 45.7% respectively (see Table V).

Organismal Correlation Analyses

Fifteen organismal correlation matrices have been summarized in Figure 5. Panels A-C reflect comparisons using the combined data set. With all catarrhines included in the

analysis (panel A) the majority of comparisons were either significantly positive or negative. A lack of resolution predominated when only the hominoidea (panel B) and pongidae (panel C) were included in the analysis. These data confirm the baraminic signal results that suggested greater resolving power was obtained from the larger data set. The specificity of the combined data set, however, was poor because humans were significantly and positively correlated with the pongids in panel A, suggesting an incorrect monobaraminic relationship. The same trends were observed with organismal correlations based on the chromosomal (panels J-L) and molecular (panels M-O) data. These results agree with the analyses of baraminic distance variation, which demonstrated the combined, chromosomal, and molecular data could not reliably distinguish humans from nonhuman primates. It is very encouraging to note that correlations of baraminic distances from ecological (panels D-F) and morphological (panels G-I) data provided adequate specificity for distinguishing the Human holobaramin. All ecological comparisons and 15/19 morphological comparisons yielded negative correlations between humans and nonhuman primates, suggesting a correct apobaraminic relationship. In summary, both the baraminic distance variation analyses and organismal correlation analyses confirmed the reliability of the ecological and morphological criteria for defining gaps between humans and nonhuman primates.

Table V. Comparisons of intragroup with control group baraminic distance variation.

Criteria	Average Baraminic Distance ($\pm 95\%$ C.I.) of Humans Versus			Cercopithecidae Only
	Cercopithecidae	Hylobatidae	Pongidae	
Combined	0.574 (0.607, 0.541)	0.427	0.258 (0.355, 0.161)	0.233 (0.300, 0.166)
Ecological	0.745 (0.802, 0.688)	0.800	0.767 (0.935, 0.599)	0.096 (0.142, 0.050)
Morphological	0.755 (0.779, 0.731)	0.707	0.628 (0.951, 0.305)	0.058 (0.101, 0.015)
Chromosomal	0.900 (1.000, 0.622)	1.000	0.750 (1.000, 0.291)	0.364 (0.703, 0.025)
Molecular	0.512 (0.552, 0.472)	0.290	0.108 (0.192, 0.024)	0.285 (0.364, 0.206)
n	5	1	4	11

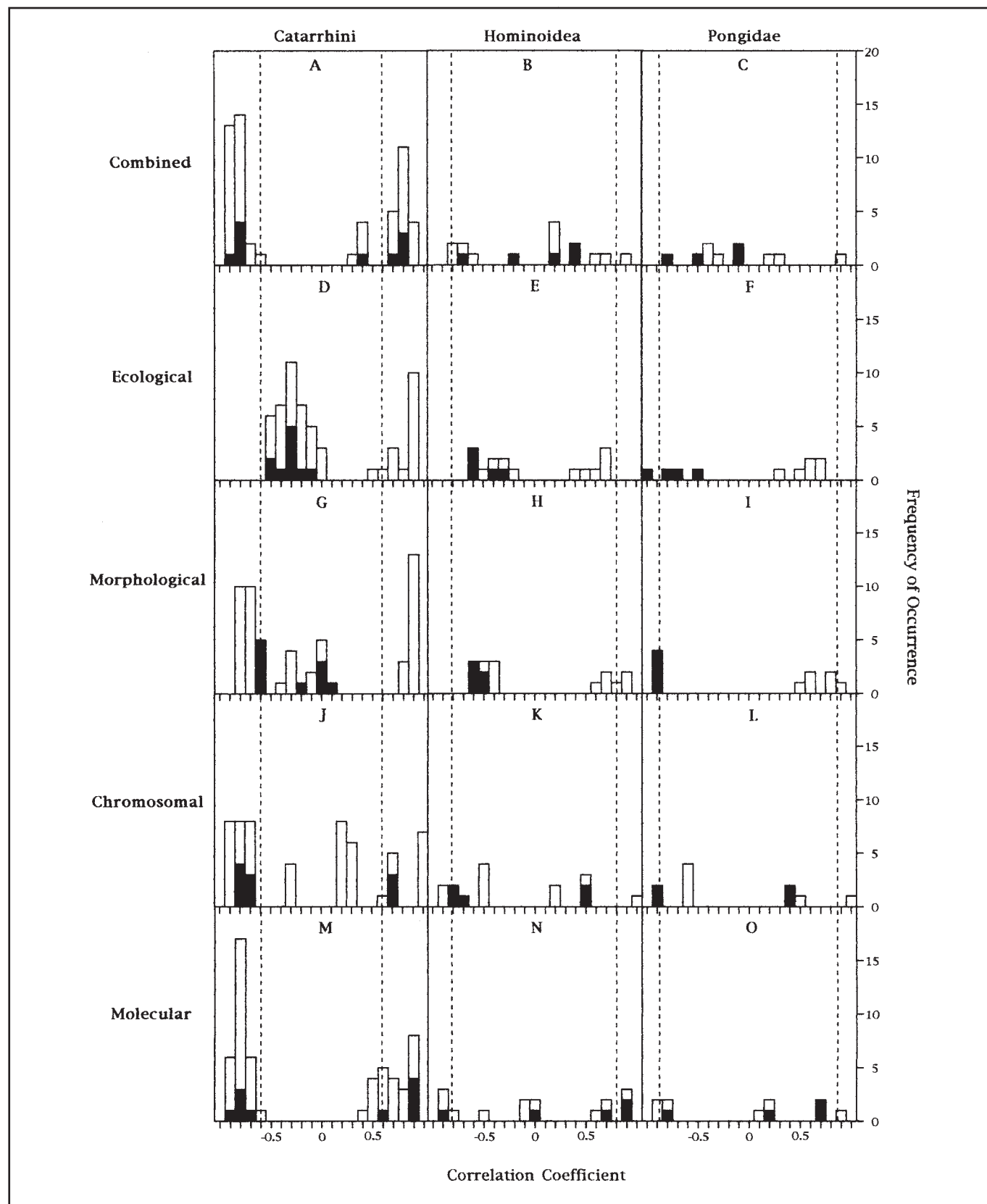


Figure 5. Exhaustive summary of the organismal correlation analyses based on different groups of taxa and different data sets. The dotted lines represent critical values for a 95% probability that the correlation is not zero. Black bars denote humans-nonhuman primate comparisons, and white bars represent comparisons among nonhuman primates.

Evaluation of the Homoplasy Criterion

Homoplasies are readily identified as characters that occur in disjoint branches of a cladogram. We utilize the homoplasy index, which measures the goodness-of-fit of a data set to a cladogram, to quantitate and compare homoplasy. The index is calculated as:

$$H.I. = 1 - \frac{(S-C)}{L} \quad (8)$$

where S equals the total number of character states, C equals the number of characters, and L equals the cladogram length. The homoplasy index is the complementary form of the consistency index (Kluge and Farris, 1969), and is scaled from 0 to 1 in order of increasing homoplasy. Bias resulting from a direct relationship between the index and the cladogram length can limit its utility in comparative studies (see Archie, 1989 and Farris, 1989 but also De Queiroz and Wimberge, 1993).

In evolutionary theory similar selective pressures are often suggested to be the driving force that leads to homoplasy. Another explanation for homoplasy offered by Scherer (1993) suggests that scattering characters from a complex ancestor via the capacity for interspecific hybridization might result in a mosaic network of characters. Lammerts and Howe (1974) have also implicated hybridization as a mechanism for propagating diversity within the created kind. According to these hypotheses, large numbers of homoplasies within a holobaramin may be indicative of frequent gene flow. It should be noted that homoplasy could also be the result of errors in data collection or cladogram construction, or it could be due to the expression of latent genetic information in disjoint lineages. Since members of different holobaramins are not expected to be reproductively compatible, homoplasy between holobaramins would highlight the baraminically uninformative characters. Such attributes could have originated by the activity of a common Creator, but could also represent an interholobaraminic transfer of genetic information via an unknown vector.

The majority of homoplasies in the present survey were found within the molecular data set (Table VI), which confirmed the baraminic distance variation and organismal correlation data that suggested the hemoglobin and 12S-rRNA data was largely baraminically uninformative. Within the Cercopithecidae only molecular characters were homoplasious. This result was somewhat surprising. Since many of the cercopithecids are known to hybridize (Hartwig-Scherer, 1993), we might have expected a larger amount of homoplasy within this group. The ecological and morphological characters exhibited comparable levels of homoplasy as found in other studies (De Queiroz & Wimberge, 1993).

Note that homoplasies can exist within monobaraminic groups (Robinson, 1997). The molecular criterion actually demonstrated more homoplasy within the Cercopithecidae monobaramin, than the ecological and chromosomal criteria exhibited within the Catarrhini apobaramin (Table VI). The number of homoplasies between any given pair of spe-

Table VI. Comparisons of homoplasy within the Catarrhini apobaramin and Cercopithecidae monobaramin.

Criteria	Catarrhini		Cercopithecidae	
	Length	H.I.	Length	H.I.
Combined	380	0.208	128	0.125
Ecological	49	0.143	7	0.000
Morphological	92	0.130	7	0.000
Chromosomal	13	0.000	3	0.000
Molecular	234	0.291	118	0.195

Note: Length refers to the total number of character changes required by the indicated cladogram, and H.I. is an abbreviation for the homoplasy index. The cercopithecidae values were obtained by pruning all other taxa from the cladograms.

cies was roughly proportional to their baraminic distance (Figure 6). The highest frequency of homoplasy occurred between cercopithecoids and hominoids, which were the most divergent taxa. Humans exhibited morphological and molecular homoplasies with the Cercopithecidae and Hylobatidae, but no homoplasies with the Pongidae. In order for homoplasy to have been a reliable indicator of baraminic relationships, it would have been desirable to see a spike in homoplasy frequency between humans and pongids. We therefore recommend that the homoplasy criterion be examined in greater detail before using it to identify baraminic units.

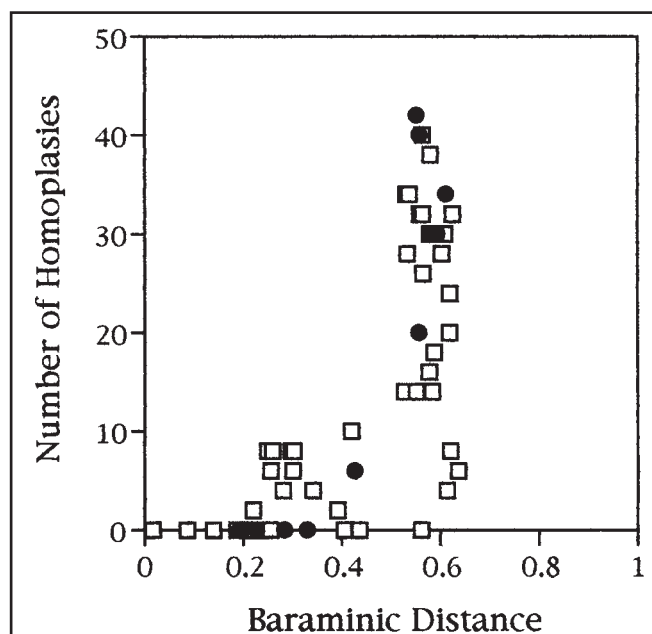


Figure 6. Plot of pairwise baraminic distances versus the number of pairwise homoplasies detected in the cladistic analysis. Black circles denote human-nonhuman primate comparisons, and white squares represent comparisons among nonhuman primates.

Discussion

Character selection, not the method of analysis, is expected to be the primary factor affecting baraminic hypotheses. False conclusions can be reached unless baraminically informative data has been sampled. Since we have no *a priori* knowledge regarding which characters are more reliable for identifying holobaramins, it is important to evaluate the reliability of a wide variety of biological data for inferring baraminic relationships.

New insight into the value of different criteria has been provided by quantitative phenetic and cladistic testing of the Catarrhine primates. Investigations of the molecular criterion questioned the use of hemoglobin amino acid sequences and 12S-rRNA sequences for identifying holobaramins. Although these data readily distinguished humans from cercopithecids they did not efficiently distinguish humans from other hominoids. The variation in hemoglobin amino acid sequences may be simply too limited to provide adequate specificity in baraminic studies. Variation in 12S-rRNA sequences are also limited possibly because of functional constraints (consider that 12S-rRNA must interact properly with DNA, RNA, and protein to form a functional ribosome).

Robinson (1997) demonstrated that the sequence variation among six mitochondrial tRNA genes between humans and chimpanzees was within the range of variation of monobaraminic turtles. Since appreciable levels of variation in hemoglobin, 12S-rRNA, and tRNA sequences may occur at taxonomic levels higher than the holobaramin, we recommend caution in using these specific molecules to identify baraminic units. In contrast, protein-coding genes such as cytochrome *b* seem to provide adequate specificity for identifying baraminic units (Robinson, 1997; Robinson and Cavanaugh, 1997). The chromosomal criterion was of limited utility in this survey possibly because too few characters were sampled. Consequently, baraminic distances calculated from criteria composed of only a few characters should be interpreted with caution.

Jones (1982) and Wise (1992) encouraged the use of ecological data in baraminic studies. Robinson (1997) questioned the specificity of the ecological and trophic criteria because a variety of habitats and trophic categories were found among monobaraminic turtles. The present survey demonstrated that the baraminic distances calculated from several ecological characters provided some of the strongest evidence for discontinuity. These data highlight the importance of using numerous characters to represent a criterion. No single character should be expected to identify a holobaramin.

The morphological criterion provided another reliable data set for defining discontinuity. It is interesting to note that the ecological and morphological criteria were the most adept at distinguishing humans and the most highly correlated, indicating that the data sets in strongest agreement were the most reliable.

Appendix I

Ecological characters: gestation length, weaning age, length of estrous cycle, female age at first breeding, male and female age at sexual maturity, lifespan, interbirth interval, arboreal and terrestrial habitats, folioivory, single and multiple male breeding groups, monogamy, population group size and density, percent foliage in diet, home range size (Clutton-Brock and Harvey, 1979; Harvey and Clutton-Brock, 1985)

Morphological characters: male and female body weight, neonatal body weight, adult and neonatal brain weight, incisor crown compressed, mesial groove and sexual dimorphism of canines, premolar compressed and single cusp, two cusps, hypoconulid, buccal cingulum, talonid, third molar size and width, hypocone, lingual cingulum, protoconule, second molar size, mandibular depth and shape, choanal shape, inter-orbital distance, length of ulnar olecranon, ulnar-carpal articulation, astragalo-calcaneal joint, tail, number of lumbar, sacral, and caudal vertebrae, arm-trunk, leg-trunk, appearance and ontogeny of ischial callosities, foot-free hind limb, tarsus-foot, longest metatarsal-foot, longest free toe-foot, hallucal-foot, hallucal-third radius, axony (Ankel, 1972; Delson and Andrews, 1975; Lessertisseur and Jouffroy, 1975; Harvey and Clutton-Brock, 1985)

Chromosomal characters: diploid number, number of submetacentric and acrocentric chromosomes, Y chromosome morphology (Chiarelli, 1975)

Molecular characters: 25 polymorphic sites for the alpha and beta chains of hemoglobin, 114 polymorphic sites for 12S-rRNA (GenBank/EMBL accession numbers: P01925, P02026, P01933, P02031, P01931, P02030, P02028, P01926, P02025, P06635, P01923, P02024, P01922, P02023, 360949, 360950, 223012, L35203, L35204, L35184, L35196, L35207, L35201, L35209, D38115, X99256, X93340, V00710)

Acknowledgements

We thank Dr. Kurt P. Wise for critical reading of an earlier manuscript, and Dr. Eugene F. Chaffin for editorial remarks. We also thank Todd C. Wood, Walter J. ReMine, and Dr. Frank Maas for helpful comments during various stages of the development of this paper.

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Diet, Health and Evolution

Jerry Bergman*

Abstract

Evidence is accumulating that food is critically important medicine and that the wrong diet is the major cause of death in the western world. This paper reviews the empirical research on nutrition. The conclusion is that a Biblical diet high in fruits, vegetables, grains, nuts and low in fat and red meat is critical for good health. Historically, physicians have tended to downgrade the importance of diet in health, an attitude which began changing with the discovery that vitamin C could cure scurvy and vitamin B₁ supplements could cure beriberi.

Nutrition is now seen as so critically important that it is often a major adjunct in the curing of disease and is recognized as critically important in the prevention of disease. The high level of compatibility between the food made by plants and the nutritional needs of humans is discussed from both the creationist's and evolutionist's standpoint. It is concluded that the creationists' explanation, that vegetables with grains and fruits and nuts were specifically designed for human consumption, fits the evidence better than the evolutionary assumption.

Introduction

Modern nutrition research supports the conclusions expressed by the cliché "You are what you eat." The major philosophy behind this conclusion is based primarily upon the foundations of creationism. The diet preference for "natural" food—that food without excess amounts of certain "artificial" additives especially fat, salt and destructive processing—implies that what is natural is often healthier (Guthrie and Picciano, 1995; Davis, 1954). Conversely, many assume that most human efforts to improve food by processing and adding various chemicals or altering the natural growing conditions of food are probably undesirable in the long run.

In short, it is believed that "nature knows best"—and even *with all of our knowledge*, we will more often than not in the long run hurt the situation until we fully understand the biochemistry of food and the body (Shepard, 1984; Commoner, 1971). The controversies over the use of hormones to cause cows to produce more milk and use of radiation to control food bacteria are excellent examples (Fox, 1992). Why is it commonly believed that "nature knows best," meaning what is natural is often better than highly processed food?

A major impetus behind the modern nutrition movement that began in the middle 1800s was the Seventh-day Adventist Church (Bergman, 1995). The concern of the movement was to return to primitive Christianity, and in or-

der to do so, its leaders embarked on a program of extensive Bible study. It was felt that the Scriptures provided a guide not only for moral conduct but also in other areas of life as well, especially in health matters. The scriptures, especially the Old Testament, were scoured for advice and wisdom relative to health and diet. This study revealed that God made certain vegetables, fruits, grains, and nuts for human consumption, and reluctantly permitted humans to eat meat—but this permission forbade the ingestion of fat (Lev 3: 17, 7: 23).

Toward this end, diets were developed which were semi-vegetarian, and avoided high consumption of meat, especially red meat, and stimulants such as caffeine, tobacco and alcohol. Groups such as the Seventh-day Adventists relied

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on this diet for years, and it was eventually determined that persons on these diets had disease rates that were much lower than the general population, especially for heart disease and many kinds of cancers.

Adventists were also deeply involved in medical training and founded numerous hospitals and medical colleges. It was natural that they would study their own health compared to that of others, and it soon became apparent that these diets had a dramatic effect on longevity, adding as much as 20 years, far more than could be accounted for by random factors.

This movement eventually spread to the secular health

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Received 17 August 1996; Revised 15 July 1997

field where it was empirically vindicated. It is now generally recognized by secular physicians that many major scientific dietary guidelines were first developed by religious movements founded in the 1800s. Medical science has largely vindicated many of the general principles that were outlined especially in the Old Testament. Almost 3,000 scientific studies have since demonstrated that a diet low in fat, red meat, alcohol, abstinence of smoking and high amounts of vegetables and fiber effectively helped to prevent cancer, heart disease, and numerous other diseases (Nestle, Housman and Hurley, 1989; Koop 1988). A basic guideline followed by these religious movements was that our Creator knew which diet was best and outlined it in the Old Testament for our benefit. Of course, the Old Testament also includes dietary provisions related to religious principles apart from health, and it requires some knowledge of the Scriptures in order to separate these (Bergman, 1995).

Specifically, Genesis 1:29-30 and 2: 16-17 gives humans permission to eat “all vegetarian bearing seeds...and every tree on which there is the fruit bearing seeds.” This category includes cereals (Genesis 43: 31-32) vegetables (Genesis 25:34), fruits and nuts (Deuteronomy 8:8, Joel 1: 12, Haggai 2: 19, Genesis 43: 11, Jeremiah 1: 11, Isaiah 25:6), spices and honey (Matthew 23:23, 13:31; Luke 11:42) and various beverages (Isaiah 17: 18, John 2: 9-10). No evidence exists that humans ate any type of meat including that from pigs, cows or fowl until after the Flood (Genesis 9: 3-4). The primary diet in ancient Israel consisted of wheat, seeds, onions, melons, apples, barley, radishes, dates, honey, garlic, lentils, corn, buckwheat, millet, oats, rice, apricots, berries, cherries, currants, grapes, pears, oranges, pomegranates, cabbage, broccoli, kale, cauliflower, lettuce, spinach, turnips and other greens (Edmonds, 1992).

Much has been written about the Biblical reasons and history of eating meat. Usually the argument is that health had deteriorated so much because of the human fallen state that a proper amount of protein and nutrients could be obtained only by supplementing the diet with meat. Nonetheless, the common people ordinarily did not eat much meat and it was historically, at best, considered a condiment or a for special occasions by most people (Tannahill, 1973, p. 62, 71-72, 86). Throughout most of Asia and the Middle East, meat is still considered a condiment to be sprinkled on food to flavor it and not as a major part of the meal. In summary of the Biblical diet, Edmonds said:

In Biblical times, people... had no microwave ovens, no canned foods, no frozen dinners, But... they survived—and thrived—on tasty, nourishing food. And they did it by following the dietary and health guidelines set down in the Bible itself! The first three chapters of the Book of Genesis outline a clear, timeless set of rules for eating, drinking and generally healthful liv-

ing. Modern nutritionists are now finding to their astonishment that the Biblical prophets who recorded these rules were way ahead of their time. Today’s scientists, for example, only recently began learning the extreme importance of low-fat eating. Studies in the past 20 years showed that the human physiology works best when fueled by lots of fiber and little fat. The way to get those ideal nutritional elements is to favor plant foods — fruits, vegetables and grains — over animal foods, such as meats, cheeses and other dairy products. During the 1980s, all the major health and medical organizations in the United States adopted low-fat, high-fiber dietary guidelines. But the Bible made those same recommendations some 4,000 years ago! (1992, pp. 2-3.)

The Evolutionary View

Evolutionary naturalism typically assumes that multi-millions of years of biological evolution will evolve (or develop) a structure that works to maximize an organism’s own

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survival. The fittest of the population is most likely to survive each generation and thus can beget the next. The advantages that the survivors possess will tend to accumulate until the “most fit” organism evolves, the one which is best adapted to its surrounding environment. In this view, a “natural” vitamin may be better than an “artificial” one, because it is assumed a mixture of chemicals has evolved which maximizes the animals’ survival to the end of their fertile age and also maximizes their offspring number.

In this view, the “natural” vitamin would meet the needs of the plant or animal that synthesizes it but not necessarily the needs of humans. Intelligence could produce a better compound than the random variations favored by natural selection. We have much to learn about the world around us. Even if we knew all there is to know, scientists could almost always produce at least evolution’s equal, and most often a compound better than that produced by blind natural selection.

The conclusions of nutrition research do not support evolutionary naturalism because natural selection will at best produce *only* that mixture and proportion of life chemicals which helps a specific plant or animal adapt to its own individual *local* environment. Further, as the environment is always changing, what works now may not be effective in the future. Consequently, the compounds that would evolve would be best *only* for the biochemistry of the plant

that evolved it—not necessarily its predators such as humans. Evolution selects for that which is most beneficial for the animal itself, not other living things, and *only* that which facilitates *survival* to the end of the animal's reproductive stage of life (Bergman, 1993).

For this reason thousands of differences in the biochemistry of living things would have evolved to maximize the survival of each individual plant or animal. This, though, is not what is found. All living things without exception are based on one basic plan and design—about 20 amino acids, carbohydrates, fats, and a small amount of vitamins, and minerals. And the nutritional needs of all animals are remarkably similar.

Further, evolution's driving force promotes a higher level of reproduction and survival *only* as they relate to reproduction rates and not to health, freedom from pain, physical enjoyment of activities, or longevity far beyond the reproductive years. In many societies, humans often live 40 or 50 years beyond their fertile life stage. Only creationism can explain these facts. Evolution theorists have attempted to deal with this problem by arguing that humans have co-evolved with plants and animals, a view that deals poorly with the above concern. The major objection to co-evolution is that, although clear evidence for diet changes exists, no evidence exists for the macroevolution of food biochemistry—it is the same today as it has been throughout history as verified by studies of insects sealed in amber and animals frozen at the poles (Tannahill, 1973).

The Creation Perspective

The health food movement often concludes that anything “natural,” especially related to food, is generally better because of the implied belief that, even though produced by the plant, it is *designed* to be consumed by humans and is for this reason best for our health (Brennan, 1975). The “nature knows best” conclusion implies that we can *attempt* to improve on nature, but our knowledge is presently, and may always be, inferior to that of nature's Designer (see Commoner, 1971). Any attempt to improve on nature often results in causing more harm than good until the complex biochemistry involved is understood.

Creationists conclude that natural foods are better because they are *designed* to be food for humans. The balance and type of nutrients and the specific chemical formations in them are likely *better* for us than that which we ourselves manufacture. This may even be true for some compounds for which a difference exists between natural and artificial, such as many “natural” and “artificial” vitamins. The man-made compound is, at best, a copy of the original; and the genius is in the design of the original, not in its copy. Some people fear that certain artificial vitamins may *not* be identical to those produced naturally; even with a successful copy, a natural compound's chemical formula

may have a different 3-D structure, called a isomer or isomorph of the compound.

Many people prefer not to take the risk and would rather rely on natural foods. Fresh fruits and vegetables contain large amounts of vitamins A, C and E and other antioxidants, but artificial vitamins may cause health damage by releasing free-radicals in the body. Free radical damage has been implicated in cancer, strokes, heart attacks and “normal” aging (Koop, 1988). Reducing free radical damage could, at the least, ameliorate these health problems. Consequently, foods can do much to fight aging and can reduce enormously the likelihood of cancer, heart attacks, and strokes (Koop, 1988; Merchand et al., 1989).

Plant chemicals that may fight cancer include compounds called *functional components*, part of a large class of naturally-produced plant compounds called *phytochemicals*. These include *flavonoids* in beans, *indoles* and *isothiocyanates* in broccoli, and *genistein* in soybeans (Schardt, 1994). Also important are *monoterpenes* in citrus fruits, and *saponines* in many vegetables and herbs (Napier, 1995, p. 12). Many scientists believe that most of our modern health problems are largely a result of our unnatural unbalanced diet and lifestyle (McNutt, 1995; Russell, 1980). The empirical research has repeatedly demonstrated that a diet high in fruits and vegetables significantly lowers the risk of cancer, heart disease and numerous other diseases (Williamson, 1996).

Although the vast majority of prepackaged and processed foods come from plants and animals, some are more a product of chemical laboratories than natural plant processes. An example is the trans-fatty acids formed in the manufacture of margarine from plant oils—the oils are polyunsaturated but the process of making margarine reverses this advantage somewhat. Even our attempts to supplement our diet with vitamin and mineral pills have sometimes proven ineffective, and at times harmful.

The very word “natural” on a food is now a major advertising slogan. Unfortunately, the health food movement includes many charlatans and uninformed but well-intentioned persons. Some stray too far from the empirical

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research and advocate unproven megavitamin or esoteric food supplements. These persons are not advocating a “natural” diet, but a human diet based on less than full knowledge of the biochemistry of the body and food. The best scientific recommendation is to eat real food instead of relying on supplements. If you just take supplements, you simply don't get all of the compounds in foods we're still learning about. We don't know yet if we should combine an indole with an isoflavone, or folic acid with selenium. Right now, only nature knows best (Napier, 1995, p. 12).

This belief in relying on food for health is also common in the ecology movement which teaches that human disruptions of the environment may cause much harm (Shepard, 1984). Experience has repeatedly proven the validity of this conclusion. Since God originally created the universe and everything in it as a unified and balanced system, He knows what is best for each part. Humans do not know what is best because they do not know nearly as much as the Creator does (Russell, 1980). Commoner, a leading environmental crusader, developed and researched what he calls the ecosystem's four laws of ecology. The first law states that everything is in some way related to everything else within the system (1971, p. 33). A pollutant, although it initially may enter just the air, eventually contaminates the water, soil, and animals as it slowly diffuses throughout the entire system.

Commoner's third law (1971, p. 41) is "nature knows best," and everything that humans do to the environment must be compensated for in some way. Alluding to Paley, Commoner (1971, p. 421) summarizes this law with, "the watchmaker knows best." As Shepard (1984, p. 380) stresses, it is "not nice to fool mother nature"—and actually impossible to do so because the global ecosystem is a connected whole in which nothing can be gained or lost, even if overall local improvement results, without affecting other parts. Anything extracted from it must be compensated for or replaced. Payment of this price cannot be avoided—only postponed (Commoner, 1971, p. 46). A major source of evolution is change—an altering of the ecological balance—a process which is at first often more destructive than constructive to life. Relative to this law, Shepard states, that,

While humans are busy 'improving' on nature, they are creating some hazardous side effects. We know, for example, that modern fertilizers increase crop yields, but also sometimes contaminate nearby water systems. Also, some areas of the world are turning into deserts as a result of over-cultivation. Each year an estimated 2 million acres of land is lost to cultivation in Africa, resulting in mass starvation (1984, p. 380).

The Food Mothers Provide Their Young

The best example of the superiority of natural food is the diet naturally provided for plant embryos in fruit and seeds, as well as the milk and the other food that mothers provide for their young. Extensive research has found that the proper balance of nutrients, including the nine essential amino acids, carbohydrates, essential fatty acids, vitamins and minerals are all present in the appropriate proportions in human breast milk (Russell, 1995). Human breast milk also contains hundreds of other less well understood food factors, many of which are turning out to have critical roles

in the infant's health (Newman, 1995).

Also in milk are antibodies that protect against pathogens and protein factors that can evidently stimulate antibody production to boost the baby's immune system (Riar, Carter, and Smith, 1995; Newman, 1995; Homer, 1994; Day et al., 1992). One study found that an iron-building protein in mother's milk called *lactoferrin* may play a major role in the infant's defense against infections and tumors. NYU biology professor Philip Furmanski showed that lactoferrin signals the immune system cells to become activated by entering them in order to activate their DNA (Koprowski and Gwynne, 1995, p. 13).

The intimate contact between the mother and child during nursing also allows the infant's antigens to pass into the mother, which in turn causes the mother to produce antibodies and immunoglobulins which in turn are passed on to the baby at later feedings. In this way, the mother's immune

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system works with the infant's to help insure maximum health for the baby. A study by Cunningham comparing breast-fed to bottle-fed infants found that breast-fed infants have less than *half* the number of ear infections, one fifth fewer respiratory illnesses, less than half of the diarrhea and vomiting problems, one third lower hospital admissions, and less than half the number of all illnesses (1977, pp. 721-729).

Interestingly, the composition of mother's milk changes both according to the infant's needs and according to the baby's developmental stage. Research has found that the milk types produced are so different that each is given a separate name. The early milk is termed *colostrum*, which is suited for the baby's first week outside of the womb. The transitional milk lasts from one to four weeks, and then the mature milk, which also changes in harmony with the baby's developmental needs, is produced. Other research has found that the milk concentrations change even between the early and late daily feedings (Russell, 1995).

Compounds also exist in breast milk to increase the bioavailability of the vitamins and minerals it contains. If the mother does not breast feed her child, many of these benefits are not available to the infant, or must be obtained from dietary supplements. Iron, zinc, and folic acid are examples of common supplements which must be added to the bottle-fed baby's diet because they are found in insufficient quantities in cow's milk.

The infant has a comparatively large caloric need due to the rapid growth that occurs from infancy into early childhood. Whole milk is an economical source of calories for infants and young children, but is not an ideal adult food because fifty percent of milk's caloric content is from lipids

(fat). Rapidly developing children need a high fat diet, but adults do not. Lipids contain about nine kilocalories per gram, but carbohydrates and proteins only four kilocalories per gram. This allows the infant to achieve its proper calorie intake in less than *half* the feeding time that would be required if its calories came from other sources.

Mother's milk also contains high lipase levels which break down the lipids so they are more bioavailable to the infant. Because lipases are enzymes, and as enzymes they tend to deteriorate quickly, the milk must be fresh—a clear advantage of breast feeding over bottled milk (Russell, 1995). Many other benefits of breast feeding for the mother have been well documented, including the psychosocial benefits of bonding, as well as some protection from breast cancer which is proportional to the amount of time that the mother breast feeds (Newcomb, et al., 1994, p. 81)

The Evolutionary Theory of Mother's Milk

Evolutionists try to explain the above by concluding that infants of mothers with milk compounds which confer health protections upon them would be more likely to survive to pass these traits on to their offspring. The problem with this explanation is that mother's milk would not confer an advantage *until* the entire process was perfected to the degree that the infant was more likely to survive. Also, the advantage of mother's milk compared to modern formula usually does not affect the child's ability to survive, but will help the child to avoid many of the long list of so called childhood illnesses.

Many of the advantages of using breast milk do not affect the *quantity*, but the *quality* of life. Secondly, all other factors being equal, evolution would select for organisms that gave birth to 20 children during a life time and lost 10, as opposed to an organism that gave birth to 14 children and lost two. Evolution selects for *offspring number* that can sire more offspring, and consequently the average number of offspring will be larger for superior animals that do not control their reproduction rate as do humans.

In other words, evolution theory would predict that the number of offspring would become greater and greater because the more fertile animals give birth to more offspring to pass on the trait that causes greater fertility. With billions of years of evolution selecting for offspring number, it is difficult to explain the fact that many modern mammals, such as pandas and others, give birth to only one offspring a season or less, and as few as one or two offspring during a reproductive lifetime.

Secondly, given the evolutionary assumption that humans evolved from a primate ancestor, this selection would not have applied to humans because humans have historically often controlled their number of offspring by both birth control and abortion (Noonan, 1970). Even in the Greco-Roman world abortion was common, and parents were free to commit infanticide or abandonment of their

children until Christianity dominated the empire (Noonan, 1970, p. 6) This practice largely negates the effect of many natural factors that tend to increase the offspring number.

Evolutionists can only speculate about an organism possessing some trait because of its survival advantage. Plants contain many anti-carcinogenic compounds. At present no confirmed evidence exists that they are of any benefit to the plant. This would be difficult to explain by natural selection if it is proven true. Plants are not susceptible to most cancers, hence these anti-carcinogenic agents appear to be beneficial only for humans and other organisms that utilize these compounds. Of course, it is quite possible that these anti-carcinogenic compounds will be found to have some benefit to the plants, but so far this does not seem to be the case.

The evolutionary hypothesis is clearly deficient because if evolution is a blind process, driven only by chance survival factors which are highly situational, no clearly "best" structure would exist. What would be produced are only organisms that can more successfully compete for a limited time—and never forever. An animal at best may function better than other organisms in a certain local specific environment, but only if conditions do not change beyond a certain point. Consequently, the unique set of chemical combinations found in fruit may be effective for that fruit at a given time in evolution, but are not necessarily the "best" food for humans—or even for the animals that thrive where the fruit grows. They would probably not contain the proper nutrients for any other living organisms—not even for humans, but may often be undigestible or even poisonous. In

The evolutionary hypothesis is clearly deficient because if evolution is a blind process, driven only by chance survival factors which are highly situational, no clearly "best" structure would exist.

short, according to evolution, citrus fruit evolved vitamin C only to enable the plant itself to survive, and not to be nutritious for other organisms such as humans and guinea pigs.

The health food movement, though, stresses that *most* natural foods, vitamins, etc. are good for *all* living things, but often only so long as they are "natural." Natural foods—fruits, vegetables, nuts and spices—were made by God for human consumption, and for this reason are to be preferred. God's words in Genesis convey this: "of every fruit in the garden you may eat." (Genesis 2:16). The evolutionary hypothesis allows that what is natural would be healthy for humans only by chance. On the other hand, the creationist orientation concludes that a balanced diet of natural food is almost always (or always) the most healthful for humans (a condition evolution theory would contradict).

The evolutionary orientation implies that intelligent human direction could drastically improve what is natural. Humans can certainly improve on the products of a blind, brutal survival of the fittest process propelled by chance, fortunate events, and the flow of natural law. Even the improvement of plants by breeding does not contradict this

because the plants still provide natural food, and are bred to *optimize* that which is natural. Nor does the fact that some plants produce poisons cause a problem in some situations because this fact can be fully explained by a creationist's world view (Bergman, 1995a).

The assumption that our bodies are "designed" a certain way, and therefore have certain needs which natural food is specifically designed to meet, provides the basis for such statements as:

Foods, by the grace of God and nature, have power to give you freedom from goiter, bronchitis or hay fever. Out of the kitchen can come meals to help you put an end—permanently—to stomach trouble, gall bladder complaints or liver disturbances. In foods, your doctor can find complex chemicals which will help you recover from [many diseases]...medicine capable of curing anemia within a few short weeks actually grows in the farmer's fields. In your vegetable dealer's bins are medicinal substances which, together with sunshine, will heal the softened bones of a baby with rickets. Milkmen bring you magic fluid which will help keep your children from developing pigeon chests, knock-knees, bowed legs and other such deformities...foods are medicines in the real and best sense of the word—true specifics (Lindlahr, 1972, p. 15-16).

The health food movement also stresses that many foods are medicines, which implies that our bodies are designed to grow up healthy and stay healthy only *if* the proper foods are consumed—those which are selected in the proper balance because they were *designed* to maximize our bodies' potential (Dobelis, 1986; Clark, 1965). Although not necessary, knowledge of their chemistry helps us to understand *why* these foods are helpful or necessary to human health. We must also discover *which* foods and *how much* of each are ideal to maximize our health potential (Lucas, 1992). Because a food is natural does not guarantee that it is healthful, but because relatively few plants are poisonous, most all plants are at least not harmful (Levy and Primack, 1984).

The medical profession is now far more accepting of the claims of the mainstream health food movement than just a decade ago (Nittler, 1972). Many doctors agree that food is in the long run the best healer and that all disease can at least partly be aggravated by a poor diet (Ginness, 1993). This field has exploded recently and is called the study of *nutraceuticals*. The nutraceutical movement and the trend to require doctors to complete course work in nutrition are both evidence of this. In the words of Weil:

In my four years at Harvard Medical School and one year of internship, I received a total of 30 minutes of nutritional instruction, grudgingly allocated to a dietitian to tell us about the special diets we could order for hospitalized patients. ...When I was in school, medical doctors were quick to brand as a quack anyone who argued that diet could be a risk factor for cancer. It is now generally accepted that high-fat, low-fiber diets,

especially those high in meat and low in vegetables, predispose people to cancer of the colon, breast, uterus, and prostate. Those who argued that vitamins had any benefits other than preventing deficiency diseases in "recommended daily allowances" also risked the charge of quackery, but we now find that beta-carotene, a precursor of vitamin A, has strong cancer-inhibiting effects, especially against lung and cervical cancer (1993, p. 12-13).

Over 3,000 major scientific studies have verified this conclusion. Note Napier's conclusion that "There's more to food than vitamins, minerals, fiber, calories, and protein ..." He adds that we are discovering a plethora of bioactive substances and that:

A previously hidden world of natural chemicals in edible plants is unfolding, and the more researchers learn, the more certain they are that mom was right: we should eat our vegetables, and lots of them. "There's an explosion of compelling and consistent data associating diets rich in fruits and vegetables with a lower cancer risk...." One analysis of data from 23 epidemiologic studies found that a diet rich in vegetables and grains slashed colon cancer risk by 40%.... All in all, at least 200 epidemiologic studies from around the world have found a link between a plant-rich diet and a lower risk for many types of tumors (1995, pp. 9-10).

These findings have inspired scientists to analyze fruits and vegetables in order to find out what they contain that

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may fight cancer. Many well known anti-cancer nutrients, including folic acid, selenium, and lycopene, which imparts a red color to fruits and tomatoes, have functions that include an ability to fight cancer and prevent strokes (Selhub et al., 1995). Lycopene is especially effective in fighting prostate cancer and cancers of the digestive tract. These compounds seem to "interact with every step in the cancer process, mostly slowing, stopping, or reversing them...." (Napier, 1995, p. 10) Most of these functional components appear to boost the production or activity of enzymes that act as *blocking agents*, detoxifying carcinogens or keeping them from reaching or penetrating cells.

Some function as *suppressing agents*, restraining malignant changes in cells that have previously been exposed to carcinogens. This evidence demonstrates that plants were designed not only to nourish us but also to heal us and help us stay healthy and free of disease (Watanabe et al., 1995; Fraser, 1994). Some of the many compounds which we now know to be anticarcinogenic and that are found in food, mostly vegetables and fruits, include the following.

1) *Indoles* and *isothiocyanates* are found in high levels in broccoli—and this is a reason for the high dietary level of broccoli recommendation. They fight cancer primarily by preventing cancer causing substances from reaching their

cellular targets, and they may also suppress tumor growth (Caragay, 1992; Conning, 1991; Wattenberg, 1990; Marchand et al., 1989).

2) *Saponin* family—a large group of glycosylated steroids found in many vegetables and herbs. They not only have anti-cancer activity but also help to lower the blood levels of certain lipids and help to recycle red blood cells (Yoshiki and Okubu, 1995; Amarowicz, Shimoyamada, and Okubo, 1994; Potter et al., 1993).

3) *Flavonoids* found in many fruits and vegetables function as antioxidants and block carcinogens from entering cells, to help suppress malignant changes in cells, and also to fight cancer by interfering with the binding of certain hormones to cells (Foti, Piatelli, Baratta, and Ruberto, 1996; Williamson, 1996; Summan, 1996).

4) *Isoflavones* act as antioxidants, carcinogen blockers and tumor suppressors (Foti et al., 1996). Studies have found that people with high levels of isoflavones, commonly found in soy beans, have a markedly lower level of breast and prostate cancer and oxidative damage (Wiseman, 1996). Some of the forms of isoflavones include genistein, biochanin, and daidzein.

5) *Lignans* are common in sesame and flax seeds, thus are found in linseed oils. They function as antioxidants and may block or suppress cancerous changes (Herman et al., 1995). Flax seeds are also high in omega-3 fatty acids which may protect against colon cancer and heart disease by acting to reduce the likelihood of excessive blood clotting. The tendency for blood to clot inappropriately comes from blood pooling for long periods of time in inactive persons or from cigarette smoke. The latter causes platelets to be sticky, facilitating clotting and causing many health problems. These include pulmonary embolisms, myocardial infarction (commonly called a heart attack), and cerebral ischemia (commonly termed a stroke).

6) *Monoterpenes* may act to interfere with the action of carcinogens and occurs naturally in citrus fruits and caraway seeds (Caragay, 1992).

7) *Organosulfur* compounds may act as cancer blocking or suppressing agents and are found in garlic, onions, leeks, and shallots (Caragay, 1992).

8) *Carotenoids* are potent cancer fighters and include a large number of compounds including beta-carotene (Herman et al., 1995; Caragay, 1992). They also may enhance normal communication among cells, which can help to prevent cancer cell development. Beta carotene is also evidently transformed into *retinoic acid*, which can help control the proto-oncogenes that are important in cancer development. Carotenoids are commonly found in fruits and vegetables, especially the red and yellow pigmented plants.

9) *Folate* or folic acid is a B vitamin important in fighting and preventing colon cancer and precancerous colon polyps. It is also important for normal tissue formation and maintaining the integrity of DNA. Critical for the formation of cell division, folic acid is one of the few recommended sup-

plements for pregnant and lactating women. Deficiency of either folate or vitamin B-12 causes diseases that include megaloblastic anemia. Another critical function of folic acid is to reduce the level of homocystine in the blood, important in reducing the likelihood of strokes and heart attacks (Marchand et al., 1989).

As noted, evolution cannot explain why plants manufacture many of these phytochemicals because many are evidently not needed for the plant, but are essential for the health of humans. This is also true of many medicines—over half of which have their source in plants. The latest example is Taxol, an anticancer compound and is the only known compound effective in treating certain types of cancer such as ovarian cancer. Taxol was obtained from the

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bark of the slow growing Pacific Yew tree until an artificial source was developed recently. The bark from about 4,000 trees was needed to produce a mere kilogram of Taxol, and the trees, although once common, are now rare. These facts were strong motivators to develop genetic or artificial sources. They are also evidence of design and a life system that is highly interdependent, as ecological research has now eloquently demonstrated.

Summary

A modern understanding of nutritional science has revealed that plants are designed specifically for human consumption and that health is best maintained on a balanced diet consisting of a wide variety of plant foods. Even many toxic plants have an important use (Bergman, 1995). The Biblical diet outline is an excellent starting point to begin to understand life's complex biochemical needs and to ensure that the approximately 50 nutrients now known to be necessary for health are consumed in the proper amounts. We also now realize that many past attempts to "improve" our diet or food enjoyment have failed or caused problems, not the least of which is the addition of huge amounts of salt and fat so typical of western diets today. For this reason, diet is the leading cause of death in Western nations (Koop, 1988).

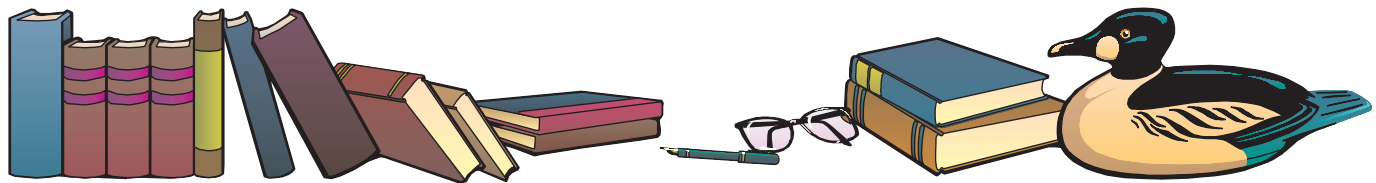
A complex of lipids is also necessary for a good diet. Although olive oil was a recommended staple of the Israelites, never before in history has the diet of a large number of people been so high in fat as in the western world today, especially saturated fat (olive oil is a monounsaturated fat, the best kind). The health food movement has attracted a wide variety of persons and has also expounded many extremes, fads, and foolish ideas, but some of its core ideas are based on the Scriptures and have proven correct. The U.S. Sur-

geon General's report reviewed about 3,000 major scientific studies and concluded the following: The best recommendation is 55 percent of calories should be from complex carbohydrates (grains and starches such as from potatoes), and each adult should consume an average of five to nine servings of fruits and vegetables daily. Avoid red meat and eat chicken or lean pork no more than once a week, and fish twice a week. Ideally, it should be a condiment and not a major part of the meal. Also, avoid processed foods because most are extremely high in fat, salt, and calories. For adults fat should be no more than 30 percent of all food calories, and many argue that the percentage of fat calories in our diet should be closer to 10 percent. It is now over 37 percent for the average American. A high fat diet is a major cause of many cancers, heart attacks, and strokes. Last, eat a diet high in fiber, low in sodium and sugar, do not smoke, maintain desirable weight and drink alcoholic beverages in moderation (Koop, 1988).

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Book Review

Noah's Ark: A Feasibility Study by John Woodmorappe
 Institute for Creation Research, Santee, CA. 1996. 306 pages. \$21.95.
 Reviewed by Eugene F. Chaffin*

Various anti-creationists, compromising evangelicals, and other critics attempt to discredit the Biblical account of Noah's Ark. John Woodmorappe does an admirable job of discussing the scientific issues often raised in these discussions: the manpower needed for the care of the animals aboard the Ark, space required for the proper environment and feedstuffs, decisions apropos for gathering and selecting the best specimens, criteria selected for codifying which kinds needed to be on the ark, and a wealth of other arguments needed for answering the critics. Readers should include persons seriously desiring to understand the scientific considerations behind the historical account of God's care of the Ark animals, utilizing Noah and family for many of the essential details. The book is directed at a high scientific level. The chapters on genetics are not written at an introductory level, but are directed towards persons who have mastered elementary biochemistry and genetics.

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The plan of attack chosen by the author is largely reactionary, in the following sense. The author repeatedly informs the reader of points made by critics who did not believe in the historicity of the story of the Ark, who did not believe that the Genesis Flood was worldwide, or who did not subscribe to other details of the Scriptural account. These critics often resort to ridicule, attempting to make believers appear foolish. Woodmorappe, however, invariably finds credible evidence which rather causes the critics to appear foolish. One begins to wonder whether the author should forget the critics and follow a plan of attack directed toward criteria for the management of the Ark. There is no point in discussing many of the ludicrous arguments of these parrots for the evolutionary establishment. However, another approach would be the subject of a future volume. In the present volume, Woodmorappe has pushed the level of discussion to a new height, and future critics will need to do better to retain their credibility.

Flood Geology Sheds Light on Unaweep Canyon Mystery

Michael Shaver*

Abstract

The topography of West Central Colorado provides challenges for historical geology. The scale of features necessitates a cataclysmic process in order to accommodate a young earth chronology. Implications for current creationist theories regarding the rapid formation of the Grand Can-

yon are described. Steam superposition at Unaweep Canyon is an area for creationist research. This involves issues regarding the incision of Unaweep Canyon into crystalline rock and the time of canyon formation. The author proposes multiple episodes of drainage of flood waters.

Introduction

Two erosion features differing by orders of magnitude are represented in Western Colorado. The larger feature is the Grand Valley and its extension, the Uncompahgre Valley, the basic structure of which is represented in Figure 1. The master valley has a width of ranging from 10 to 20 miles and lies at 4600 feet elevation above sea level at Grand Junction. Up the Colorado River 89 miles from Grand Junction the valley is narrower but elevations similar, with an adjacent flat-lying strata (the "Flat Tops") over 10,000 feet in elevation.

Adjacent to the Grand and Uncompahgre Valleys are broad, elevated flat-lying areas: Grand Mesa (a true mesa to the east of Grand Junction roughly 15 miles at over 10,000

feet elevation), the crest of the Uncompahgre Plateau, and the Roan Plateau north of this study area. The Colorado River leaves this broad valley near Fruita, but the valley remains broad as it opens into Central Utah, as illustrated in Figure 2.

Table I shows the gradual increase in elevation in the river system over many miles. Into this general topography are eroded numerous "smaller" canyons. Into the flanks of the Uncompahgre Plateau are canyons with depths of up to 700 feet. The most spectacular are those for which the Colorado National Monument was named a park. Other canyons are etched into the flank of the plateau through the 80 mile length of the plateau.

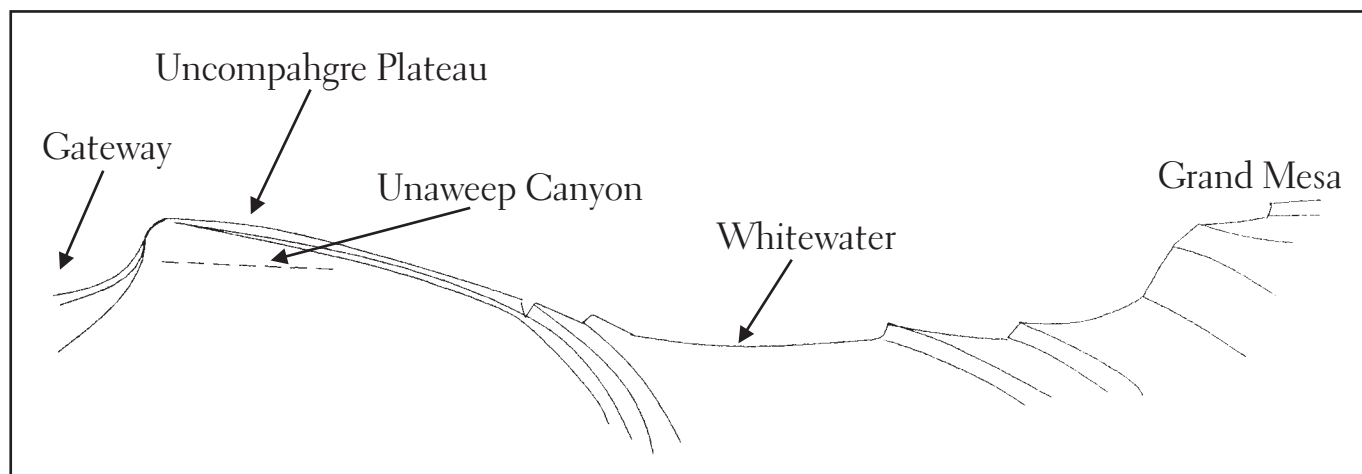


Figure 1: An idealized structure illustration of a cross section from the town of Gateway (on the west, right side of diagram) eastward (right) to the top of Grand Mesa. The dotted line across the Uncompahgre Plateau represents the canyon floor of Unaweep Canyon, intermediate in elevation between the valley bottom and the adjacent crests.

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Received 28 February 1997; Revised 18 July 1997

Table I. Elevation increase near Fruita, Colorado.

Site	Elevation	Distance from Fruita
Fruita	4498 feet	
Grand Junction (Colorado River)	4600 feet	Approximately 15 miles east
Montrose (Uncompahgre River)	5794 feet	Approximately 80 miles southeast
Glenwood Springs (Colorado River)	5760 feet	Approximately 105 miles east northeast

Regional Stratigraphy

Table II shows a generalized geologic column of strata found within this area from Precambrian crystalline rock at the bottom of canyons at Colorado National Monument, through Mesozoic and Cenozoic strata to the top of Grand Mesa about 25 miles east of Colorado National Monument. The stratigraphic units change across the study area as some disappear while others thicken. For example, the prominent cliff former in the park (Wingate Sandstone) is absent just 20 miles away under Grand Mesa. The Green River Formation under Grand Mesa changes from a thin stratigraphic layer to more than 1000 feet thick as it extends to the north. Still, it may help orient the reader.

The rapid deposition of the entire Plateau region, including rock systems seen in Colorado National Monument (Entrada, Kayenta, Wingate, Chinle) was touched upon by Clark (1966):

Conclusions are (1) sediments were brought in from great distances (2) great sweeps of water instead of local river or flood action were necessary to spread out these sediments over this vast area, and (3) the various formations were laid down one after another in rapid succession.

Creationist articles which deal with some of the rock units in the region are listed in Table III.

The Colorado Plateau in Western Colorado

The origin of the Colorado Plateau is presented in uniformitarian literature as the product of a series of depositional eras which culminate in the gradual uplift and slow erosion of the present topography. In contrast, the Flood Model would propose that the entire Colorado Plateau strata was deposited rapidly in one cataclysm. Evidence favoring this view includes the work of Robert Gentry (Connor, 1977; Gentry, 1986, p. 58) on polonium halos in coalified

wood recovered from a number of sites on the Plateau including the Morrison Formation and strata dated Eocene at the top of the local geologic column in the Roan Plateau. By analyzing the compressed halos Gentry produced physical evidence that the Mesozoic and Cenozoic strata were deposited in rapid succession with no time breaks between the strata—during the Flood.

Similarly, there is evidence linking the deposition of Paleozoic strata to those above. That data involves the presence of fossil pollen from advanced plants found in the lowest fossil-bearing rock units (Cambrian), whereas the trees from which the pollen was supposedly derived are found higher in the local and global geologic column (Cretaceous). The initial creationist work was conducted by Clifford Burdick (1966), but due to challenges of the veracity of the work a more painstaking effort was undertaken by Howe, Williams, Matzko, and Lammerts (1988). The latter work duplicated the Burdick results.

Creationists have proposed that entrenched meanders constitute a third evidence for the erosion of the region before complete hardening of the present sandstone (Morris and Wiggert, 1972). River meanders cut deep into hard sandstone are seen in many places in the region. Morris notes that from an engineering standpoint, the entrenching of the rivers is best explained if the rock is not yet hardened or lithified. The meanders in this area are thousands of feet below the mesa and plateau tops described in this paper. The “slow” view therefore necessitates the removal of thousands of feet of overburden before the present canyon walls would be exposed to such erosion, and in a time frame which is short enough to preclude lithification of the rocks. Entrenched meanders in Western Colorado include those near Gateway on the Dolores River and on Plateau Creek north of Grand Mesa.

Table II. Regional Stratigraphy of Western Colorado, adapted from Lohman (1965), Prather (1982), and Young (1984)

Uniformitarian term for time periods	Thickness in feet	Rock layers exposed in Grand Mesa-Uncompahgre area
Miocene	100	Basalt cap
Eocene	1000	Green River Formation
Paleocene	1,700	Wasatch Formation
<i>Unconformity</i>		
Late Cretaceous	1,500	Mesa Verde Formation
Late Cretaceous	3,800	Mancos Shale
Late Cretaceous	150	Dakota Formation
Late Cretaceous	60	Burro Canyon Formation
Early Cretaceous	600	Morrison Formation
Late Jurassic	54	Summerville Formation
Late Jurassic	150	Entrada Sandstone
<i>Unconformity inferred</i>		

Holroyd's article on boulder distribution in canyons on the Uncompahgre Plateau argues for a rapid development of the canyons (1994). He noted a lack of "old talus" in the bottom of canyon that he studied. An insufficient amount of talus was noted as a regional phenomena (Holroyd, 1987, 1994).

The Challenge of First Order Features

The challenge to the Flood Model not yet addressed in creationist literature (so far as this author is aware) is the perplexing erosion of the first order of features of this part of the Colorado Plateau. There is a corresponding flat, elevated topography, which is inferred by connecting the tops of Grand Mesa, the Roan Plateau (a maturely dissected plateau at roughly 8500 feet elevation forming the northern horizon from Grand Junction), the crest of the Uncompahgre Plateau (9287 feet), and the Flattops north of Glenwood Springs (elevations over 10,000 feet). Between these levels are the broad Grand and Uncompahgre Valleys at elevations sampled in Table I. These two valleys are continuous and related to the exposure of Mancos Shale, a thick but more easily eroded formation. This valley is narrowest from the crest of the Uncompahgre Plateau to the southwest rim of Grand Mesa (Indian Point) where it is roughly 30 miles across and has a depth of six thousand feet across, below the inferred original surface (see Figure 3).

To imagine the amount of material I presume was

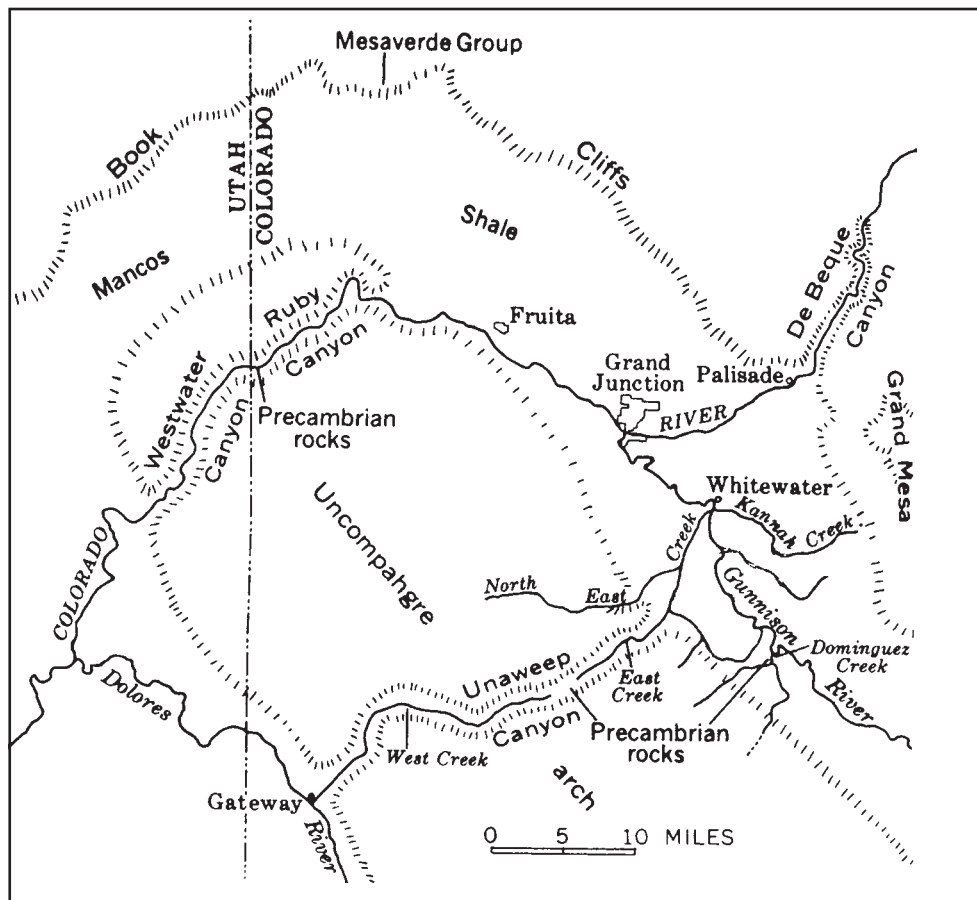


Figure 2. Map of Western Colorado showing geologic features of interest (after USGS, Lohman (1965)).

eroded, one could consider a conservative calculation. Multiply the 80 miles distance between the towns of Montrose and Fruita, Colorado by the width of the flattest valley bottom (conservatively five miles) and the height of Grand Mesa above the adjacent valley. The number of cubic miles removed from above the flattest part of the valley alone is thus over 400. Grand Mesa is bounded on the south by the drainage of the Gunnison River, which features similar elevations and more inferred material removed. The Grand Valley continues west from Fruita and the valley of the Colorado River continues northeast from the area involved in the calculation. This implies that the amount of material removed must be much more.

If the upwarp of the Uncompahgre Plateau is a post-Flood feature, the amount of material eroded and transported elsewhere since the end of the Flood would be even greater. The flat topography would not be bounded by the width of the valley to the west as in my calculation.

Upriver from the Grand Valley is the valley occupied by the Colorado River between Battlement Mesa's Haystack Mountain (10,978') and the Roan Plateau. The strata on each side of the valley is relatively flat, hence the valley seems to be erosional (unlike the Uncompahgre Plateau, which features flexed, faulted and dipping sedimentary rock).

Table III. Related Creationist Articles

Geologic formation or member in the Upper Colorado	Related creationist article dealing with the formation
Mancos shale	Froede, 1995
Dakota sandstone	Burdick 1973; Holroyd 1996
Kayenta Formation	Rosnau, Auldaney, Howe, Waisgerber, 1989
Chinle Formation	Chadwick, 1974
Precambrian	Talbott, 1977; Gentry, 1986.



Figure 3: Background: Grand Mesa (horizon) and the Grand-Uncompahgre Valley. Foreground: monocline of Dakota sandstone on the flank of the Uncompahgre Plateau into which the canyon is incised, exposing a cross section. Northwest of Delta, CO

Unaweep Canyon

A river channel presently occupied only by ephemeral streams (Unaweep Canyon, see Figures 2 and 4) exists across the crest of the Uncompahgre Plateau. It is traversed by Highway 141 between the towns of Gateway and White-water, in the adjacent valleys. The canyon is remarkably like that of the Black Canyon of the Colorado, only partially filled with alluvium and thus appearing flat-bottomed. Basalt boulders presumed to be from the basalt cap of Grand Mesa have been found on the west side of the valley, indicating that the canyon was a route of the ancestral Colorado or Gunnison Rivers (or retreating Floodwaters) carrying boulders west. The canyon crosses the crest of the plateau at a gentle gradient at 7000 feet elevation, 2500 feet below the plateau crest but thousands of feet above the broad valleys adjacent to the plateau. The pass is so gentle that it is difficult to detect.

Unaweep Canyon is interesting in several regards. It is a site which illustrates the persistence of features from the Paleozoic

strata to the present topography by exposing a cross section view of thin sedimentary strata deposited atop the Uncompahgre Plateau. Beneath it the crystalline Precambrian rock forms the canyon walls. A short distance to the west at the town of Gateway the Chinle Formation and Wingate Sandstone are thousands of feet thick (see Figure 5). The difference in depth of Chinle strata is one basis on which an earlier uplift and erosion is postulated, the late Paleozoic "Uncompahgre Highland". That uplift largely parallels the present plateau, a persistence which seems more compatible with a young-earth setting than parallel uplifts hundreds of millions of years apart.

Discussion

The matching tops of the Roan Plateau, Battlement Mesa, and Grand Mesa imply a plain covering the region before erosion. I envision this plain as the Flood-maximum surface. The warping of the Uncompahgre Plateau probably predates the deposition of the uppermost strata of the region. That strata is exposed on the sides of the remarkably flat-topped Grand Mesa and presumably covered most of the



Figure 4: Unaweep Canyon's east entrance, Highway 141 in shadow for scale, showing Precambrian crystalline rock forming cliffs and a veneer of sedimentary rock above

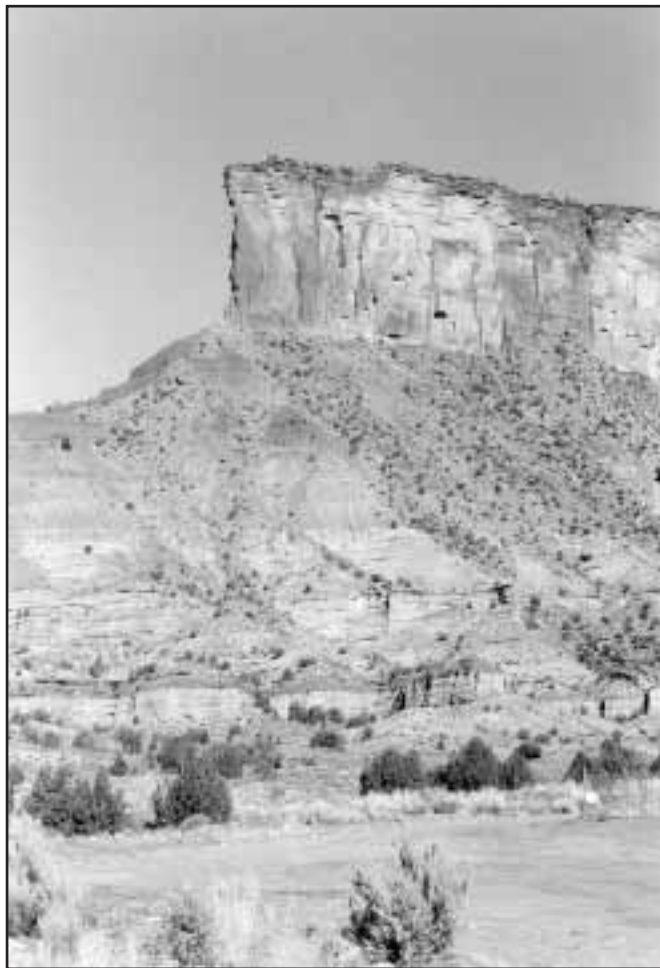


Figure 5: Chinle Formation capped by Wingate sandstone north of Gateway, CO, in contrast to the small veneer of sedimentary rock in Figure 4 and 5 in nearby Unaweep Canyon.

Uncompahgre as well, thin across its top. Such a deep sequence of sediments would imply that the Flood proper deposited strata classified from Miocene to Triassic in this area. Retreating Floodwater would seem adequate to carve such broad valleys if they covered the region to a considerable depth and moved on the surface of the submerged continent with velocity, or if the waters had a source of resupply (e.g. tidal action, tectonic shifting with tsunamis generation, or some other source).

The lack of a well-defined delta downriver in the Colorado River system is conspicuous given the amount of material eroded from these valleys, an echo of the same problem that has been noted for the Grand Canyon downstream. A large river eroding the dendritic canyon system of the Upper Colorado would be expected to leave a huge delta of alluvium at its base level.

The major excavation of the broad valleys may have been completed when secondary processes of cliff sapping, mass wasting, and Ice Age regional catastrophic precipitation produced the dramatic cliffs, entrenched meanders, and stream superposition features for which the region is famous (such

as Colorado National Monument and the Black Canyon of the Gunnison National Monument). The relatively flat top of Grand Mesa implies that deformation of the crust so as to exaggerate the topographic relief was small. The broad valleys appear to be erosional features. Unlike the Mississippi Valley, floods associated with continental glacial phenomena do not seem plausible here based on current (but perhaps inadequate) understanding of the geographic limits of glaciation (Mehlert, 1988). Further research is necessary to determine how the Ice Age affected the region for the purpose of this model.

Prior authors have proposed that regional lakes in the post-Flood era might have drained catastrophically and resulted in the rapid erosion of the Grand Canyon (Austin, 1994; Williams, Meyer, and Wolfrom, 1992). One of the proposed lakes occupies the Grand Valley up to the foot of Grand Mesa. But this valley is itself a major erosional feature! The erosion of the Grand Canyon might therefore be in part due to an earlier and larger amount of water needed to erode the master valleys of the upper Colorado in which the proposed Canyonland Lake would lie.

Sources for the amounts of water necessary to transport material on such a scale include surges of Flood waters from the east prior to the rise of the Colorado Rockies, perhaps related to giant gyres associated with continental flooding in recent computer modeling (Baumgardner and Barnette, 1994). It is noted that the top of Grand Mesa preserves what is thought to be a broad valley which filled with basalt. That basalt is thickest to the east, where it is now highest. The valley which the basalt filled is therefore thought to have drained east rather than west at the time of the basalt flows. If so, perhaps the present slope of the Mesa top to the west is due to the post-Flood deposition uplift of the Rockies to the east after erosion and transportation of material from the master valleys had commenced.

The suggestion that Mancos Shale (Late Cretaceous) is a “retreating Floodwater” deposit (Froede, 1995) would require that the strata above the Mancos (hence, after the Mancos) in this locale be deposited in the post-Flood era and then eroded back to the present valleys in post-Flood regional catastrophism. This seems difficult in a young earth framework due to the extent and depth of the strata and need for Flood waters as a potential mechanism for cataclysmic mass wasting.

Some have suggested that the Mesozoic-Cenozoic boundary as a Flood-post-Flood boundary. The scale of deposition and erosion argues in favor of the strata in this area being Flood strata, concluding with the mid-Cenozoic basalt caps of Grand Mesa, Battlement Mesa, and the Flat-tops. If not, the mechanics of river erosion on this scale in a short chronology seems difficult. The wide Grand Valley north of Westwater Canyon, where the present river does not go, is a case in point.

I propose that the large valleys (Grand Valley, Uncompahgre Valley) resulted from the retreating Flood water. The “smaller” canyons (Ruby and Westwater Canyons, the Black Canyon of the Gunnison, entrenched meanders, the cliffs at Colorado National Monument and related canyons such as

Bangs Canyon) are the result of post-Flood ice-age erosion, mass wasting and cliff sapping (Williams, 1995; Froede, 1996.) on a catastrophic rather than cataclysmic scale. Incomplete lithification of strata and abundant ice-age moisture would contribute to the rapid formation of these canyons systems.

Outstanding Issues Remaining

With Canyon Formation

Unaweep Canyon straddles the Uncompahgre Plateau at an elevation (6973 feet) intermediate between the crest of the Uncompahgre Plateau (9399 feet) and the trough of the Grand Valley (Whiterwater, 4660 feet). The Canyon is eroded deep into crystalline rock, making incomplete lithification unavailable as a way to accelerate erosion rates (see Figure 6). Unaweep Canyon appears to be an example of stream superposition and finally abandonment of the channel in favor of the present route of the Colorado and Gunnison Rivers across softer shale to the north. If a river carved the initial 2500 feet of Unaweep Canyon into crystalline rock, then rivers carving the adjacent broad valleys to lower elevations than Unaweep Canyon (roughly 2500 feet) imply a time interval. If retreating Flood water carved the broad Grand Valley, what carved the Unaweep Canyon at an elevation intermediate between plateau crest and valley bottom?

One possible solution is that the canyon is a product of bottom currents which moved along the top of the submerged continental surface. However, these would not likely reach speeds capable of producing cavitation and thus accelerate erosion of crystalline rock in so narrow a channel. Present outer continental shelf canyons may be compared, but the time available for canyon development would be measured in years to centuries.

Another possible solution is that the Flood waters which drained from the continents occurred in more than one episode, with interludes of catastrophic river action between re-invasion and re-drainage by Flood waters (or, uplift and re-subsidence or the region). If so, Unaweep Canyon is river-carved during an interlude in the Flood, yet the still-lower Grand Valley is the product of subsequent Flood water drainage.

A support for the later scenario is the riverless lower Grand Valley, which is wide north of the present temporary



Figure 6: Unaweep Canyon from the Highway 141, near the pass. Note the thin layer of sedimentary rocks forming a distinct layer atop the crystalline basement rocks forming the cliff face.

base level of the Colorado River in the crystalline rocks at the northern end of the Uncompahgre Plateau (Westwater Canyon). This wide valley would need to be eroded by mass wasting and numerous small streams in the post-Flood era unless cataclysmic processes are invoked. Cataclysmic processes would involve the Flood proper, unless a post-flood agent is conceived. This is thousands of feet lower than Unaweep Canyon.

Both the uniformitarian and Flood models have outstanding issues remaining. Models are not falsified by challenges, but challenges may point to areas of needed revision and improve the models. This area presents a difficulty to Flood geology. I hope that contemplating this problem might unlock other areas in the Rocky Mountain West which have stream superposition problems and immense topographic relief. I also hope that other creationists will consider the problem of the broad valleys noted here, as well as Unaweep Canyon. It is a fascinating area to study.

Acknowledgments

I thank the reviewers for helpful suggestions to improve the readability of the manuscript and the editor for encouragement in persevering in the attempt to write the article. Thanks to Rick Fleharty of Montrose, who drew Figure 1 via computer, and to my wife for allowing my inattention to other duties.

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A Message from the Managing Editor

Lane P. Lester

The members of the Creation Research Society board of directors are "working directors;" they all pitch in to further the work of the Society. One of the jobs to be done is that of managing editor of the *Creation Research Society Quarterly*. The title of "managing editor" means different things for different publications, but for the CRSQ it means the person who takes the final edited manuscripts and illustrations and combines them into the published magazine.

For the past four years, Dr. George Howe has served as the managing editor of the CRSQ. He has decided to pass that responsibility along, and he recommended that I be his successor. Whether he did me a favor remains to be seen, as does the question of whether he did the Society a favor as well.

George's approach to editorial layout has been to do his cutting and pasting with real scissors and glue. The only muscle activity in my technique involves pressing computer keys and moving a mouse. For those interested in computerized publishing, this issue of the CRSQ was composed in Corel Ventura. The output file was used to generate the photographic film from which the press plates were made.

By way of a disclaimer I should say that, although I have published a few biology textbooks, this is my first experience with a scientific journal. The changes I have made have been for one of two reasons, either to make the CRSQ as readable as possible, or just because I like the way it looks. That is one of the advantages of volunteer labor: no one is likely to be very critical of your work.

The Big Sky Paving Gravel Deposit, Cascade County, Montana

Peter Klevberg*

Abstract

Gravel-capped buttes, benches, and pediments are common in Montana east of the continental divide. One such gravel deposit near Great Falls, Montana, has been extensively mined by Big Sky Paving, Inc. Gravel fabric, sorting, bedding, load structures, and an associated clay rhythmite unit within the gravel deposit are described in this pa-

per. A brief summary of traditional genitive explanations is presented. However, the characteristics of the Big Sky Paving deposit appear to be at variance with these uniformitarian explanations. A biblical approach to earth history provides superior explanations for the depositional features of this deposit.

Introduction

Traditional views of earth history have been severely challenged by data acquired during recent decades from surficial deposits east of the continental divide in Montana and adjacent areas (Crickmay, 1972, 1974, 1975; Shaw, Rains, Eyton and Weissling, 1996). A notable example is the Big Sky Paving gravel deposit near Great Falls, Montana (Figure 1). The gravel pit is located in the southeast corner of Section 32, Township 21 North, Range 3 East, northwest of the City of Great Falls in Cascade County, Montana, at an elevation of approximately 1,082 m above mean sea level (3,550 ft ASL). The site is the summit of a flat-topped hill or butte forming an erosional remnant of an extensive bench or plateau (Figure 2). The valley of the Sun River bounds the south side of the hill and is approximately 65 m (200 feet) lower than the hill and adjacent bench.

This gravel pit is typical of economic gravel deposits in the Great Falls area. Many of the other gravel mining operations in the area are located on the benches bounded by the valleys of the Missouri and Sun Rivers. Such gravel-capped benches are common in Cascade County (Soil Conservation Service, 1982). They are usually referred to as "stream terraces," with the gravels purportedly transported from the Rocky Mountains and deposited over long periods of time by ordinary fluvial processes. No consensus has been reached on whether these processes of

transport and deposition included stream capture, lateral corrasion, braided streams, or other fluvial or glaciofluvial processes (Collier and Thom, 1917; Fields, Rasmussen,

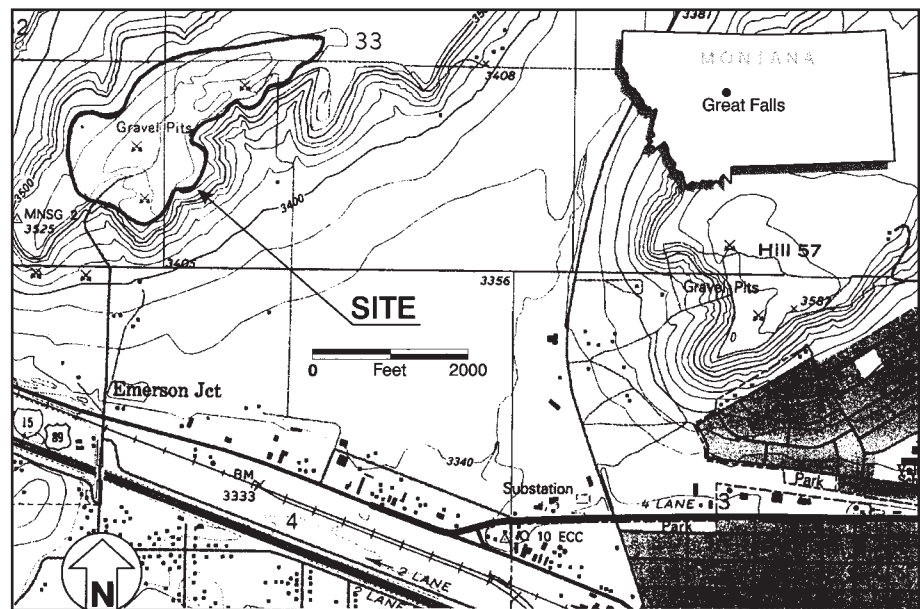


Figure 1. Site location map of Big Sky Paving gravel pit, Cascade County, Montana. From USGS 7.5' Great Falls NW Quad.

Tabrum and Nichols, 1985; Hyndman, Alt and Sears, 1988; Ritter, 1967). With the exception of the Sun River Valley, alluvial gravel deposits at elevations lower than the "stream terrace" bench deposits are very uncommon.

The deposit mined by Big Sky Paving (and most local mining operations), labeled the "older Pleistocene gravel," is described by Lemke and Maughan (1977):

Poorly sorted deposit consisting of abundant, well-rounded gravel, cobbles, and boulder-size rocks of quartzite and argillite, and lesser chert, limestone, and sandstone in a silty sand matrix. High to moderate permeability and well-drained. Rocks are coated with

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Received 11 September 1997; Revised 14 October 1997



Figure 2. View northwest toward bench from northwest side of Great Falls. Big Sky Paving gravel deposit caps bench in background. Location of active mining in 1995-1997 indicated by arrow.

caliche, especially in upper part of the deposit, and locally are cemented. Unit lies on bedrock and in most places predates the glacial deposits. Generally between 5 feet (1.5 m) and 20 feet (6 m) thick.

The author interviewed Mr. Bill Pfleger, owner of Big Sky Paving, regarding the deposit. He said the deposit has been mined by various companies for at least 20 to 30 years (Pfleger, 1996). Stratification (e.g. separation of clast-supported gravel and sand interbeds) was not common in the deposit according to Mr. Pfleger. Further, he was not aware of structures elsewhere in the pit resembling the load casts observed by the author.

Description of Deposit

The Big Sky Paving deposit originally covered approximately 33 hectares (80 acres) with an average thickness of 3 to 4 m (9 to 12 feet) (Pfleger, 1996). The area described here is primarily the southwest-central portion of the deposit (Figure 1), which was investigated by the author on March 29, 1995, and February 19 and 23, and August 29, 1997. Thin overburden consisting of discontinuous patches of very dark brown to mottled fat clay or silty topsoil roughly 0.1 to 0.5 m (4 to 18 inches or 0.3 to 1.5 feet) overlies the gravel and generally grades abruptly into it. The deposit is underlain by bentonitic shale of the Taft Hill member of the Blackleaf Formation (Lemke and Maughan, 1977). Appendix I has more information about this formation. The gravel-bedrock contact is reportedly unconformable, an assertion substantiated by the irregular base of the pit. Though the contact is generally obscured, maroon bentonitic shale appears to underlie the gravel.

The deposit consists primarily of well sorted (poorly graded) gravel with some interbedded sand. Sand beds up to 1 m (3 feet) thick were common in the 1995 working face but are uncommon elsewhere in the pit. Stratification is weak in most of the deposit, but evident in exposed faces,

especially to the east. Since much of the deposit has already been mined, a quantitative assessment of stratification is not possible. Much of the gravel is clast-supported, with easily observed voids between cobbles and large pebbles. The presence of carbonate precipitates ("caliche," in roughly the upper 0.5 to 1.5 m (1.5 to 4.5 feet) of the deposit provides a weak cement which bonds the clasts and enables near vertical slopes to be maintained in the upper part of most of the pit (calcic or petrocalcic horizons—Soil Conservation Service, 1975). In the west-central part of the pit, soft sediment deformation features, including load casts and contorted bedding, were present (Figure 4). This part of the pit constituted the working face at the time of a site visit by the author on March 29, 1995. These soft-sediment deformation features are the focus of this article.

The majority of clasts observed (roughly 70%) were bladed or oblate, well-rounded, red to tan quartzite. Other lithologies observed were sandstone, limestone, argillite, chert, and trachyandesite. The largest clast observed by the author was a prolate, well-rounded red banded quartzite cobble with a median diameter of 23 cm (9 in). With the exception of the sandstone (apparently from the subjacent Blackleaf Formation), the lithologies observed are presently exposed in the Rocky Mountains a minimum of 95 km (60 miles) to the west.

Channel deposits, cross-bedding, and pervasive imbrication were not observed in 1995 or 1997. With one exception, imbrication was limited to a few locations on a scale of approximately one meter, and appeared to conform to deformational features. Only one portion of the deposit exhibited strong imbrication. This was the south working face observed during a site visit on February 19, 1997, located approximately 100 m (300 feet) south-southeast of the March, 1995, working face (center of south end of deposit, Figures 1 and 2). Oblate pebbles and cobbles in the 1997 working face exhibited northwest to southwest dip directions, indicating transport from the west (Figure 3). Maximum dip observed was 25° to the west with an inferred paleocurrent direction of 080° (N80E).

A few minor soft sediment deformation structures were observed in most of the pit, being absent in those areas



Figure 3. View of 1997 south working face showing imbrication.



Figure 4. View of 1995 working face showing sand interbeds and load casts. Length of scale is one meter. Snow covers slough from working face.

nearly devoid of sand interbeds. In the west-central part of the pit (1995 working face), sand interbeds between gravel strata displayed load casts and contorted or convolute laminations (Figures 4–11). Load casts were present, though not abundant, in the north working face observed in February, 1997, located approximately 15 m south of the 1995 working face (Figure 12). Sand was abundant in the 1997 north working face and contained randomly oriented oblate and bladed pebbles up to 6 cm (2.5 inches) median diameter.

A thin clay deposit roughly 25 cm (10 inches) thick at the east end of the 1995 working face (located slightly to the left of the area shown in Figure 4) was observed which formed the overburden over an area approximately 3 m (10 ft) in diameter (Figure 13). This small deposit of fine-grained sediment consisted of laminated silty clay and fat clay overlying clast-supported gravel (Figure 14). The laminations were deformed, broken, or absent in the upper part of the clay unit. Cobbles were present in the upper part of the clay, possibly representing disturbance during removal of other overburden nearby, or more likely the average annual wetting depth and resulting blending of the clay and gravel units to achieve a less ordered, lower energy state. Laminations were intact in the lower half of the clay unit. Laminations were approximately 1 cm (0.5 in) thick. Deposits of this sort are typically called “varves” and assumed to represent annual layers in proglacial lakes (Gilbert, 1975; Bates and Jackson, 1984; Oard, 1992a). The Big Sky Paving pit lies outside glacial deposits and Glacial Lake Great Falls according to Lemke (1977) and Lemke and Maughan (1977).

Similar dark clay was observed in February, 1997, forming overburden along part of the 1997 south working face but lacked laminations. By August, 1997, mining had exposed a clay rhythmite across approximately 30 m of the working face. This corresponded spatially with the clay observed in February, 1997. The rhythmite constituted an interbed between gravel strata and dipped toward the northeast. This appears consistent with proximal imbrication and with the attitude of other stratified parts of the deposit. A zone of

disturbed laminae containing pebbles and cobbles formed the top of the unit, similar to that observed in the 1995 working face.

Elsewhere, dark clay interbedded with silt, sand, and fine gravel (granules and pebbles) was observed in 1997 at the southeast edge of the deposit. One fine-grained, stratified interbed (Figure 15) was observed with progradation indicating flow in a direction approximately 090° (N90E). Imbrication of small gravel in the nearby face (Figure 16) was quite variable, but oblate pebbles generally dipped east-northeast. The strike of stratification in this face was measured at 095° (N95E), dipping to the south at 7°. Lime cementation was present in two seams of coarse gravel in the southeast corner of the pit. These zones (petrocalcic horizons) were stratiform for a distance of roughly 50 m, becoming more weakly cemented to the east and more strongly cemented but irregular in form to the north.

Depositional Environment

Soft sediment deformation features provide clues to the depositional environment. Load casts, contorted bedding, and highly deformed or convolute laminations are often observed where sandstones overlie mudrocks. Selley (1976, p. 227) attributed them to a variety of ancient and modern depositional environments, including turbidite, deltaic, and fluvial facies. Tucker states:

Load structures are formed through differential sinking of one bed into another. Load casts are common on the soles of sandstone overlying mudrock, occurring as bulbous, rounded structures, generally without any preferred elongation or orientation (Tucker, 1982, p. 70).

These inferred depositional processes are time-dependent because fluid pore pressure in the lower stratum, a critical variable, is dependent on the permeability of the upper stratum and loading experienced by the sediment. Load casts are indicative of the rapidity of deposition of the overlying stratum and hydroplastic nature of the underlying



Figure 5. Massive sand interbed in clast-supported gravel. Length of scale is one meter.



Figure 6. Convolute lamination or contorted bedding in sand interbed. Length of scale is one meter.

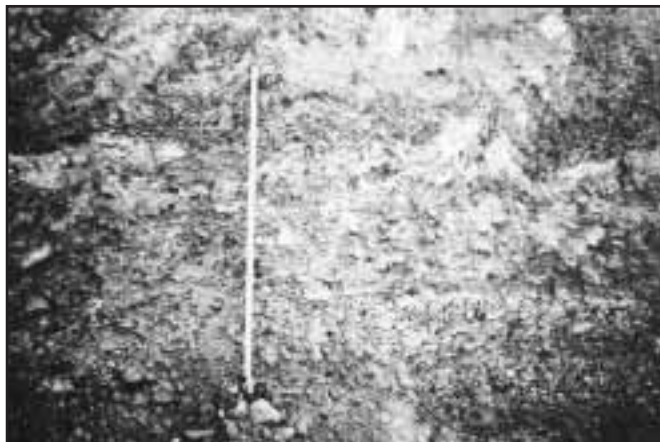


Figure 7. Close-up view of load structures to left of meter stick in Figure 4. Note that fabric cuts across gravel-sand interface at left side of load cast. Length of scale is one meter.



Figure 8. Zone of extensive mixing of poorly graded (uniform particle size) gravel, sand with gravel, and well-graded (poorly sorted) gravel. Note that bedding plane visible in lower right of photograph disappears to left. Length of scale is one meter.



Figure 9. Closer view of load structures near meter stick in Figure 4. Both contorted laminations and load casts are evident in sand interbed. Length of scale is one meter.



Figure 10. Closer view of Figure 9. Note clast-supported gravel beneath sand body. Length of scale is one meter.



Figure 11. View to right of Figure 10. Note coarse, poorly-graded gravel above deformed sand interbed, sandy gravel below interbed, and mixing of units at right. Length of scale is one meter.

stratum, not of a unique depositional environment (Potter and Pettijohn, 1977, p.200).

Experimentation by various researchers has provided theoretical explanations for load casts and other soft sediment deformation phenomena. "There is general agreement that these structures are generated by the differential loading of a waterlogged sand on an unconsolidated mud" (Selley, 1976, p.227). The instability that produces the deformation results from a reverse density gradient (Blatt, Middleton, and Murray, 1972, pp. 173,174). As stated by Blatt, Middleton, and Murray (1972, pp. 174,175), the presence of pore fluids is an important factor in the deformation of the unconsolidated sediments:

In a sediment where the increase in effective pressure is produced rapidly (e.g. by fast sedimentation), the compression of the sediment at some time t will be less than the ultimate compression that would take place if enough time were to be allowed for the pore water to escape. The degree of consolidation is defined as the ratio between the compression at t and the ultimate compression. At any stage short of ultimate compression, part of the pressure of the sediment must be transmitted to the pore fluid so that the pore fluid pressure exceeds hydrostatic by an amount equal to the excess pore pressure. Sediments with excess pore pressures are described as underconsolidated.

The response of a sediment to shearing depends on the angle of internal friction (ϕ) and the cohesion of the sediment (c). Suppose the shear stress is τ and the total normal pressure is σ , then the effective pressure ($\sigma-u$), where u is the pore pressure; the relation between these pressure and stress variables is given by:

$$\tau = c + (\sigma - u) \tan \phi. \quad (1)$$

Deformation of the sediment may therefore be facilitated by reducing the cohesion c , by reducing the coefficient of internal friction $\tan \phi$ (e.g. by altering the packing of the sediment), or by increasing the pore pressure u . In the previous section it was remarked that most soft-sediment deformation structures in sands are restricted to coarse silt to fine sand grades. The reason for this is now clear. These size grades are the ones where the cohesion is not large, where rapid deposition from suspension and an unstable packing are possible, and where the permeability is low enough to prevent rapid loss of pore fluids. Consequently, the fine sands are those most likely to undergo loss of strength and at least partial liquefaction.

Contorted bedding and convolute lamination can be produced by a variety of causes. McKee, Crosby and Berryhill (1967) attributed convolute laminations in fluvial sand to quicksand conditions (zero intergranular pressure) at the conclusion of flooding (p. 840).

Deformed bedding can arise from a number of processes. Shearing by currents on a sediment surface and frictional drag exerted by moving sand are thought to cause some convolute bedding and overturned cross-

bedding. Dewatering processes such as fluidization and liquefaction (often induced by earthquake shocks) give rise to convolutions, contortions and disruptions (Tucker, 1982, pp.68,69).

The deformation structures at the Big Sky Paving pit differ from these classic cases in that the sediments are gravel overlying sand rather than sand overlying mud. Although the features observed in the Big Sky Paving deposit are similar in form to load casts and deformed bedding commonly seen in fine-grained sediments, the properties of the sediments differ, as summarized in Table I.

Cohesion is generally low in granular soils and may be negligible in poorly graded (well sorted) ones consisting of well-rounded particles, such as the upper gravel stratum in the 1995 working face (Figures 4, 5, 8, 10, and 11). This would favor development of load structures following deposition. Rapid deposition from suspension is not commonly considered in studies of gravel deposits because of the energy required to transport large pebbles and cobbles in this mode. However, transport via intermittent suspension and rolling would tend to produce channel and bar deposits, which are not observed at the Big Sky Paving pit. The general lack of imbrication also suggests that the deposit was not formed by typical fluvial processes. Imbrication is common in fluvial deposits, but would not be expected if the

Table I. Salient Implications of Deformation Features at Big Sky Paving Gravel Deposit, Cascade County, Montana.

Observation	Implication	Conclusion
Poorly graded, well rounded clasts	Cohesion relatively low	Favorable condition for development of load structures following deposition
Lack of channel and bar deposits	Transport via intermittent suspension and rolling unlikely; migrating channels unlikely	Transport via suspension probable; possibly sheet flow rather than channelized flow
Coarse-grained sediments	Relatively large energy level required for transport	Catastrophic deposition, not typical fluvial deposition
General lack of imbrication	Deposit probably not formed by typical fluvial processes	Clasts probably deposited from suspended rather than bed load
High permeability	Water could escape rapidly from sediments during deposition	Time required to form deformation structures brief and transport energy high



Figure 12. View of 1997 north working face.

clasts were deposited from suspended rather than bed load. The permeabilities of sand and gravel are obviously much greater than permeabilities typical of fine-grained sediments, suggesting that pore fluids would be lost relatively rapidly from the Big Sky Paving deposit immediately upon deposition. If the role of fluid pore pressure is of primary importance in the formation of load structures, then the time required to form them must have been very short in light of the permeability of these coarse-grained sediments. If the role of fluid pore pressure is not of primary importance in forming load structures, then the transport energy must have been high to deposit coarse gravel atop the sand stratum.

Stratification does not imply a depositional hiatus or change in flow regime. Stratified deposition of fine-grained sediments has been documented by Berthault (1986), Carey and Roy (1985), and others, and some quantitative descriptions of the fluid mechanics processes have been developed. Whether similar processes occur in coarse-grained sediment deposition (dominated by inertial forces) is unclear; however, Shaw and Kellerhals (1977) documented segregated sand and gravel deposits which provided evidence for contemporaneous transport of the sand and gravel fractions.

Assuming equant quartzite particles (for simplicity) and fluid properties approximating those of "clean water," the terminal velocity of the suspended particles can be balanced with the drag force resulting from current turbulence using the empirical relation that the transverse component of velocity is approximately eight percent of the component of velocity in the direction of transport (Blatt, Middleton, and Murray, 1972, p. 100). This results in the following restriction on the minimum average current speed $u_{\min}$ (time rate of change of position in the direction of transport):

$$u_{\min} \geq 12.5 \sqrt{(2F_D / (C_D A \rho))}, \quad (2)$$

where F_D is the drag force, C_D is the drag coefficient relative to turbulence (i.e. counteracting gravity), A is the particle area normal to the gravitational gradient, and ρ is fluid density. Note that $u_{\min}$ refers to the magnitude of the current transporting the suspended sediment and may differ from the average speed of the current as a whole, which may have

been greater. The calculation is iterative, the drag coefficient being determined from a figure for axisymmetric bodies (Roberson and Crowe, 1985).

Using the above relations and a median clast diameter of 64 mm (2.5 in), a minimum current speed in excess of 11 m/s (36 fps or 24 mph) is required to maintain the clast in suspension. For 100 mm diameter (4-inch) cobbles (common in some of the coarse gravel bodies addressed here), this equates to a minimum mean current speed of 14 m/s (46 fps or 30 mph). For bladed 64 mm (2.5-inch) clasts, the estimates are less precise due to likely rotation of particles in the current and resulting changes in values of A and C_D ; however, a reasonable estimate is $u_{\min}$ in excess of 17 m/s (56 fps or 38 mph). For the occasional 150 mm (6-inch) bladed cobble, the value of $u_{\min}$ required to maintain transport in suspension would be approximately 30 m/s (98 fps or 68 mph). The average current speed at the time of deposition could have been any value in excess of $u_{\min}$ to maintain sediment in suspension. Interaction of particles in sediment-laden water might be expected to reduce the requisite value of $u_{\min}$ somewhat, while simultaneously increasing the requisite energy for fluid transport. Lower power (time rate of energy) levels are required for transport of coarse sediments as bed load than as suspended load. Since the largest clast (230 mm or 9 inches) was not observed in situ, it may not have been associated with the load casts and may have been transported as bed load. Most paleohydraulic equations applicable to coarse sediments address bed load transport. These equations are based on hydrodynamic theory or empirical data for the limited range of conditions encountered in certain modern streams (Williams, 1984). Maizels (1983) evaluated open channel flow equations commonly used in engineering calculations for application to coarse sediment transport. Church, Wolcott and Maizels (1990) provided corrections to Maizels' article, showed the basic equivalence of the various methods, and recommended use of the Keulegan Equation. Unfortunately, the Keulegan Equation, like most open channel flow equations, requires knowledge of flow depth. Flow depth may be known for modern streams through gauging or channel depth, but is not generally accessible in paleohydraulic analyses.

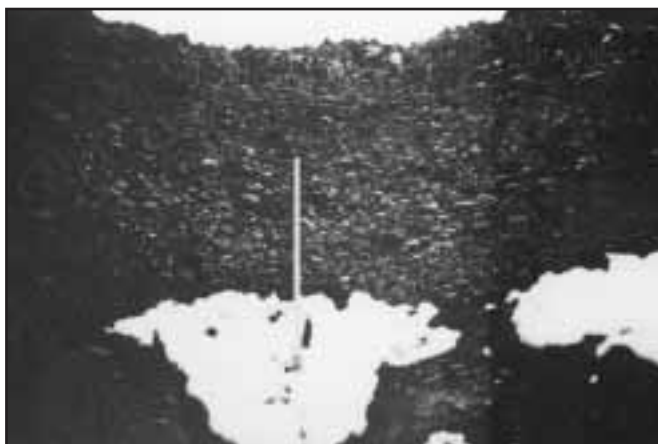


Figure 13. Laminated clay atop clast-supported gravel. Length of scale is one meter.



Figure 14. Closer view of laminated clay. Upper part of clay unit probably corresponds with the average annual wetting depth. Scale graduated in feet.

Costa (1983) compared two theoretical methods (turning moments of Helley and drag-lift-friction) and two empirical methods (least squares regression and U.S. Bureau of Reclamation) for velocity and depth estimation from coarse sediment transport to nine watersheds in the Colorado Front Range. He found that discharge estimates for historic flash floods based on an arithmetic average of the four methods differed by less than 76 percent from values obtained by the slope-area method traditionally used to estimate ungauged stream discharges. Similarly, Williams (1983) presented an empirical relation for minimum current speed based on intermediate particle diameter. Although large velocity fluctuations typical of turbulent flow may exceed the threshold velocity for incipient motion, transport of coarse bedload requires a minimum mean current speed somewhat greater than the threshold velocity, since the threshold velocity is defined by incipient motion.

Slope is somewhat difficult to estimate from the erosional remnants west and east of the Big Sky Paving deposit, and actually appears adverse in relation to Hill 57 (Figure 1). The depositional surface slope based on the surface of the

Blackleaf Formation outcropping on various erosional remnants as much as 30 km (20 miles) west of the site (Lemke, 1977) is less than 0.0010 and closer to 0.0001. The streams studied by Costa, which generally had slopes in excess of 0.05, may make poor analogues for the Big Sky Paving deposit, which has a much smaller slope. However, the data he used in developing his equations included some streams with slopes of 0.001 or less. Based on the maximum observed clast size and the method of Costa, the magnitude of the threshold velocity necessary to transport the gravel as bedload would have been 2.6 m/s (8.5 fps or 6 mph). The method of Williams yields a minimum current speed of 1 to 7 m/s (3 to 23 fps, or 2 to 16 mph). This indicates that the minimum current speed required for the suspended sediment load to produce load casts is greater than that required for transporting the largest observed clast as bed load.

Genitive Inferences

The characteristics of the Big Sky Paving gravel deposit suggest that a powerful current deposited the sand and gravel rapidly from suspension. The location of the load structures in the west part of the deposit; imbricated pebbles and cobbles near the center; and stratified, finer, more variable material to the east may indicate a loss of competence across the deposit, possibly due to irregularities or obstructions in the bed. It may also indicate overloading of the current with sediment. Obstructions might shelter sand, preventing removal by the current transporting the pebbles and cobbles; however, other studies indicate that sand and gravel may be deposited together (Shaw and Kellerhals, 1977) or that relatively large, heavy bodies may be deposited above sand in upper flow regime fluvial deposits (McKee, et al., 1967). A local loss of competence might also result from transient turbulent processes or fluctuations in the current. Increased variability in sediment type, a general decrease in grain size, and variability in inferred paleocurrent directions in the southeast part of the deposit may have resulted from

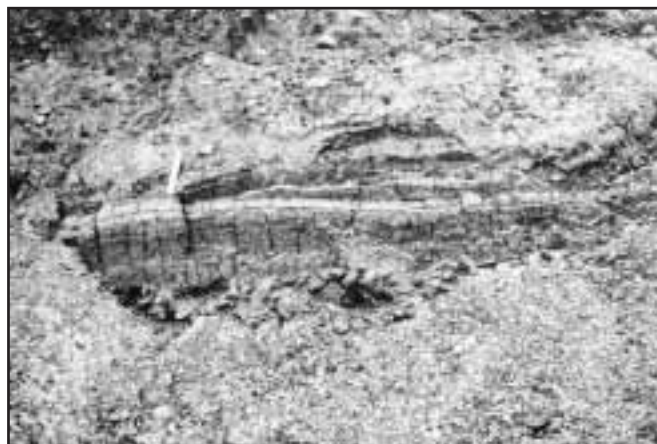


Figure 15. Fine-grained interbeds in southeast corner of deposit. Scale is 6 inches (15 cm). Mottled appearance from snow.



Figure 16. East face in southeast corner of deposit showing gravel strata. Pebbles dip east-northeast. Stratification strikes 095° (S85E), dipping south at 7° .

eddies, episodic deposition, or development of the Sun River channel to the south. The close association of these features attributed, respectively, to transport as suspended load and transport as bed load may indicate that the actual current speed was not significantly greater than the minima estimated above.

Historical Analysis

According to the establishment geologic paradigm, the Big Sky Paving deposit and related gravel deposits are traditionally viewed as stream terrace deposits. They are widely believed to have formed in the early “Pleistocene Epoch” as individual streams transported gravel eroded from the Rocky Mountains eastward across the plains, or as flash floods transported gravel across alluvial fans or bajadas. Laminated clay deposits are typically thought to be “varves,” representing annual depositional cycles in proglacial lakes or older lacustrine environments.

The features observed at the Big Sky Paving gravel pit appear to require a catastrophic event in the relatively recent past. Load casts and deformed bedding observed in this gravel deposit indicate depositional instability caused by a reversed density gradient. The general lack of imbrication, absence of channel and bar deposits, and the abundance of clast-supported gravel do not support a traditional fluvial interpretation of the deposit. The deformation features observed in the deposit are expected where sediment has been transported as suspended rather than bed load. The characteristics of this gravel deposit appear most consistent with very rapid, high energy deposition and syndepositional deformation.

The paucity of overburden and presence of clast-supported gravel are not compatible with an age of many thousands of years of exposure. Based on the presence of large aeolian deposits elsewhere in the area (Lemke and Maughan, 1977), aeolian transport alone might have been sufficient to deposit considerably more than the average 25

cm of fine-grained material, and a particle size gradient should be evident as sand and smaller particles migrate downward through the gravel. The presence of relatively pure carbonate cement is not indicative of a gradual, ongoing process. Multiple, distinct horizons and irregular boundaries between lime-cemented and lime-deficient gravel may indicate that the carbonate is syndepositional. Multiple caliche layers would not be expected to form, since layers formed earlier would be destroyed by dissolution. The abundance of limestone in the presumed source area suggests that the limestone may have been the source of the carbonate minerals cementing the gravel and may have been deposited with the quartzite pebbles and cobbles.

The gravel deposit shows evidence of energetic deposition (as do similar deposits in the area). Historically, vast, highly energetic currents capable of transporting cobbles and boulders great distances over large areas can be expected to have occurred during the Deluge (Genesis 6:13,14; 7:11,18-24; 8:1-5). Such phenomena might correspond to the Dispersive Phase of Walker’s geochronologic paradigm (Walker, 1994) or the Upper Flood Division of Froede (Froede, 1995). As pointed out by Reed, Froede, and Bennett (1996, p.100), the end of the Deluge may be difficult to identify in the geology of a locale due to a gradual decline in the rate of energy expended in geologic processes. The historical setting for the formation of the Big Sky Paving deposit, as an example of a remnant of a laterally extensive, high energy process, is therefore most likely very late diluvian or very early postdiluvian time. The probability of such a geologic process declines with increasing time since the Deluge.

Another possibility would be catastrophic glaciofluvial events. Although continental glaciation would be grossly improbable from a uniformitarian standpoint, catastrophic glaciation could well have resulted from the Deluge (Oard, 1990). Catastrophic melting and outburst flooding (jökulhlaup) could explain many features inexplicable by present processes. Such a genitive mechanism would correspond to the Residual Phase of Walker’s geochronologic paradigm (Walker, 1994) or the Upper Ice Age Division of Froede (Froede, 1995). However, the fact that the Big Sky Paving deposit is part of a vast sheet deposit 65 m above the valley of the underfit Sun River and at a considerable distance from the source area does not appear to support a glaciofluvial explanation.

The presence of laminated clay atop clast-supported gravel and as an interbed within gravel strata is not consistent with gradual deposition in a lacustrine or glaciolacustrine environment. The lack of clay-size particles in the subjacent gravel supports neither gradual deposition nor extended time since deposition. Since moisture adequate to permit natural mixing of the clay and gravel by gravity alone appears to be affecting the upper portion of the clay deposits, it appears probable that even slightly more moisture than experienced in the present arid climate would be sufficient to induce mixing of the clay and subjacent gravel. This is not consistent with the idea of a gradual retreat of glaciers and concomitant climate change. Vast periods of time virtu-

ally imply climate change.

Formation of laminated deposits of some fine-grained sediments has been observed to be independent of current velocity (Berthault, 1986). Many clay and silt rhythmites have been shown to result from hyperpycnal flows such as turbidity currents rather than the traditional "varve" mechanism (Lambert and Hsü, 1979; Oard, 1992a,b). The clay was probably deposited rapidly. The discontinuous nature of the clay deposits may result from partial erosion of the rhytmite, or it may indicate that various rhytmite units formed in a relatively heterogeneous depositional milieu.

Conclusions

The Big Sky Paving deposit is unusual in the prevalence of load casts and related soft-sediment deformation structures in sand beds beneath gravels. These features are typical of deposition from suspension, requiring energetic currents. The changes in particle size, imbrication, and bedding across the deposit are consistent with an eastward paleocurrent direction, possibly with a decelerating or variable current. The lithologies are typical of rocks outcropping in the Front Range of the Rocky Mountains 95 km (60 mi) or more to the west. These features are consistent with genitive speculations invoking transport via highly energetic sheet flow. The presence of laminated clay above largely clast-supported gravel is consistent with neither glaciolacustrine deposition nor a long time period since deposition. The inferred depositional environment is not consistent with the historical framework of the establishment geologic paradigm. The inferred genitive history of the deposit is compatible with the diluvial geologic paradigm and probably corresponds to late diluvian or early postdiluvian time. Although the Deluge appears to be the only reasonable explanation for the geologic conditions necessary to form the deposit, greater precision in historical placement of the deposit than that presented here does not appear justified by the scientific data as is probably unwise. Other surficial gravel deposits in the region should be examined and the geologic data compared with traditional interpretations (including alleged age). Recognition of biblical authority provides a superior approach to both the scientific study of this deposit and its implications for earth history. The same may be expected elsewhere (Matthew 5:18).

Acknowledgments

The author thanks Mr. Bill Pflieger for providing access to his pit and background information about it. Messrs. K. Bill Clark, Erling Juel and Michael J. Oard provided helpful criticisms and witty sarcasms. The comments of Dr. Chaffin and two anonymous reviewers were very helpful. Mr. Richard Bandy provided helpful insights from the perspective of soil science. *Deum laudo* (Psalm 119:130).

Glossary

- aeolian—Deposited primarily by wind.
- alluvial—Unconsolidated detrital sediments, usually deposited by streams along their courses.
- bentonite—Clay composed primarily of montmorillonite, with minor amounts of other smectite minerals.
- bladed—Shaped like a flattened cylinder or elongated disk.
- caliche—A soil type in which grains are cemented by calcium carbonate.
- clast—An individual rock particle, including sand grains, pebbles, cobbles, and boulders.
- cobble—A rock with median diameter of 64 mm to 256 mm (2.5 to 10 inches), intermediate in size between pebble and boulder.
- corrasion—Abrasion, ablation, and attrition.
- deltaic—Typical of deposits formed where running, sediment-laden water enters still water.
- Deluge—The global, catastrophic flood that occurred during the lifetime of Noah.
- diluvian—Occurring during the Deluge.
- equant—Roughly spherical.
- fabric—Grain orientation in a deposit.
- fat—Said of clay having a plasticity index of 50 or greater; indicates high moisture sensitivity and domination by smectite minerals.
- fluvial—Typical of deposits formed by streams.
- geochronologic—Pertaining to the history of events molding the Earth's surface.
- glaciofluvial—Typical of deposits formed by streams emanating from glaciers.
- imbrication—The shingle-like orientation or fabric of bladed or oblate particles. The particles usually dip into the current.
- lacustrine—A lake environment; typical of deposits formed in lakes.
- load cast—A bulbous or irregular projection of an overlying bed into an underlying bed, inferred to be a soft sediment deformation feature.
- oblate—Disk shaped.
- paleohydrology—Estimation of possible past flow parameters from sediment characteristics, erosional and depositional features.
- pediment—A gently sloping erosion surface projecting from a steep mountain front.
- permeability—The rate at which water can migrate through a sediment under a given pressure (head).
- petrocalcic horizon—A soil science term for a lime-cemented conglomerate, i.e. earth material in which calcium carbonate fills spaces between mineral particles and cements them.
- progradation—Differential deposition of sediments (e.g. sand, silt, then clay), resulting in movement of an inclined depositional surface in the current direction.
- prolate—Roller shaped or roughly cylindrical.
- rhytmite—A banded sediment in which sediment types alternate.

syndepositional—Occurring during a depositional process.
 terminal velocity—The velocity at which the drag force opposing particle motion equals the weight of the particle, resulting in constant speed downward through the fluid.
 turbidite—Characteristic of deposits formed by turbidity currents (hyperpycnal flows or bodies of heavily sediment laden fluid that move along the bottom of water bodies, often at great speeds or for great distances).

Appendix I—The Blackleaf Formation

According to Lemke and Maughan (1977), the Blackleaf Formation consists of two members, the Taft Hill Member and the Flood Member. The basal Flood Member consists of three units: a basal flaggy sandstone interbedded with shale [claystone?] approximately 6 m (20 ft) thick; a dark shale unit approximately 15 m (50 ft) thick; and an upper massive sandstone unit approximately 20 m (65 ft) thick. The upper Flood Member sandstone forms prominent bluffs, including the base of the bench on which the Big Sky Paving deposit rests. The Taft Hill Member forms the upper portion of the Blackleaf Formation. It consists of many thin strata and laminae of bentonitic shale, bentonite, siltstone, and glauconitic sandstone. Roughly the basal 30 m (100 ft) of the approximately 73 m (240 ft) thick member is present beneath the Big Sky Paving deposit. The Taft Hill Member weathers rapidly and is easily eroded.

According to the establishment geologic paradigm, the Blackleaf Formation is “Upper Cretaceous.” It overlies the Kootenai Formation, a highly variable “continental” deposit included in the “Colorado Shale” group. The Big Sky Paving gravel is labeled “early Pleistocene.” Virtually identical gravel 9 km (5 mi) east of the Big Sky Paving site is labeled “upper Pleistocene” due to stratigraphic relations with presumed glacial deposits. An unconsolidated silty fine sand (glaciolacustrine) unit containing fossil snails in places follows the base of the bench on which the gravel deposit is located.

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Book Review

After the Flood: The Early Post-Flood History of Europe Traced Back to Noah by Bill Cooper
New Wine Press. Chichester, England. 1995. 256 pages. Paper £7.99.

Reviewed by Pete J. Williams*

Though records such as those of Nennius (eighth century AD) and Geoffrey of Monmouth (twelfth century AD) are generally regarded by scholars as of little historical value for consideration of the pre-Roman period in Britain, Cooper believes that these and other sources of similar date make it possible to reconstruct the history and succession of kings in Britain for over a thousand years before Caesar's conquest of Britain. In addition these records preserve striking independent confirmation of the genealogical material found in the Table of Nations in Genesis 10 and 11 since six royal houses in Britain, as well as the Danish, Norwegian, and Irish Celtic kings trace their descent from Noah. In addition to arguing for the general historicity of the genealogical records, Cooper also argues that many records of monsters from this period are in fact records of dinosaurs. This is argued at length in respect of Grendel, the monster of the *Beowulf* epic.

Creationists cannot assume that the conclusions of evolutionists about a document can be accepted unaltered, and Cooper is surely right to bring the sources he does to our attention for evaluation. However, he presents his readers too often with the choice of either believing that such sources are pious fiction or that they preserve historical records of early post-Flood history independent of the Bible. The

reader is quickly convinced that we are not dealing with fraud or fiction, and so is left with the suggested solution that some of the descendants of Japheth reliably recorded their genealogies for well over two thousand years. However, the large time-scale involved allows the genealogical records to have arisen at a period sufficiently distant from the medieval scribes to exonerate them from dishonesty, and yet not sufficiently close to the figures of Genesis 10 and 11 to provide historical confirmation of their existence.

Furthermore the independence from the Bible of the genealogical records cited by Cooper is highly debatable. The fact that the manuscripts involved come from areas where the Bible had been available to scribes for hundreds of years, and the way that Nennius (see Appendix 5) contains a genealogy relating Biblical figures to characters from Vergil's *Aeneid* (the best known Latin epic) witnesses against the independence of the genealogies.

The first three of the fourteen appendices are useful in providing extra-Biblical attestations of the names of the descendants of Shem, Ham, and Japheth recorded in Genesis 10 and 11. These suggested attestations, which are of mixed value, come from a much wider variety of sources than the northwest European sources which constitute the bulk of the book. Cooper is not so familiar with these sources, and thus one reads seven times of the "Armana tablets" when one should read of the "Amarna tablets."

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Notes from the Panorama of Science

Pollen Transfer in Camphor Weed Flowers Portrays Design in Origins

Trichostema lanceolatum is known as the camphor weed or vinegar weed because of its pungent aroma. Camphor weed is a North American member of the mint family, and it grows sporadically on dry plains and low hills from California to Washington (Figures 1 and 2). Together with other forbs, it is sometimes found growing in grassy meadows near woodlands of live oak or valley oak. Camphor weeds may also be found in oat fields after oat harvest (Howe, 1985, pp. 5 and 6). In May, when the soil moisture is depleted and the grasses have died, camphor weeds remain green. In southern California camphor weeds produce flowers from May to September.

The flowers are small, having a beautiful lavender corolla that is bilaterally symmetrical. The upper portion of the corolla forms a thin flexible tube which surrounds the anthers and the stigma (Figures 3 and 5). The lower petal lobes form a “landing pad” from which visiting insects can gain access to nectar glands which are found deeper in the flower. A foraging insect lands on these lower corolla lobes and inserts its mouthparts into the nectar-containing lower section. Then the narrow upper portion of the corolla straightens out, snaps rapidly downward, and brushes pollen onto the back of the visiting insect (Figures 4 and 5).

After the pollinating insect flies away, the narrow tube flips back into its original upright position. When the particular insect then visits other flowers, the pollen on its back is automatically transferred to the stigmas of those other flowers by this same spring-like mechanism. As a result, fertilization will occur, seeds will form, and the reproduction of the species is ensured. Relationships like this one, in which a flower dusts pollen onto the dorsal surface of a visiting insect, are called *nototribic* and are common in other species of the genus *Trichostema* (see Spira, 1978 and 1980) as well as other genera of the mint family (see Proctor and Yeo, 1972, and Macior, 1974).

I attempted to compare the weights of various kinds of pollinating insects with the force required to bring down the pollen dusting lever in camphor weed flowers (Howe, 1986). In order to ascertain the weight required on the lower corolla lobes to trip the mechanism, I pierced the lobe with a staple from which additional staples could then be hung to add more weight as needed (Figure 8). These were Bates standard staples weighing 33 milligrams (mg) each. If one staple by itself did not trigger the action of a flower, one or two other staples were added until the “lever” was sprung.

Sixty different camphor weed flowers were tested in the foregoing manner with the following results: 14 of them (23%) were triggered by one staple (33 mg), 35 flowers (58%) were activated by two staples (66 mg), and the remaining 11 flowers (19%) were sprung by the combined weight of three staples (99 mg). All flowers tested required less than 99 mg weight to trigger their pollen apparatuses (Howe, 1986, p.177).



Figure 1. The habitat of the camphor weed. Camphor weeds are seen growing here with grass and black mustard plants near the chair in the foreground. In the background is a valley oak tree, a scrub oak, and several blue elder shrubs.



Figure 2. An individual camphor weed plant is seen here with a tripod at its left for size comparison.

I collected specimens of the insect types frequently seen visiting camphor weed flowers (Spira, 1980, and Howe, 1985). They were stunned in an ethyl acetate jar and weighed immediately. Mean weights and standard deviations are given in Table I.

Table I. Insect pollinator weights.

Scientific Name	Common Name	Mean Weight
<i>Bombus sonorus</i>	bumblebee	223 ± 21*
<i>Apis mellifera</i>	honeybee	90 ± 4.5
<i>Anthophora urbana</i>	mason bee (female)	98 ± 13
<i>Ochlodes syvanoides</i>	woodland skipper	88 ± 7.2
<i>syvanoides</i>	(moth)	

*Milligrams ± standard deviation (n=6)



Figure 3. The camphor weed flower is *nototribic* meaning that it automatically dusts pollen onto the back of visiting insects, thereby ensuring transfer of pollen from one flower to another.

All of the bumblebees and most of the other insects which routinely extract nectar from camphor weed flowers are heavy enough to flex the flowers by simply landing on the petal lobes (Figure 6). In other words, the flowers possess the correct flex point to respond to the weight of these pollinators. Macroevolutionists generally attribute correspondence of pollinator weight and flower action to a gradual process of “coevolution” or “coadaptation” by which insects and flowers are believed to have become matched to each other. The means are not apparent, however, by which the flowers would have been able to pollinate successfully during the time required for this theoretical transition to have occurred. Also, it is not obvious that suitable mutations of shapes, sizes, and tensile strengths of flower parts would have arisen at the appropriate times to generate such



Figure 4. In the top photograph a bumblebee is seen extracting nectar from a camphor weed flower while the curved stamens can be seen dusting pollen onto the bee's head. In the lower photograph a woodland skipper moth is doing the same thing.

a close fit as an end result.

A more credible origins explanation exists to those who are willing to grant the likelihood of special creation. Mechanisms like these support a belief in design rather than natural selection. In a creation view the Designer gave the flowers their appropriate shape and made most of the camphor weed's pollinators heavy enough to spring the floral mechanism.

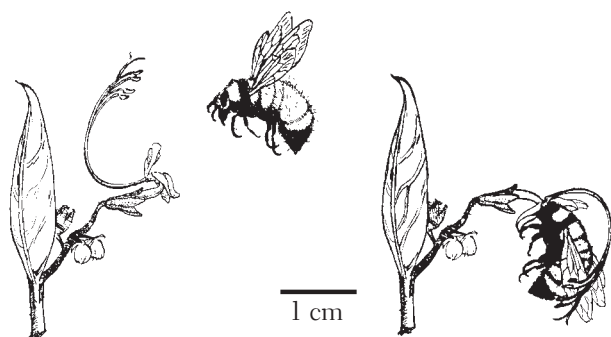


Figure 5. *Trichostema lanatum* (camphor weed) flower before (left) and after (right) a bumblebee has alighted in quest of nectar. When the bee alights, its weight and the movement of its mouth parts in the floral tube cause the anthers and the style to bend downward, dusting the pollen onto the dorsal surface of the bee. Drawing by Ross Marshall. Size bar is one centimeter.



Figure 6. Two Bumblebees (left and center) and a woodland skipper moth (*Ochiodes sylvanoides sylvanoides*). These two species easily trigger the camphor weed pollination mechanism by weight alone. Size bar is one inch.



Figure 7. Two male mason bees (*Anthophora urbana*) left and center, together with a female mason bee at the right. The honeybee and the female mason bees are heavy enough to trip the camphor weed pollen device. The male mason bees are too light to trip some of the flowers. Upper size bar is one centimeter, lower one is one inch.

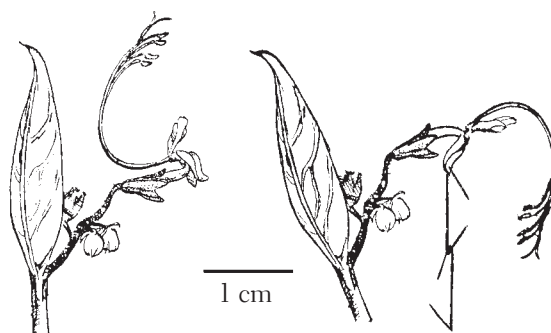


Figure 8. Two staples are shown suspended from the lower petal lobes of a camphor weed flower at the right. Sixty-six mg (two staples) was enough to trigger most flowers and all were tripped by 3 staples (99 mg.)

But some of the plant's lighter insect visitors, like the male mason bees (Figure 7), are not heavy enough to trip most of the flowers. Two male mason bees I collected had weights of 59 and 53 mg—too light to have triggered many of the flowers by their weight alone. Perhaps insects that are slightly too light could supply the additional force required by thrusting their mouthparts into the curved corolla tube to straighten out the S-shaped upper tube.

To test this hypothesis, I tried inserting each of the following slender objects into camphor weed corolla tubes: a bristle of a "soft" toothbrush, a polyolefin bristle of a paint brush, and the mouthparts of a honeybee's head which I held and manipulated with tweezers. Each of these items, when pushed into the corolla, easily flexed the pollen apparatus. Spira (1980) assumed that weight alone causes the pollen dusting function. But these experiments suggest that insects which are too light to trip the mechanism, can supply increments of additional force by pushing their tongue or other mouthparts into the corolla.

People who are open to evidences for design can see that this second and more delicate means of flexing the flower is yet another demonstration of God's providential role. He created little flowers that were preadapted to their insect pollinators. It behooves us in our science to recognize intelligent activity when we see it and to "give credit to Whom credit is due."

Acknowledgments

I thank Ross Marshall for the sketches in this paper and Edna Benzel for help with manuscript preparation. I thank the donors to the C.R.S. Research Fund, interest from which has helped in partial support of this research project.

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Trigger Finger on a Shaky Gun — Stephen Jay Gould's "Take" on Papal Epistemology

"Those whose wisdom is imaginary enjoy the favor of judges similarly qualified..."—Blaise Pascal

In the March 1997 issue of *Natural History*, Dr. Stephen Jay Gould celebrates the reconciliation of evolution and religion in Pope John Paul's recent pronouncements (*L'Osservatore Romano*, 1996) on evolution and Roman Catholic theology. Gould is happy. The Pope is happy. Scientists who wish to retain vague religious sensibilities should be happy. One even gets the impression from the article that God—who-probably-does-not-exist is also happy with the new rapprochement. What is the solution that has escaped so many well-meaning people for so long? It is simple! The answer is NOMA or "nonoverlapping magisteria"—a fancy way of saying, "you stay on your side of the room, and I'll stay on mine." Gould is happy because he believes that he can define both the room and the dividing line, thus giving religion the dark, drafty old closet, while simultaneously touting his respect for and accommodation of religion. Marxism* has always bred clever propagandists. Fortunately, there is only one victim of this arrangement—Truth.

Although an entire review could be written about Dr. Gould's misrepresentation of the positions of both the Pope and those in the modern creationist movement, the fascinating aspect of this article is not so much Dr. Gould's well-known antipathy towards the Biblical Christian position, but the insight that this article provides into his own worldview and its inconsistencies, a worldview aptly anticipated and characterized by Blaise Pascal in the introductory quote. The following series of quotes from the article represent both the main thrust of his discussion of the Roman Catholic position on evolution and his own frame of reference for analyzing that position. What emerges from the article is a prime example of the misdirection and sleight-of-hand skills of a thoroughly modern scientist; using language that resonates with a Christian metaphysical base but that promotes a disguised alternate. The disguise is revealed, however, by the classic symptom of prioritizing method over result: in other words, "science" is more important than truth.

On page 16 of the article, Gould relates his conversation with a group of Catholic priests at the Vatican regarding

creationism: "We all left satisfied, but I certainly felt bemused by the anomaly of my role as a Jewish agnostic, trying to reassure a group of Catholic priests that evolution remained both true and entirely consistent with religious belief." At first glance, you might say, "Whoa! I know what my religious convictions are, and I am familiar enough with evolution to know that this assertion is not true." However, that assessment, while accurate, does not get to the heart of the issue. This reviewer is curiously reminded by this quote of Plato's assessment of the epistemology of the famous sophist, Protagoras. Paraphrased, he asserted that all men are equally right only because all men are equally wrong. For Gould, as for Protagoras, it is not so crucial to define the comparative terms like "evolution" or "religious belief" as it is to maintain flexibility in the definition of "truth", which in turn allows flexibility in any other definition. And truth is obviously defined in terms of Gould's opinions. He offers the optimistic side of Protagoras—"we can all be right"; but the flip side of relativist epistemology—"we are all wrong"—cannot be far below the surface.

The scene of battle shifts then from paleontology, biology, etc. to the age-old question, "What is truth?" Dr. Gould's "fundamentalist" problem is not so much related to the age of the Earth or a global flood as it is with the stubborn refusal of biblical "literalists" to adopt a relativistic epistemology. After all, how can you argue with people who take the ridiculous attitude that God should be found true, even if every man (including experts) are found liars? The authority to define is assumed by Gould. It certainly broadens the way, and allows an accommodation with religious types that share his aversion to absolutes. Unfortunately, the wide path leads to a deadly trap. How can anyone's self-defined reality guarantee any confluence between reality, truth, and human knowledge in general?

The Protestant "fundamentalist hicks" that earn Gould's *faux* sympathy have at least avoided the punji sticks of relativism. They understand that science can only be justified within a framework that allows for a confident conjunction of reality, truth, and human knowledge. In their obviously oversimplified understanding of things, they define truth as knowledge of reality as perceived by God. Truth is absolute because God knows all things. He knows all things because

*Dr. Gould has identified himself as a Marxist, and has been so classified by his peers. See Bird (1991, p. 226) and Ruse (1986, pp. 453, 455, 456; 1983, pp. 3, 18).

He planned and made all things. The created order is organized and purposeful because God is, too. Since God comprehends truth about His creation; man (made in His image) has, too, the potential to know truths about that creation. Since truth is unified by the existence of only one God, truth gained through any method of human endeavor is valid; different methods can achieve the same truth from different directions. Although human finitude and separation from God breed uncertainty, it is mitigated by the direct revelation of truth to man by God. Thus, these “poor fools” are able to pursue their “simplistic” science confident that the perceived physical world makes sense and is predictable, that man is inherently able to comprehend and even manipulate physical reality, that such an activity can be done initially in a piecemeal fashion and confidently integrated in a later step, and that what they are doing has moral value. When science is ripped out of this frame of reference, these justifications fail, and more and more complex ad hoc schemes are devised to allow science to proceed based only on the shaky foundation of human wisdom.

Gould attacks the revelatory position in an effort to deflect problems away from his own. He states on page 18, “...but creationism based on biblical literalism makes little sense in either Catholicism or Judaism, for neither religion maintains any extensive tradition for reading the Bible as literal truth...”. For someone who takes pride in his original insight of “...when puzzled, it never hurts to read the original documents...”, (page 18) it is puzzling that Gould seems to have not bothered with any historical works on hermeneutics. Numerous theologians, Catholic, Protestant, and Jewish have provided interpretive strategies contrary to his understanding. Protestants might point to original documents of Luther or Calvin. However, if he prefers a more modern approach, the International Congress on Biblical Inerrancy Summit I published articles of affirmation and denial on the subject (Geisler, 1979) that would correct many of Dr. Gould’s misapprehensions about biblical theology. For a broader understanding, he might even want to read the Bible, and investigate how it presents itself for interpretation. Is there allegory? Yes. Is there poetry? Yes. Is there metaphor? Yes. Is there assertion of moral virtue? Yes. And, oh by the way, is there assertion of historical fact? Unfortunately for Dr. Gould and other NOMA advocates (NOMAdS?)—[sigh] yes.

Gould’s unwillingness to take his own advice and research the original documents is illustrated by his casual misrepresentation and misinterpretation of Micah 6:8. He states on page 18: “...for a great book tells us that the truth can make us free and that we will live in optimal harmony with our fellows when we learn to do justly, love mercy, and walk humbly.” Why is one not surprised that he has left off the remainder of the verse: “with your God.”? And does the verse purport to optimize human harmony, or rather is it that the preceding clause states that this “advice” is actually what is *required* of the believer by God? How can Gould be required to do anything by a God who does not exist? When Gould walks with his god, he obviously walks alone.

The thesis of the article is expressed in several quotes on pages 18 and 20:

The lack of conflict between science and religion arises from a lack of overlap between their respective domains of professional expertise—science in the empirical constitution of the universe, and religion in the search for proper ethical values and the spiritual meaning of our lives.

And again:

We may, I think, adopt this word and concept to express the central point of this essay and the principled resolution of supposed “conflict” or “warfare” between science and religion. No such conflict should exist because each subject has a legitimate magisterium, or domain of teaching authority—and these magisteria do not overlap (the principle that I would like to designate as NOMA, or “nonoverlapping magisteria”). The net of science covers the empirical universe: what is it made of (fact) and why does it work this way (theory). The net of religion extends over questions of moral meaning and value. These two magisteria do not overlap, nor do they encompass all inquiry (consider, for starters, the magisterium of art and the meaning of beauty). To cite the arch clichés, we get the age of rocks, and religion retains the rock of ages; we study how the heavens go, and they determine how to go to heaven.

No matter how generous the offer of a reservation might be, epistemology, like physics, demands a frame of reference. In epistemology, there is a choice, and Gould has not clearly stated it. The frame of reference can be based on outcome or some other criterion, such as method. In other words, there is either one umbrella domain of truth that supports and integrates all human methods; or there are an infinite number of arbitrary (in this case, method-based) domains, each with their own truth. And since truth is no longer an ultimate constraint, the possible list of “magisteria” is infinite. Any magisterium can be based on the preference of whoever is concerned about any given subject at any given time. Both “science” and “religion” in Gould’s approach are arbitrary constructs that satisfy his personal preferences. Why not others? And why cannot Gould’s “science” and “religion” magisteria be defined with different boundaries? Why only one for “science”? Why not a NOMA (or is it NOMUM, singular) for stratigraphy? Why not further subdivisions within stratigraphy—ultimately, one for each stratigrapher, or is it one for each ripple in each stratigrapher’s stream of consciousness? The primary difference between Gould and God is the fundamental unity or disunity of the domains. God and the foolish Christians recognize “Truth” as the domain that embraces true religion and true science. Loss of the unity of truth means the loss of the possibility of truth, and Gould is back to Protagoras (was it the Sophist or Christian worldview in which modern science developed)?

In all his excitement over the new concordat with Roman Catholic theology, Dr. Gould appears to forget a fundamen-

tal point of the issue he has raised. Does the explanation of history fall within the “science” magisterium or the “religion” magisterium? In the biblical Christian worldview, there is no conflict between revelation in Scripture and revelation in nature. Indeed, the latter would be unknowable apart from rational categories defined and defended only by the former. Thus, even those “misguided” creationists do not seem to have any arguments with definitions of gravity, pressure, magnetism, or any host of other observed phenomena. The arena of conflict is history. Has Dr. Gould missed this crucial point, or as a good Marxist, has he hoped that his opponents have so that he can take it without a fight? The Bible and evolution claim teaching authority with regard to history—both its factuality and meaning. Gould’s approach only works if the Bible is historically irrelevant. Any verifiable historical fact in the Bible sends a brisk zephyr right through the hermeneutical house of cards constructed by Gould.

It is obvious that Gould’s confidence in his evolutionary understanding of nature is so complete that Roman Catholic theology contrary to his beliefs would never make a dent in his faith. Why, then, is he so overjoyed by the Pope’s new teaching? He states on page 61:

In conclusion, Pius had grudgingly admitted evolution as a legitimate hypothesis that he regarded as only tentatively supported and potentially (as I suspect he hoped) untrue. John Paul, nearly fifty years later, reaffirms the legitimacy of evolution under the NOMA principle—no news here—but then adds that additional data and theory have placed the factuality of evolution beyond reasonable doubt. Sincere Christians must now accept evolution not merely as a plausible possibility but also as an effectively proven fact.

Later on the same page, “I believe, with all my heart, in a respectful, even loving concordat between our magisteria—the NOMA solution. NOMA represents a principled position on moral and intellectual grounds, not a mere diplomatic stance.” Who cares (if there is no truth) about “principles” and “moral grounds” (by the way, is “principle” defined here within the religion magisterium or the science magisterium)? Or does Gould recognize that his NOMA solution really is a diplomatic facade for modern sophists who would deny Truth and its Author? Anyone can claim they are acting out principled positions on moral and intellectual grounds, as long as they can define their own personal magisterium. One might even claim in that context that Hitler also staked out principled positions on moral and intellectual grounds. Who is to say in Gould’s world that he was wrong? Was he not just acting within his own “Nazi” magisterium?

The reason for Gould’s newfound enthusiasm for the Pope is finally explained, albeit somewhat indirectly, on page 62. “Religion is too important to too many people for any dismissal or denigration of the comfort still sought by many folks from theology.” The failure of the Russian experiment to reconstruct the “new Soviet man” defines Gould’s problem. How can one get around the fact that man is incurably religious? An accommodation must be reached

with all those stubborn peasants who refuse to abandon religious tradition and conviction and embrace the metaphysics of evolution. This troubles Gould on page 62:

As a moral position (and therefore not as a deduction from my knowledge of nature’s factuality), I prefer the “cold bath” theory that nature can be truly “cruel” and “indifferent”—in the utterly inappropriate terms of our ethical discourse—because nature was not constructed as our eventual abode, did not know we were coming (we were, after all, interlopers of the latest geological microsecond), and does not give a damn about us (speaking metaphorically). I regard such a position as liberating, not depressing, because we then become free to conduct moral discourse—and nothing could be more important—in our own terms, spared from the delusion that we might read moral truth passively from nature’s factuality.

One wonders whether a preference for this view of nature is tied to the circumstances of being a world-famous Ivy League scholar. Would a crippled beggar on the streets of Cairo, for example, feel “liberated” by Gould’s view of nature? Even Gould recognizes that difficulty in the next paragraph, “But I recognize that such a position frightens many people...”. Here finally, is the source of satisfaction that Gould finds in the NOMA solution. It offers its advocates the smug superiority of being liberated from the childish fears of nature, and at the same time allows a warm feeling of caring, sympathy, and tolerance for these weaker, unenlightened human beings who do not understand that religion is a fraud. Although these poor fools deny the obvious facts of existence, the kind benevolence of the “NOMAd” will paternalistically accept them and their escapist theology—as long as the ability to exercise power over the masses remains their prerogative. This is exactly the danger that Pope John Paul II discerned in the encyclical *Centesimus Annus* (The Hundredth Year), where he stated in section 45, “It must be observed in this regard that if there is no ultimate truth to guide and direct political activity, then ideas and convictions can easily be manipulated for reasons of power”. (Neuhaus, 1997; p. 35).

Of course, the prerogative of power is disguised by the utopian dream of human harmony in NOMA-world:

But we would both be enlightened and filled with better understanding of these deep and ultimately unanswerable issues. Here, I believe, lies the greatest strength and necessity of NOMA, the nonoverlapping magisteria of science and religion. NOMA permits—indeed enjoins—the prospect of respectful discourse, of constant input from both magisteria toward the common goal of wisdom. (page 62).

Too bad that the utopian harmony may be disturbed somewhat by the advocates of all the other magisteria clamoring to be let in. And what do you do with the advocates of the magisteria that teach adherents to kill all opponents? But for now, even though these “issues” are unanswerable, there is a certain self-satisfaction in being one of the intellectual elite who can at least move beyond the simplistic, common sense answers of traditional religion and blather

endlessly in search of the unanswerable. Escape from the strictures of absolute truth liberates and steers the path of wisdom. In the NOMA economy of Stephen Jay Gould, does not wisdom equal mere process?

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In his previous three books Hugh Ross espoused many ideas about creation with which members of the CRS disagree. He has been a proponent of the (overlapping) day-age theory, progressive creation, a local flood, and death before the Fall, to mention just a few points of contention. In his latest book Ross does not address these sorts of issues, and so many readers of the CRSQ will find far less about which to quibble.

The thesis of *Beyond the Cosmos* is that a very modern idea of physics allows us to better understand some aspects of God that were previously difficult. The modern physical idea is the multidimensionality of string theory, and Ross suggests that this gives us insight into the extradimensionality of God. String theory postulates that particles of matter can be expressed as vibrations similar to those on physical strings such as found on some musical instruments. For the theory to work there must be six spatial dimensions that are associated with the strings. Everyone is familiar with the three spatial dimensions of width, length, and height, but while the six additional dimensions are mathematically similar to the other three, they do not manifest themselves in everyday life.

It should be noted that while this reviewer has thought that he had some sort of qualitative understanding of this

theory, he has always had a nagging feeling that there is a supposedly obvious aspect of the theory that totally escapes him. It should also be pointed out that this theory is quite controversial in physics today. Not all accept it, and there are other competing ones, though one would not get that from Ross' book. Indeed, in this book string theory is presented as if it is the only viable option.

Ross suggests that Augustine erred when he concluded that God operates outside of space and time. Instead he proposes that in order to operate as He does, the Lord must possess at least one additional time dimension. This along with the ordinary time dimension, the three normal spatial dimensions, and the six additional spatial dimensions of the string theory gives a total of eleven dimensions in which God works. Ross then proceeds to offer resolutions for ageless theological questions, and as in his usual style, he overstates the case. He especially notes that only in the latter twentieth century when we are able to grasp new ideas of physics are we prepared to better understand these problems.

A series of diagrams are used to explain the effects that higher dimensions have upon a lower dimensional world. Readers of the very old book *Flatland* (1953) and a sequel *Sphereland* (1965) will recognize this sort of approach, for

these books also explored the implications of extradimensionality. One problem Ross purports to answer is how God can hear the prayers of millions of people simultaneously. His solution is that God can operate in a dimension of time perpendicular to our time. Thus while an instant occurs in our time, an infinite amount of time could exist in which God could easily hear everyone's prayers. The same reasoning is used to show how Jesus could have suffered on the cross for each of us individually. And all of this time many of us had simply assumed that God just had the infinite capacity to do this. In chapter nine Ross discusses and dismisses many of the common analogies used to illustrate the Trinity. Of course he concludes that only his extra-dimensional illustration is adequate. Some of the other questions that Ross deals with in this way are God's omnipresence, predestination, and the problem of evil and suffering. It's good to know that we finally have the answers to all of these deep questions.

As in his earlier books, Ross uses the principle of causality to argue that the origin of the universe *vis a vis* the big bang requires the existence of a creator, but this is an improper application of the principle. Causality only operates in time. The big bang is not just an explosion of matter and energy but rather it is an explosion of space and time. If the big bang was the beginning of time, then the concept of "before" time = 0 makes no sense. A cause must precede an effect, so if an event has no precedent, it can have no cause. Ross seems to want to have some dimensionality before the big bang. It should be emphasized that this is not what the standard cosmological model is. If this is Ross's intent, then he is creating his own model, and this model is no less metaphysical than other attempted explanations of the big bang (e. g. quantum fluctuations, infinite expansion, budding from a cosmic froth).

On page 35 Ross repeats the often stated concept that relativity theory does not allow for any absolute reference frame with which to measure velocities. Though nearly everyone seems to think that this is true, actually it is not. If it were, it would not be possible to measure the dipole anisotropy in the 3°K background radiation presumably due to our motion through space. I find it shocking that a man of Ross' credentials does not know this. Nevertheless, Ross builds upon this to conclude that the universe has no center. Again, this is simply wrong. While most modern cosmological models assume that the universe has no center, this is not demanded by relativity. Indeed, many readers are aware that the Humphreys cosmology rejects this assumption. It is a little known fact that the earlier versions of what has become known as the big bang model had a center and an edge.

In discussing the Heisenberg uncertainty principle on page 37 Ross says: "A certain amount of ignorance for the

human observer is fundamentally built into the sub-microscopic world of quantum mechanics. Though God can describe all the properties of quantum particles and quantum events, humans cannot." But the uncertainty principle is not an uncertainty of ignorance; it is a fundamental uncertainty imposed upon the world by the wave equation of quantum mechanics. To simply posit that God knows everything does not make it so in this context. Some of the greatest minds of twentieth century physics have wrestled with this question. For instance, in criticizing the Copenhagen interpretation, Einstein is reported to have said, "God does not play dice with the universe." Apparently Einstein realized the consequences of the uncertainty principle better than Ross.

On pages 106-107 is found a very interesting quote: "When Jesus of Nazareth died on the cross, much more happened than a physical death. The book of Romans reminds us that sin entered the world through one human's decision to disregard God's way and to act on his own authority. This first expression of sin did not cause Adam and Eve to immediately drop dead physically. Physical death came to them some time later." This statement seems quite contrary to earlier ones by Ross where he taught that the death of the curse only referred to spiritual death. It is unlikely that Ross has changed his position on this, so what other possibilities exist? He could have innocently misstated so that one would get the wrong conclusion. It is also possible that Ross has cleverly crafted his words to obscure his true beliefs on this subject. In his other three books Ross certainly has avoided some other issues that would prove to be unpopular among much of his intended audience. Two examples are his teachings on a local flood and the overlapping nature of the days of creation.

Some of the comments on the dust jacket suggest that this book is a theological treatise, though it would be in the context of modern physical ideas. The thesis that only twentieth century physics has enabled us to understand many great theological questions strikes me as arrogant. Given how little is devoted to the question of origins, one may wonder why this book is reviewed here. As a leading critic of recent creation, it behooves us to stay abreast of Ross' work. Perhaps I have nit-picked on some subjects, but I believe that his premise that only modern theories of physics can illuminate many Biblical doctrines is flawed. I have to agree with Augustine that space and time are God's creation and as such God operates outside of and transcendent to them. Ross offers some interesting thoughts, but his approach to these questions is not to be preferred.

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Letters to the Editor

Reply to Don DeYoung's Letter on Animal Death and the Curse

DeYoung began his letter in the June 1997 issue of the Quarterly with this question. Did animals die before the curse of Genesis 3? He then makes this statement; This is the position of old earth creation, the gap theory, day age theory, and theistic evolution. That is true. But I, a young earth creationist, believes that the death of animals was not related to the curse.

DeYoung's position is based on Romans 5:12: "Wherefore, as by one man sin entered into the world, and death by sin; and so death passed upon all men, for that all have sinned." He then comments that "The usual explanation is that the death of Romans 5:2 describes physical or spiritual death of humans, not animals. However this explanation is not convincing." But it was convincing to me for several reasons.

Romans 5:12 does *not* say that "death passed upon all men and animals." It only mentions men with the explanation that "all" men sin. If animals had been included then it would mean that all animals also sin. I do not believe they sin for their lives are lived by their God-given instincts.

1 Corinthians 15:22, "For as in Adam *all* die, even so in Christ shall *all* be made alive," amplifies the position that animals were not included in the curse. We creationists make much of the numbering of creation days that indicates that those days were 24 hour days. Everywhere in Scripture when the word day is amplified by a number it always means a 24-hour day. Therefore it must also mean that in Genesis 1. Thus, the word *all* must refer to the same thing each time it is used for comparison of two things as in the above verse. If animals were included in the "all die," then animals have to be included in the "all be made alive." This would mean that every piece of beef, chicken, or fish we have eaten will be "made alive" someday as humans will be. I do not believe that and do not think anyone else does either.

There is a second reason for believing that animals did not die because of the curse. In Genesis 1:22 God told the sea and air creatures to "Be fruitful, and multiply, and fill the waters in the seas, and let fowl multiply in the earth." I believe we can assume he told the dry land creatures to do the same. Then, in Genesis 1:28, God blessed Adam and Eve, "and God said unto them, Be fruitful, and multiply, and fill the earth."

My belief is that God populated the whole earth with animals while He only created two humans. At the rate of reproduction even if the animals had all started with one pair they would have filled the earth long before humans did. This would have been a problem for humans to fulfill the instruction for them to fill the earth unless the animal population decreased as the human population increased. Even if the humans had never sinned the animal population would

have to die off in order for the humans to obey God's command.

My solution to this problem is that every creature was created with a certain life span. When that time was up the creature would have died. Not because of sickness or predation, but because their God-given life span had been reached.

Of course dead animals just lying around decaying would have spoiled the environment so my idea is that today's predators also were given the job of "housekeeping." They were to eat the dead and so rapidly return the creatures to the earth. Until the Flood they ate vegetation. After the Flood they became today's carnivores but in the millennium they will return to the vegetable diet.

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DeYoung's Reply

I appreciate Mr. Peterson's input on the important topic of animal death. He believes that such death was a natural part of the original very good creation. But then the curse had no apparent effect on the animal world, in conflict with Genesis 3:14 which states that all animals were cursed, especially the serpent. Also, if not death, in what sense does the whole creation groan, waiting for the renewal as described in Romans 8:22-23? Surely God knows the limits of earth population, and if no fall had occurred, biological and geographic solutions were in place to avoid overpopulation. I agree that the all in Romans 5:12 concerns the death of mankind. Suffering and death in the animal world is included only as an implicit result of man's fall. I further agree that animals do not commit sin as we do, although they experience its consequences, as in the Genesis Flood.

There is an additional point of interest. In the future millennial state, animals will apparently revert to an herbivore nature (Isaiah 65:25). During this same millennial period, however, Ezekiel 47:10 describes many fisherman along the shores of the Dead Sea, now made into freshwater. If the vegetarian diet includes mankind, then fish must be in a separate category from typical meat, and valid for millennial food.

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Government Distribution of Anti-Creationist Material

While perusing the government archives on Compu-serve, I came across the following note:

Separation of Church and State?

To give equal time to all sides, many schools are teaching creationism. The Anthropology Outreach Office has put together a free teaching packet titled "Creationism" for grades K-12, which covers issues surrounding creationism and education for teachers and administrators from all disciplines. It includes reprints of articles on the subject by scientists, educators, and others. For your copy, contact: Anthropology Outreach and Public Information Office, National Museum of Natural History, Room 363, MRC 112, Smithsonian Institution, Washington, DC 20560; 202-357-1592.

As my wife is a certified teacher, we sent for the packet, expecting to receive information pretending to support both sides but strongly biased toward evolution. What we got was some of the most violently anti-creationist material we've ever seen. The following articles are included in the packet:

- Asimov, Isaac. 1981. The threat of creationism. *New York Times Magazine*. June 14. pp. 90-101.
- Boadt, Lawrence. 1982. Countering the creationists: The theologian. *Academe* 68(2):17-20.
- Callaghan, Catherine A. 1980. Evolution and creationist arguments. *The American Biology Teacher* 42: 422-426, plus three page supplement.
- Cole, John R. and Laurie R. Godfrey. not dated. *Evolution and creationism: A partial bibliography*, distributed through the American Association of Physical Anthropologists.
- Creationism in the Schools: The Arkansas Decision (Reprint of Judge Overton's Decision). 1982. *The American Biology Teacher* 44: 172-179.
- Draft of a bill written by creationists to legislate the teaching of creation-science in public schools. It is typical of the type of bill introduced into legislatures which tries to eliminate all religious connotations of creationism and treats creationism as a science.
- Eldredge, Niles. 1981. The origin of the specious and the dissent of man: Creationism isn't science. *The New Republic* 184(April 4): 15-17, 20.

Is DNA Really a Helix?

The "double helix" of Watson and Crick is the structure into which highly-purified DNA *spontaneously* winds itself under specific laboratory conditions. For close to a half-century, it has been almost invariably presumed to be the structure of DNA in living creatures. The fact that DNA in cells and viruses is *never* "pure", but is invariably complexed with protein, has done little to dampen the enthusiasm for the "double helix."

To those who deny God's Creation, asserting that life is nothing more than a billions-of-years-old chain of chemical

Godfrey, Laurie R. 1981. The flood of antievolutionism: Where is the science in scientific creationism? *Natural History* 90(6):4-10.

Gray, J. Patrick and Linda D. Wolfe. 1982. Sociobiology and creationism: Two ethnosociologies of American culture. *American Anthropologist* 84(3): 580-594.

Hammond, Allen and Lynn Margulis. 1981. Farewell to Newton, Einstein, Darwin... *Science* 81 2(10): 55-57.

Lanouette, JoAnne. 1982. Creationism $\neq$ science. *Anthropology Notes* 4(1):1-3, 13-14.

Lewin, Roger. 1982. A tale with many connections. *Science* 215:484-487.

Lewin, Roger. 1982. Where is the science in creation science? *Science* 215: 142-146.

Moore, John A. 1982. Countering the creationists: The scientist. *Academe* 68(2):14-17.

Moyer, Wayne A. 1981. The implications of balanced treatment, paper presented at the Charlotte meeting of the North Carolina Science Teachers Association, November 13, 1981.

Moyer, Wayne A. 1981. Arguments for maintaining the integrity of science education. *The American Biology Teacher* 43: 380-381.

The nature of knowledge. 1981. *The Economist*, December 26, pp. 99-104.

Numbers, Ronald L. 1982. Creationism in 20th-Century America. *Science* 218:538-544.

ONeil, Robert M. 1982. Creationism, curriculum, and the Constitution. *Academe* 68(2):21-26.

Pollitzer, William S. 1980. Evolution and special creation. *American Journal of Physical Anthropology* 53:329-331.

Skow, John. 1981. The genesis of equal time. *Science* 81 2(10): 54,57-60.

I pose a question to those readers who are knowledgeable in law. Contrary to the above note, is it not illegal to teach creationism in a government-sponsored school? A lawyer friend told me it's legal within a class on religion, history, culture, etc., but illegal within a class on science. If so, is it not also illegal to use government funds to copy and distribute anti-creationist material in the name of science?

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"accidents," this form of DNA is very appealing as the starting point for a Darwinian-type theory of spontaneous macromolecular evolution. Conversely, the finding of an entirely *different* form of DNA in cells; one which was *contrary* to anything which could be readily imagined to have developed spontaneously might encourage doubting scientists to reconsider the role of God in Creation.

Since the discovery of circular DNA by Cairns (1963a, pp. 208-213), a small but steady stream of stubborn, non-conforming molecular biologists have protested the blind

acceptance of the “double helix”, proposing instead that the two strands of DNA are topologically parallel. See, for example, Rodley, Scobie, Bates and Lewitt (1976, pp. 2959-2963), Sasisekharan, Pattabiraman and Gupta (1978, pp. 4092-4096), Pohl and Roberts (1978, pp. 383-402). The basic underlying motivation for this non-conformity stems from the observed tendency of naturally-occurring DNA to be *circular*. If circular DNA chromosomes were really helical, then they would consist of pairs of single-stranded circles *locked together* topologically by thousands of helical turns (make a string model if you cannot picture this). Such a structure *could not replicate* unless all of its thousands of interlocking twists were unwound and re-wound in each generation. Considering the awkwardness of this requirement, one might well wonder why models of DNA *other* than Watson-Crick have not been seriously entertained by the scientific establishment.

The reason is that early alkali denaturation studies of small circular viral DNA's consistently showed that the *single strands did not separate* when the double-stranded structure was denatured. This was no more or less than what was predicted by the Watson-Crick theory, where a pair of complementary single-stranded circles was presumed to be *topologically linked*, and therefore not physically able to separate upon denaturation. The fact that the denaturation experiments bore this out was taken to be powerful evidence in support of the Watson-Crick structure; so powerful, in fact, that consideration of any other structure was quite evidently deemed to be a waste of time.

I have found that the resistance of small circular viral DNA to denaturation can be readily explained *without* invoking topological linkages. If, as I strongly suspect, it can be shown experimentally that the single strands of circular double-stranded DNA are *not* topologically linked, then the Watson-Crick structure is wrong for native DNA.

I strongly suspect that the Watson-Crick structure is wrong for native DNA.

Reviewers of manuscripts on this subject typically display an overwhelming inability to grasp the motive behind them. Why bother? The answer is really quite simple. When circular DNA was first discovered, the problem of unwinding the presumptive twists during replication was immediately recognized (Cairns, 1963b, pp. 43-46). There were two obvious possible explanations: (1) the presumptive twists did not exist, and circular DNA therefore did not have the Watson-Crick structure, or (2) the twists *did* exist, and had to be unwound every time the DNA replicated. Of these two obvious possibilities, *only the second was ever mentioned*. Why was the first not even mentioned?

I have always believed that the establishment's insistence upon the Watson-Crick structure was more representative of egocentricity than good science. My own father believed that the discovery of the chemical structure of the hereditary material elevated man to the status of a “near-god”, and I am thus well-accustomed to this kind of apostate thinking. Those readers who doubt that today's scientists think this way ought to consider the following. A number of the Nobel

laureates responsible for our supposedly “godlike” knowledge of the chemistry of the physical body have branched, of late, into the field of “chemical basis of consciousness”; assuring us, in effect, that the immortal soul is *also* merely a routine chemical reaction; one which will presently be elucidated in all its details. Of course, no “chemical soul” has been brought forth by any of this. But the belief that science will elevate man to the status of a “god” remains disturbingly pervasive, and, in my opinion, has caused the “double helix” to become the modern-day scientific equivalent of an idol; an object of veneration, not to be questioned.

At the outset of this work, I was faced with a number of what seemed to be formidable barriers, if the non-denaturation of circular DNA was going to be explained without invoking topological linkage. These were: (1) There had to be left-handed DNA as well as right-handed DNA, (2) right-handed DNA had to be more stable than left-handed DNA under physiological conditions, but left-handed DNA had to be more stable under denaturing conditions, and (3) there had to be a reasonable structure for denatured circular DNA which remained double-stranded, but *not* by virtue of topological linkage.

Left-handed DNA had just been discovered when I began my own inquiry into this problem. Considering the fact that earlier workers had denied that left-handed DNA was even possible (*i.e.*, Langridge *et al.*, 1960, pp. 38-62), its discovery emboldened me to stick with this endeavor as long as there was ongoing progress.

The progress did, in fact, continue, until all the requirements for the theory were eventually met. Not only has the differential stability of right- and left-handed DNA at physiological and denaturing conditions been demonstrated, but a detailed molecular mechanism now exists to explain it. As for the non-topologically-linked structure for denatured circular DNA, it is now possible to base it upon the principle of the phosphate groups pointing in, toward the center of the helix. This was, curiously enough, the essential feature of the structure for DNA first proposed long ago by Linus Pauling (Pauling and Corey, 1953, pp. 84-97). Pauling's idea was totally abandoned in the wake of Watson and Crick's discovery, but it has now resurfaced by virtue of the discovery of phosphates in DNA helices in at least two different viruses! See Day, Wiseman, and Marzec, 1979, pp. 1393-1403; Liu and Day, 1994, pp. 671-674.

A detailed description of the denaturation of topologically-non-linked circular duplex DNA would vastly exceed our space limitations here, and therefore cannot be provided. I will, however, be pleased to make the full details available to any reader who is seriously interested.

There is a bit of data called the “pH vs. sedimentation coefficient” curve for small circular DNA, which is a complete description of the alkali denaturation of small circular DNA. It has a rather unique shape, not all of which is readily explained by the Watson-Crick theory. It *is* all explained, however, by the non-topologically-linked theory I have introduced here.

A consideration of the alkali denaturation data, com-

bined with a consideration of certain other select data (some of which is unpublished, and has been brought to my attention under the most singular of circumstances), leads to the conclusion that the theory proposed herein can be tested with a few simple experiments. All that is required is a laboratory, a capability of isolating (or purchasing) complementary single-strands of circular DNA, a means of distinguishing between various DNA forms (*e.g.*, analytical ultracentrifugation, electrophoresis, etc.) and a pH meter. The DNA must be denatured/renatured under a very particular and narrow range of pH, ionic strength, and temperature. The required set of necessary conditions of pH, ionic strength and temperature are sufficiently *non-obvious* that the experiment has never been done inadvertently, and it has certainly never been done intentionally.

I have never done it, because I have no laboratory.

Anyone with the above-referenced research capabilities, and, additionally, a will to proceed in this endeavor, should contact me at the address shown below, and I will provide all the essential information to complete this research.

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A Proposal for Peace Between Proponents of Old Age and Young Age Creation

I have been concerned about the animosity between some individuals on either side to the old age-young age controversy. My concern goes beyond the intellectual arguments to the spiritual implications of unloving attitudes. The effect of interpersonal conflict on rational discussion is such that it becomes difficult for logic to prevail. Also, estrangement from fellow believers robs us of joy and victory.

Great revivals of the past were fueled by confession of sins and reconciliation of brothers and sisters. Even if the fault is on both sides, the first move has to come from one or the other. I submit the enclosed "Peace Proposal," after consultation with several individuals on both side of the issue, as a starting point. I have no master plan for its use, but pray that the Master Himself use it as He sees fit. If today you hear His voice, do not harden your heart.

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Peace Proposal Between Old Age and Young Age Christian Creationists

Recognizing that a believer in Jesus Christ may be wrong about certain points of doctrine and other facts about reality and still be a believer,

And recognizing that God has chosen to do his work through fallible and weak human beings, such that He is often found to be using people who are imperfect and subject to human foibles, (for example, Jonah and Peter),

And further recognizing that it is possible to agree on certain points and cooperate in certain tasks with those who may disagree with us on other points, even though the points of disagreement may be quite substantial,

And in view of the Scriptural admonitions to love one another, speak the truth in love and come humbly to a brother overtaken in a fault,

We consider it important that a peace be made between the old and young age creationists, which does not minimize the differences and does not stifle dialogue but acknowl-

edges points of agreement and establishes Scripturally sound principles for interaction.

In view of all this, we prayerfully ask *young age creationists* to commend and pray for the courageous old age creationists who are standing up in the secular marketplace, pointing their colleagues and other seekers to the hope beyond the material world and clearly owning their own allegiance to the Creator. The Lord uses many methods and avenues to draw precious souls to Himself and Jesus said that those who were not against Him were for Him when the disciples questioned the qualifications of others claiming to work in His name.

An old universe, even if it is considered by young agers to be a “worst case scenario,” still points to a creator and this fact can be used by the Holy Spirit to lead some people to surrender their lives to the Lord Jesus Christ. Starting a conversation with an unbeliever who accepts the “Big Bang” and showing that it logically leads to a beginning and also to the need for an external cause may break down some barriers and be sufficient to provoke some individuals to move in the direction of intellectual honesty and openness to spiritual realities.

In view of all this, we prayerfully ask *old age creationists* to

commend and pray for the courageous young age creationists who stand not only against philosophic materialism but also against scientific orthodoxy. Understanding the history of science to be filled with the rise and fall of theories and occasional reversals of what was once accepted as unquestionably true, it is prudent to not dismiss heterodox interpretations as automatically false, even if they provoke scorn from the establishment. One example being the switch from nearly universal dismissal of “continental drift” to the nearly universal acceptance of “plate tectonics.”

A young Universe needs to be acknowledged as, at the very least, *compatible* with the language of Scripture if not the only possible explanation. It needs to be acknowledged as well that the Scriptural and doctrinal concerns of the young agers are genuine and need to be addressed within those disciplines.

Calling for a humility that comes only from a walk of obedience and trust in our Creator and Redeemer, we prayerfully ask both sides to vow before the Lord a willingness to lay aside personal pride and past hurts in order to further the Kingdom of our Lord Jesus Christ. We call for a willingness to truly listen and genuinely love, and beyond that, the courage to change opinions and positions if the facts warrant.

Tasso's Creation

Anyone interested in the historic and literary creationist cause should be aware of Torquato Tasso's *Creation of the World* (1594), available in an edition of the *Medieval and Renaissance Texts and Studies since 1982* (translation from Italian by Joseph Tusiani). A product of the Italian Counter-Reformation, Tasso is best known for *Jerusalem Delivered* (1575), an amalgam of historical names and incidents of the First Crusade with elaborate, romantic fiction of the sort presented earlier in the century by Ludovico Ariosto's *Orlando Furioso*. Despite Tasso's background in verse fiction, his *Creation of the World* is a noble, if limited, effort to rally the Christian world to renewed devotion to God in the context of faith in the seven-day Creation.

Tasso's *Creation* is lightly regarded by twentieth-century critics, one suspects because of its deliberate seven-day creationism.

A Protestant fundamentalist premillennialist like myself approaches Tasso with mixed feelings. *Creation of the World* contains a passage directly attacking premillennialism, which I treasure above all things, in a context defending the Papacy through an appeal to an amillennialist concept of a metaphoric “eighth day” of Creation not to be interrupted by apocalyptic revolution. Nevertheless, I sense an analogy between the Counter-Reformation, in its effort to rally the cause of Christian faith in general against what it regarded as Protestant “heresy,” and the modern plight of Christian fundamentalists like ourselves, who are being vilified by institutions such as PBS for preferring the Bible to modern thought and bad morals.

Late last year, I gained an opportunity to place three sonnets on the International Poetry Hall of Fame at www.poets.com and included a sonnet based on a response to Tasso's account of the nature of water in the canto on the Third Day. At one point, the “prescientific” Tasso confronts the basic assumption of naturalism that water moves according to its own law apart from divine initiative:

But if the water's very nature is to flow right down and not to stop on high, thus seeking in low regions its repose, to what avail was the divine command? (11. 140-43)

To this the poet replies with the unscientific thought that different bodies of water appear to follow different laws as though actuated by specific providences:

But not all seas are ruled by the same law, for in diverse way they grow or wane, varying speed and order in their waves. Near Taormina, oftener than not, and at Euboea, as we read, the sea moves forth and backward seven times a day—a wonder, this, that made a lofty mind end his existence, wearisome and worn, studying nature's most mysterious ways and saddened by the fact that she conceals all of her secrets in her dark, deep womb (11. 188-98).

The passage refers to Aristotle, who died at Chalcis, on the island of Euboea in 322 B.C.

No matter how unscientific Tasso might have been in dealing with cause-effect mechanisms, poets deal by instinct with interpretations independent of such mechanisms by reasoning, not from cause to effect, but from

observed effect to effect in acknowledgment of design such as the coincidence that Comets Hyakutake and Hale-Bopp arrived at much the same point on the two-dimensional face of the constellation of Perseus near the Pi star on April 9 of two successive years, 1996 and 1997. "Superstition" means mistaking such coincidences for cause-effect mechanisms; but "poetry," in part, results from noting how such coincidences harmonize with other coincidences to form patterns of providential outcome such as answers to prayer. In the Italian Renaissance period, authors such as Tasso were capable of moving freely from one sort of logic to the other and back again in such a way as to resist atheistic naturalism by attributing events to the personal mind of a designing God.

My sonnet "Elementary" reflects both the influence of Tasso's poem and a longstanding belief of the "poetic" or effect-to-effect type that the old-world tetrad of earth, air, fire, and water corresponds to our modern analysis of the natural cosmos into "elements" of matter ("earth"), space ("air"), energy ("fire"), and time ("water," fluid in general, and metaphysical fluid or chains of events). The "conceit" of the sonnet is that these four elements will somehow be realigned or redesigned in our future resurrection bodies:

The poet Tasso sings of water's grace
Because of how it gathers as it should
Since God the Maker made its going good
According to its flowing into place.
It complemented every other race
Of elements that wrapped the rooted wood:
Leaf-stripping wind, dry earth where reaching stood,
And bolting fire that scarred the wooden face.
These elements that struggle with a tree
Will rest in peace when life comes back to me
In form of feet that flow like sparkling water,
Strong hands that know the ways of careful matter,
A torso shaped of wind that takes on form,
And eyes like flashing liberty of storm.

Anyone interested in the context where this sonnet appears may locate it at www.poets.com/directory.html where an alphabetical list includes my name.

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Mars Landing Suggests Questions

One of many striking things connected with the recent Mars landing was the scientists' announcement that evidence indicated a prior "catastrophic flood" (their words) on Mars. Assuming evidence supports such a flood, this raises a few intriguing questions.

Was it necessary that a flood occur there at the same time it occurred here? In any case, did the flood originating from a much more dense atmosphere deplete the atmosphere to its present level? This was not the consequence, obviously, of the flood on earth, for good reason.

Which leads to another intriguing question. If scientists

can be so forthright and aboveboard concerning a flood on Mars, why can't they be the same about a catastrophic flood on earth when the evidence is all about them? The answer is, of course, that aside from the fact that a productive earth (unlike Mars) tends to hide its scars (hence the evidence), such an admission where a human race is involved would knock the props (and there are many) from under evolution.

What a difference a planet makes!

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Quote — Of the Darkness upon the Deep, and of the Invisible and Formless Earth.

And now this earth was invisible and without form, and there was I know not what depth of abyss, upon which there was no light, because it had no shape. Therefore didst Thou command it to be written, that darkness was upon the face of the deep; what else than the absence of light? For had there been light, where should it have been but by being over all, aloft, and enlightening? Where then light was not, what was the presence of darkness, but the absence of light? Darkness therefore was upon it, because light was not upon it; as where sound is not, there is silence. And what is it to have silence there, but to have no sound there?

Hast not Thou, O Lord, taught his soul, which confesseth unto Thee? Hast not Thou taught me, Lord, that before Thou formedst and diversifiedst this formless matter, there was nothing, neither colour, nor figure, nor body, nor spirit? And yet not altogether nothing; for there was a certain formlessness, without any beauty.

Augustine. 1997. *The Confessions of St. Augustine*, Electronic Edition. Pusey, Edward Bouverie, Editor. Parsons Technology. Hiawatha, IA. Originally translated into English in 401 A.D. Book 12, Chapter 3.

Does Biochemistry Require the Specificity of Carbon Atoms?

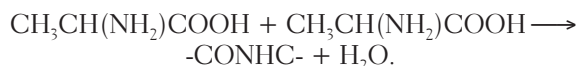
Edward Boudreaux, prompted by exo-evolutionist claims, recently investigated, using computational methods, the possibility of non-carbon-based biochemistry (CRSQ, 34:56). The carbon substitute chosen for study is the element silicon which forms four bonds like carbon and, has some limited catenation (self-bonding) ability. The hypothetical products proposed, by Boudreaux, are formed by substituting silicon in place of carbon for selected amino acid species. Boudreaux hopes to show, based upon comparative bond studies, that these pseudo-amino acids or silicino acids do not vindicate the evolutionists supposition of a non-carbon chemistry of life. He believes that biochemistry does require the specificity of carbon atoms to provide the necessary biochemical structures and functions... (which) ...must be validated with the empirical scientific data (or the calculations presented in his paper).

Overall, I agree with Boudreaux that "biochemistry does require the specificity of carbon atoms..." Proving this assertion based upon computational methods, however, seems a little unnecessary. In fact a quick functional group analysis of the proposed molecules rapidly eliminates this system from serious consideration.

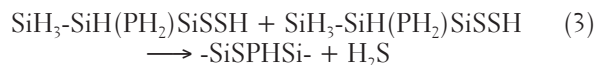
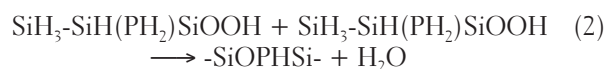
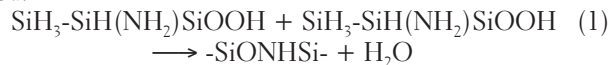
The following species or modifications were offered in Boudreaux's work:

- 1) $\text{SiH}_3\text{-SiH(NH}_2\text{)SiOOH}$,
- 2) $\text{SiH}_3\text{-SiH(PH}_2\text{)SiOOH}$, and
- 3) $\text{SiH}_3\text{-Si(PH}_2\text{)SiSSH}$.

Each represents a combination of atoms patterned after glycine [$\text{CH}_3\text{CH(NH}_2\text{)COOH}$] and will hereafter be referred to by the above reference number. These compounds, when joined together are similar in structure to their carbon peptide counterparts (Scheme 1):



Thus, the following pseudo-peptide linkages are proposed:



To begin with, it might be helpful to establish some criteria with which to evaluate these compounds and equations. Firstly, it must be understood that the system proposed, while hypothetical, should adhere to the simple chemical principles of molecular stability and among functional groups within the proposed system compatibility. Bond stability studies are the sole consideration in Boudreaux's work and will not be reviewed here. Functional group analysis will be applied in the present work to examine the question of compatibility. When applied, serious theoretical and practical difficulties become immediately obvious within the proposed system.

Functional groups are active molecular or atomic substituents within a molecule. As the name implies, they are functional or potentially reactive towards other groups on the same molecule or a nearby molecule. Thus, comparing and contrasting functional groups helps the chemist to predict the behavior of a compound or mixtures of many compounds. Compound 1 has a variety of functional groups. -SiH_3 , -NH_2 , Si-Si , and SiOOH , which have unique characteristics and reactivities towards other species. The silyl group (SiH_3) for example, is extremely sensitive to air, forming spontaneously flammable or explosive mixtures (see silanes ($\text{Si}_x\text{H}_{2x+2}$), *Encyclopedia of Chemistry*). Moreover, silanes in the presence of water, containing minute traces of hydroxyl ion, form hydrogen gas and silicic acid. The reaction with water is also accelerated with organic or inorganic bases. Returning to equations 1 and 2 and noting the presence of the silane-containing species we recognize an immediate problem. These condensation reactions generate water as a byproduct! Also, the amine functionality NH_2 (compound 1) is basic, which accelerates reaction between the silyl group and water. Therefore, equations 1 and 2 would, at least, yield an unwanted complex mixture of silicic acid species and hydrogen gas, not the simple peptide bonds proposed.

The silane functionality is also troublesome when selecting a solvent. A biochemical system patterned after our own requires a solvent to facilitate transport and reaction of chemical species dissolved within. As shown above, that solvent cannot be water for the proposed silicon system. Yet, only an aqueous caustic solution can solvate silicic acid and presumably the proposed pseudo-amino acids (according to the *Merck Index* silicic acid is insoluble in water, but can be solvated in the presence of a caustic such as sodium hydroxide). While we might be able to guess at an alternative solvent system or suitable strategy to facilitate these reactions, such proposals would no longer follow the simple substitution model under examination. For example, a blocking group might be used to protect the silyl moieties from hydrolysis in equation 1 and 2, thus, on paper making equation 1 feasible. However, the steric (or size) effect of such changes would present other problems.

Still other serious problems become apparent because of the silane functionality. For example, how will myoglobin and hemoglobin be re-engineered? Recall that these biomolecules are directly involved with carbon dioxide/oxygen exchange and transport. If oxygen comes in contact with the silane functionality rapid and vigorous reaction follows, thus consuming the pseudo-hemoglobin and myoglobin. Therefore oxygen respiration is simply impossible. Again we might simply design around the problems but to what end and how will these changes effect other systems?

Therefore, a functional group analysis clearly shows: that equations 1 and 2 would lead to a complex mixture of silicic acid species, assuming the reactions would proceed at all; and 2) oxygen and water, the two agents that power and support terrestrial life, cannot be in the presence of the pro-

posed pseudo amino acids or pseudo peptides else rapid degradation would follow. Left out of this analysis is the chemistry of phosphines, amines and their hypothetical reaction products with functional groups on the proposed molecules. In short, a biochemical system must consider solvent, temperature, pressure, compatibility of compounds, systems and functional groups and a host of other factors. It is simply wrong to undertake a study of this sort without carefully considering the chemical implications.

Finally, I applaud Boudreaux in his effort to identify and tolerate studying the possibility of silicon based biochemistry patterned after the carbon model. I say tolerate because, through a simple functional group analysis, the proposed species seem little more than improperly formulated curiosities at best. If an exo-evolutionist truly proposed this sub-

stitution system he should consider learning a little fundamental chemistry. As demonstrated, a quick tour around these molecules reveals a sophomoric understanding of chemical principles which if expressed in a living creature has characteristics best addressed in the Sunday "funny papers" rather than a reputable scientific journal. For this ungainly creature would spontaneously combust in trace amounts of oxygen or crystallize with a few drops of water. Indeed, a child armed with a water squirt gun could repel such an invasion.

God bless.

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Sequence Stratigraphy and the "Black Hole" of Naturalism

I enjoyed the recent article by Mr. Allen Bartlett, "Sequence Stratigraphy: Value and Controversy—For Whom?". Mr. Bartlett provided a knowledgeable summary of many aspects of sequence stratigraphy, and his endnotes and appendices were quite helpful. It is also refreshing to see reference made to the incisive 20th century theologian, Dr. Francis Schaeffer. I hope that Mr. Bartlett continues to contribute to CRSQ on a regular basis.

As he does, there are several questions that he might consider in his future thought on the relationship between sequence stratigraphy and uniformitarianism. He recognizes sequence stratigraphy as an innovative methodology biased away from time and toward physical process. He states that "...sequence stratigraphy is a non-time dominant method of doing geology." A more revealing line of questioning might be to speculate on whether sequence stratigraphy is non time-dominant because geologists have philosophically moved away from an earlier confrontational approach to geologic time. In other words, have geologists ceased trying to prove long time spans, viewing time as a primary assumption and no longer an open scientific issue? In naturalism, where science and metaphysics are indistinguishable on a practical level, then such an accommodation should certainly be suspected. The trend in geology toward environmental (process) interpretation, and away from "classical" stratigraphy has been evident for over 30 years in facies modeling. Is sequence stratigraphy really something totally new, or is it simply the next step along this path—a path which has never detoured away from uniformitarian presuppositions on a fundamental level, in spite of an apparently unlimited flexibility on a scientific level? Is sequence stratigraphy fundamentally innovative, or like punctuated equilibrium and Tycho Brahe's epicycles, is it merely a sophisticated cosmetic change? Francis Schaeffer might have encouraged a "worldview" analysis of such a major issue. In Reed and Froede (1997; see especially pp. 286-288) such an analysis was introduced, and the conclusion was not hopeful. *But there can be no symmetry between the biblical Chris-*

tian models and those of the naturalist-uniformitarian system, because the uniformitarian geologic column is biased towards history as a continuum, expressed by its dependence on evolution. (p. 288, note also Figure 2 and accompanying text of Reed, 1996). However, I sincerely hope that Mr. Bartlett is correct in his analysis, and that uniformitarian geologists become more sympathetic to a biblical Christian interpretation of history. Demonstration of Mr. Bartlett's thesis could be realized by the publication of a sequence stratigraphic analysis that challenges and alters the geologic column in some fundamental manner. If such a study is not forthcoming, then sequence stratigraphy may be destined to join other methodological innovations in the black hole of naturalism.

I agree with much of Mr. Bartlett's discussion of the tension between time and process in modern geology, and encourage him to consider the underlying naturalist-uniformitarian dilemma of the need for physical continuity (since there is no metaphysical reality) in an empirically discontinuous world (Reed, 1997). If sequence stratigraphy cannot resolve this tension, then can it help define the goal of creationist geology, or is it just a useful methodology? Mr. Bartlett states on page 6, "However, a new system of time reference is wastefully repetitious. Likewise, Davison's (1995, p.229) suggestion that 'creationists need to reinterpret the rocks' moves us dangerously back to square one—to the days preceding William 'Strata' Smith..." The central question is whether or not the geologic column is essentially a descriptive or interpretive construct. If its structure is derivative of and dependent on the 19th and 20th century uniformitarianism that Mr. Bartlett asserts has recently been discarded, then does it not seem logical that the column also should be fundamentally reappraised, as suggested by Walker (1994), Froede (1995), and Reed et al. (1996)? If uniformitarianism is dead, let us either burn or bury the body. And if we are confronted by almost two hundred years of error in interpretation because of the application of a fallacious paradigm, then is the move back to "square one" (in

terms of reinterpreting data gathered during that period) not required? Did not Copernicus also move dangerously back to the days preceding Ptolemy?

If creationists ever agree to the goal of a new synthesis (compressed geologic column vs. something different), then the second question to be addressed will be how to get there. Mr. Bartlett appears encouraged that the path from diluvialism to Cuvier's catastrophism to uniformitarianism might be reversed. Is it beneficial for biblical catastrophism to be opposed by naturalistic uniformitarianism, or by naturalistic catastrophism? I believe that what is clearly required is the move to a different playing field—direct opposition to naturalism in all forms by Christian theologians and philosophers who are not frightened away when naturalism assumes its disguise of "science." The role of geology in that effort is less obvious, but must include some degree of original reinterpretation of discoveries made under the dominance of the uniformitarian paradigm. I look forward to having Mr. Bartlett as a participant in that process.

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Comments on Todd Wood's Letter on "Zuiyo-maru Carcass Revisited," CRSQ 33:292-295

I wish to make some comments on Todd Wood's letter on "Zuiyo-maru carcass revisited: Plesiosaur or basking shark?"

To compare the basking shark with the plesiosaur, Todd's article lists fourteen similarities and five differences. Therefore, Todd concludes that "despite the inconsistencies, the weight of evidence strongly favors the shark identification." This argument is flawed because if object A is 99% identical to object B, it does not follow that object A is the same as object B. The best conclusion is that object A is 99% identical to object B, but object A is different from object B. In other words, if plesiosaur is 99% identical to that of a basking shark, it does not follow that the plesiosaur is a basking shark. In this case, the plesiosaur is actually $(14/19) \times 100\% = 74\%$ similar to a basking shark.

Constrained by a philosophical bias, evolutionists have concluded that since a chimpanzee is 98% identical to a human, the chimpanzee and human must have a common ancestor. Their argument is likewise flawed.

I hope that creationists should not fall into the same trap that evolutionists have laid down.

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Response from Todd Wood

Before I begin to discuss this letter, I want to ask this: Is this a battle worth fighting? Will proof of a dramatic living fossil cause all of evolutionary time to collapse into a jumble? In fact, what would catching a living plesiosaur in modern times actually demonstrate? These may seem like sarcastic questions, but they are certainly not. For whatever reason of His own, God has seen fit to give us extremely limited resources both in terms of financial provision and scientific expertise. Should we be wasting these resources on peripheral issues that have little or nothing to do with the great task before us: To re-create science based on the Truth of God? If it were not for two decades of misinformation, I certainly would not be spending any further time on this topic. As it is, I feel some measure of responsibility for exposing our fallacy.

And a serious fallacy it is. For twenty years we have promoted the Zuiyo-maru carcass as a plesiosaur, even though the research demonstrating that it was nothing more than a basking shark was published in 1978. Some creationist references to the research conducted by the Japanese scientists went so far as to imply that the research actually supported the plesiosaur identification (Taylor, 1987; Brown, 1995). I

do not know how or why this fallacy became popular among creationists, but I do know this: We must stop promoting this claim. To continue to tenaciously cling to the plesiosaur identification will only lead us further and further from the Truth.

As for Dr. Chui's objections, I have had a difficult time preparing a response because I have had a difficult time understanding his reasoning. His attempted mathematical summary of my initial presentation of the evidence into a simple "percent similarity" is certainly a gross oversimplification. Before one could even begin to assign a numerical value to the similarity of the carcass and a shark, a detailed analysis of the evidence must be made with special care given to the proper weighting of different types of data. Nevertheless, Dr. Chui is correct in stating that the carcass and basking shark are not 100% identical, but this is irrelevant to my conclusions. By using the terms "identify" and "identification" in my original discussion (Wood, 1997), I did not mean to imply that the carcass was identical to a particular shark specimen, but rather was to be identified as a member of the species basking shark (*Cetorhinus maximus*). In short, my goal is not to prove identity to an individual but to classify as a species. One does not need to demonstrate 100% identity to successfully classify an organism. Based on the evidences given in my paper it is clear that we should classify the carcass as a basking shark or very similar species.

Regarding the similarity of humans and chimpanzees, I believe that the work Dr. Chui refers to are the studies of gross genomic similarity done in the 1980s, since these are the only experiments I am aware of that have assigned such a high similarity (Sibley and Ahlquist, 1987; Caccone and Powell, 1989). These genomic estimates were made based on melting point differences of chimp/human heteroduplex DNA-DNA hybrids, and when compared to our current knowledge of large amounts of actual sequence data, are surprisingly accurate (Horai, et al., 1995; Reardon, Magnet, Kudo, and Fukuda, 1993; Perrin-Pecontal, Gouy, Nigon, and Trabuchet, 1992; Retief et al., 1993; Kawamura et al., 1991). Nevertheless, scientists certainly do not conclude that humans and chimpanzees share a common ancestor based on this datum alone. Darwin published his *Descent of Man* in 1871, more than a century before these genomic studies were completed; therefore, such analyses could not possibly have had any influence on the acceptance of human evolution by the scientific establishment. Furthermore, this point is also irrelevant to my case. I have not made any claim about the phylogeny of the carcass, basking sharks, or plesiosaurs. My intention was to show that a classification (or identification) of the carcass can be made based on evidence available since 1978.

I pray that these comments have been helpful and that we creationists will at last learn from our mistakes.

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Wood (1997) has set out evidence about this carcass in two lists; for and against it being a shark. He concludes "...the weight of evidence strongly favors the shark identification."

Having examined both his evidence and his arguments I regret that I came to the opposite conclusion, and I would like to set out my reasons for this. Wood's article gives several photos and the sketch by the biologist, but, for comparison, I present Fig. 1 "Two views of the carcass", Fig. 2 "Yano's sketch of the carcass", Fig. 3 "The skeleton of a plesiosaur" and Fig. 4 "A basking shark". I have drawn the last three to the same length so that comparisons can be made on the proportions of their different forms.

Wood lists 14 points supporting the shark identification. I would observe that many of them are vague, only indicating that it could be a shark. I also note that Wood suggests the large pelvic fins could be "claspers" (item 10). One has only to compare the small claspers on the shark with the huge fins on the carcass and those of a plesiosaur to see that considerable stretching of the imagination is required to accept this.

From this list, all that can be said is that the carcass *may* be that of a shark *or* of another creature not known to biologists at this time. As this is the first carcass of a (possible) plesiosaur they have examined, then they have no previous evidence they can use as a standard to work from. Certain specific items (e.g. elastoidin) may be possessed by plesiosaurs.

Examining Wood's second list, they are surely far more convincing that the carcass could not possibly be that of a shark. For example, he admits (item 5) that the decomposing fat was blubber which "is clearly inconsistent with a shark identification." The same would apply to the red muscle, and absence of the smell of ammonia.

Yet Wood concludes "the weight of evidence *strongly* favors the shark identification"! How he can come to such a conclusion in the face of evidence that he himself has provided is incomprehensible to this writer at least.

Wood refers to an article by John Koster that appeared in *Oceans* November 1977. This was also on website <http://www.gennet.org/nessy.htm>, and this produced five clear color photographs of the carcass, showing the red flesh and the hanging skin claimed to be a dorsal fin.

Koster gives a very objective review of the evidence but much of it is in favor of the plesiosaur identification. The person providing the information on the website hoped that readers would "enjoy the article which evolutionists policed from your review."

In the article, Koster gives the following comments by Japanese professors. One said "It's not a fish, whale or any other mammal. It's a reptile and the sketch looks very like a plesiosaur". A professor of palaeontology said "Even if the tissue contains the same protein as the shark's, it is rash to say that the monster is a shark. The finding is not enough to refute a speculation that the monster is a ple-

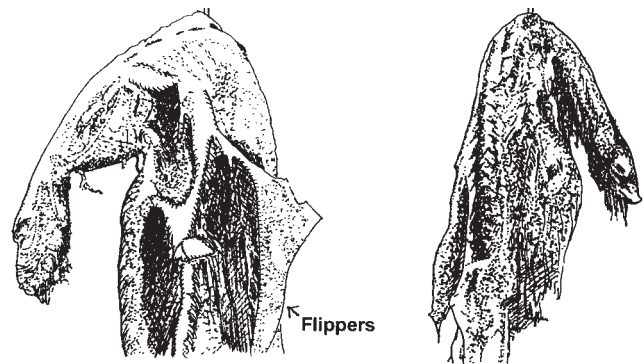


Figure 1. Two views of the carcass.

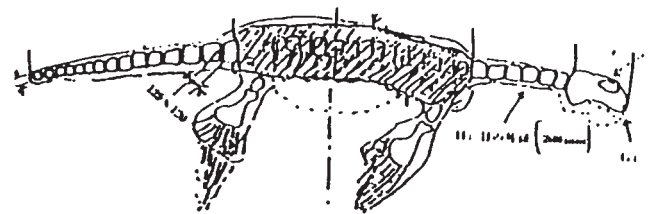


Figure 2. Yano's sketch of the carcass.

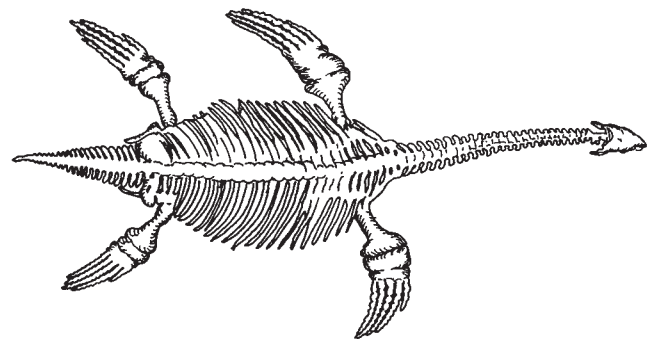


Figure 3. The skeleton of a plesiosaur.

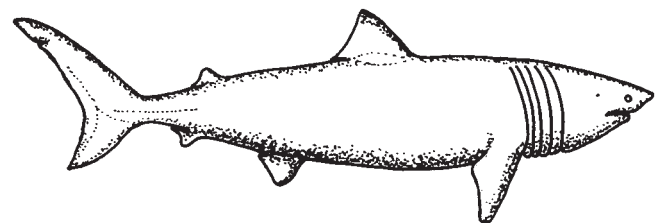


Figure 4. A basking shark.

siosaur.”

Yano went before a board of three professors who were clearly puzzled by the evidence. Amongst the comments they made were:

If this had been a seal, the tail would be too long...

If this had been a reptile the number of bones around the neck should be greater according to the drawing...

It's easier to survive in the sea than on land. One theory is that the creature is a mammal, and the other that it is a long-necked monster (in other words, a plesiosaur). And there are many points that don't fit the mammal theory. Within my knowledge it looks like a plesiosaur. But I can't say for sure...

If it were a shark, the spine would be smaller, and the neck is too long as shown in the picture. I think we can exclude the fish theory...

I don't think it is a fish...

If it's a reptile, it looks like a plesiosaur. The plesiosaur has fins in the front and back and the neck and tail were not too terribly long. (Koster, 1977)

In reading these comments it should be remembered that they are made by two professors from Japan's National Science Museum and one from Tokyo University's Marine Research Centre who were able to question Yano closely. Although very highly qualified, they were obviously puzzled, not prepared to class it as a decomposed basking shark, and even suggested that it might be a plesiosaur. In view of this, can we accept the opinions of those less well qualified, such as the “shark fin processors,” when they pronounce upon the subject?

Koster's article names five Japanese professors, all open to the possibility that it might have been a plesiosaur. Wood's paper references Koster's article but he omits to summarize these opinions by experts.

Wood quotes from a publication [CPC] which is a collection of papers published in Tokyo, which might be considered as the “official” report. I was unable to obtain a copy of this report as the British Library had no knowledge of it. If a copy could be provided, I would be happy to comment on its contents.

From what has been quoted from it, the conclusion that it was not a plesiosaur appears to be based mainly on sophisticated chemical tests upon horny fibers taken by Yano. At the risk of appearing over suspicious, we note that the soaking of the shark elastoidin in sodium hypochlorite *may* have been necessary, but why should it have been done only to one of the two specimens?

The eyewitness account of Yano may (or may not) have been included but it has not been mentioned in any summary article of this paper that I have seen. Whatever the case, his first hand evidence has been overruled or ignored in reaching their conclusion.

On the CRSnet (Internet e-mail group), Wood referred to a website article by Shuker (Shuker, 1995) in which he effectively dismisses nine “sea monster” carcasses as unlikely of being any such thing. However, some that he describes were nothing like any creature living today. Wood consid-

ered Shuker's article “a reasonable interpretation of the evidence.” Examining this, it is clear that Shuker is an evolutionist (“They lost their hind pair during evolution,” he comments).

Could I suggest that creationists should exercise great caution in repeating the opinions of evolutionist experts as if they were reliable. They have forgotten that the vast majority of professionals in science are evolutionists, and have a vested interest in ensuring no evidence contradicting evolution is ever given any credibility whatsoever. Creationists who repeat their *opinions* will find that they riding a paper tiger—to use a mixed metaphor.

Using only the evidence and references that Wood has provided, we would reject his conclusion and suggest that the Japanese carcass was possibly that of either a young plesiosaur or at least of a plesiosaur-type creature.

Why are these sightings important? The various sightings of extraordinary sea creatures are always dismissed by evolutionists as they indicate that these “extinct” species, that should have died out millions of years ago, are still living. They are probably the remnants of a much large population not very long ago, and the fact that some still exist implies that the earth is not millions of years old.

Cooper (1996), among others, has listed many sightings of dinosaur-like creatures and the various names of the sea dragons that infested the ancient sea routes. As we go further back into time, these sightings are more numerous. This is compounded by the fact that there were probably fewer sea-going vessels in the early days, yet they describe many sea creatures. Today, with a far greater traffic on the high seas, there are fewer sightings. If we imagine a graph of the sightings as a falling curve, this rapid decrease in their number within a comparatively short time suggests that we are on the tail-end of the rapid decline of these large sea animals, but that not long ago they were far more plentiful.

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Yet Another Response to Todd Wood's Letter on the *Zuiyo-Maru* Carcass

In the March 1977 issue of CRSQ, Todd Wood did a commendable job of sifting through technical data and reporting the conclusions of most of the contributing scientists who collaborated on the publication (July 1978) of a technical monograph on the snagging of an alleged plesiosaur off New Zealand. He voiced the opinion that the evidence strongly favored the identification of the mysterious creature, which unfortunately was dumped by the fishermen that caught it, as a shark and cautioned against using it as "evidence for recently-living plesiosaurs." This precaution is commendable since both creationists and evolutionists have at times been guilty of overpromoting speculative claims on the basis of little evidence. For example, despite popular creationist claims (Unfred, 1990, p. 34) that the netting of the alleged plesiosaur was "so amazing that the Japanese issued a commemorative stamp to honor the discovery," that is apparently incorrect. According to the information card accompanying the First Day of Issue Cover for this commemorative stamp, which was issued in connection with the 100th anniversary of the National Science Museum, the design was based upon a "reconstruction" of a plesiosaur skeleton that was placed on display at the museum. The most that can be claimed is that the discovery of the highly heralded carcass eight months earlier may have had some influence on the selection of the plesiosaur reconstruction being placed on the stamp. However, even that is unlikely. Despite this mistaken claim and Wood's concerns, I believe that the case of the New Zealand "Monster" is worth sharing, with caution, of course, as illustrative of how real-world science has to work amidst a webbing of pressures from establishment scientists and journalists. As to its identity, as stated at the bottom of a letter which I received from the Japan Information and Culture Center, Consulate General of Japan (March 1996), the creature is "unidentifiable."

The blinding effects of an entrenched macroevolutionary belief can be seen in that some skeptics had ruled out the discovery as either a case of fraud or misidentification apparently without even reviewing the studies made by those who had conducted first-hand investigations (Koster, 1977). A. Fraser-Brunner, aquarium curator for the Royal Zoological Society of Scotland, for example, ridiculed the plesiosaur idea and said that the carcass was "recognizable at once from photographs as that of Hooker's sea lion" ("Zoologist scotches 'Plesiosaur' rumors," 1977), a view that few scientists would agree with. Whereas the news of this discovery made headline news throughout Asia for many months (e.g., Thanh, a family relative from Vietnam a practicing civil with an M.S. from an American university, remembers the discovery and said that he believes it probably was a plesiosaur), there had been a dearth of coverage in the western world with only short excerpts appearing in a few newspapers or magazines (the lone exception being an article by Koster (1977) that appeared in *Oceans*). According to Koster, the skepticism expressed among scientists elsewhere obviously

"impressed" the Japanese.

What were some of the opinions of informed scientists who were not present at the Tokyo University of Fisheries (TUSF) meetings? Notable are the opinions expressed by professors Shikama, Imaizumi, and Ozaki which were somewhat sympathetic to the plesiosaur idea.

Tokio Shikama, professor of paleontology at Yokohama National University, said he believed the carcass to be that of a plesiosaurus ("At Sea: 'Plesiosaur' merely a rotten whale?", 1977). He pointed out that plesiosaurs were known to roam the seas off New Zealand and were believed to travel alone ("Maybe Plesiosaurus, or just a creature?", 1977). "Even if the tissue contains the same protein as the shark's," he pointed out, "it is rash to say that the monster is a shark." He concluded that "The finding is not enough to refute a speculation that the monster is a plesiosaur." (Koster, 1977) Dr. Shikama, now deceased, is not known to have recanted his views (Kasuya, 1997).

Professor Yoshinori Imaizumi, director of animal research at the Japanese National Science Museum, felt that the creature was "not a fish, whale, or any other mammal" but was likely "a reptile." ("At Sea: 'Plesiosaur' merely a rotten whale?", 1977) Dr. Shikama, now deceased, is not known to have recanted his views (Kasuya, 1997).

Although Professor Hiroshi Ozaki of Japan's National Science Museum rejected the "Nessie theory," he said, "I don't think it's a fish . . . If this is a long-necked monster, it may be a new kind." Professor Toshio Kasuya, who once said "I think we can exclude the fish theory" (Koster, 1977), has changed his opinion and now believes that the carcass was likely that of a decomposing shark (Kasuya, 1997).

It should be noted that the consensus of the 18 fisherman aboard, with a wealth of experience in seeing scavenged or decomposing sharks was indeed very different and unusual. Professor Fujio Yasuda (1978) pointed out that members of the crew, at the time of the discovery, were spreading word that the body, with a long neck, a tail, and four fins looked much like a monster from some comic books.

The first technician claimed, "Prior to tossing it back into the sea, I strapped the wire around its chest. The instant we pulled it up, the wire cut the flesh. I saw the cut, and below the fat layer, there was red flesh exactly like that of a whale. Once before, we chopped off the tail of a striped shark, and flesh was white, unlike the flesh of the beast."

Some of the other witnesses aboard the *Zuiyo-maru* commented (in addition to those who thought it was a shark, whale, or turtle): "It's Nessie, it looks like a dinosaur." "This whale has a rather long neck." "It definitely can't be a shark nor a whale."

One of the witnesses later commented, "Of the theories of the Japanese media, the shark theory is strongest, but even now, I must disagree."

That apparently was also the conclusion drawn by Obata and Tomoda (1978):

There is still no decisive evidence to determine whether the animal in question was a shark or an undescribed reptile. General opinion favors identification as a shark . . . Yet a biologist who is inclined to the 'shark concept' told us that he had an impression, when he recently had an opportunity to see a large specimen of the basking shark, that the animal in question would not be basking shark. In this note we dared to present an uncommon view, posing several questions to the now prevailing 'general opinion.' After all, whether the animal belongs to a group of sharks or whether it is a marine reptile, we do not know any genera or species that agree with it.

A re-examination of some of the points brought up by Wood in his list of "Evidence that is consistent with the shark identification" may help the reader appreciate some of the uncertainties surrounding this unusual find (numbering is from Wood's listing):

1. In summarizing the opinion of Drs. Obata and Tomoda, Todd Wood reported "The anterior fin is articulated at a right angle to the shoulder, as in sharks." What I read of their opinion seemed less certain. What they wrote in the monograph was, the anterior limb or fin *appears* to be articulated at a right angle to the shoulder . . . Whatever this animal may be, *the correct names and original positions of these bones cannot be known* without expert knowledge of osteology, comparative anatomy and vertebrate paleontology. (Obata and Tomoda, 1978; italics added for emphasis).

Drs. Yasuda and Taki (1978) also pointed out that the spatial arrangement of the four flippers relative to the torso of the specimen did not match the fin-to-body arrangement of known fishes. They said that to conclude that the unidentified animal is a shark would be to assume that the two dorsal fins, pelvic fins, anal fin, and the upper lobe of the caudal fin had all been lost or overlooked by the 18 witnesses aboard the *Zuiyo-maru*, that the anterior parts of the skull were also lost, and that Yano miscounted a single lobe of a fin as two. They said, "We consider it difficult to arrive at a conclusion on so many assumptions."

Incorporating all these observations, we are not able to find any known living fish species which agree with the unidentified animal trawled off New Zealand. If it is a species of a shark, it may represent a species unknown to science.

3. Michihiko Yano, assistant production manager of the fishing company on board at the time of the discovery, drew a cut-out sketch of the creature with bones in the limbs (which, if correct, would mean that it could not be a shark). He did not determine this merely by stepping on the fin, as Todd reported, but had kicked and walked on them (Obata and Tomoda, 1978).

7. Although it is true that rotting sharks typically lose their jaws and gill arches, which could leave the impression of a small head, Omura, Mochizuki, and Kamiya (1978) concluded that "It was impossible to tell in detail about the structure of the skull from these photographs." (It should also be noted that the specimen's two nostrils were higher

up on its head than is found among sharks.)

13. The readers should be reminded of the state of the young science of amino-acid sequencing at the time of the discovery of the carcass. Dr. Shigeru Kimura, a biochemist at the TUSF, said that although only sharks and rays among fish have the type of protein called elastoidin, "as for reptiles, I do not think there is relevant data, even abroad" that could be used as a basis for comparison. Kimura et al. (1978) cautioned that:

no chemical substances have thus far provided to be truly [sic] diagnostic for the classification of higher taxa of vertebrates, in spite of the modern biologists and paleontologists' eager desire to utilize chemical characteristics as clues to investigate animal phylogeny. As to the amino-acid composition under discussion, we have been informed that comparative studies of some groups of animals showed the existence of many amino acids common to all groups dealt with. (1978)

The biochemical similarities between the horny fibre of the carcass and that of a basking shark does not prove that it was a shark, simply because no one has ever studied the horny fibre of a plesiosaur to know whether or not it naturally is similar to that of a basking shark. In the absence of a living plesiosaur for comparison, such a determination cannot be made.

Dr. H. Douglas Dean, late professor of biology at Pepperdine University, who had served as my mentor, in a private conversation with me, stated that after examining all the evidence that he believed that eh "New Zealand Monster" probably was a plesiosaur or at least the carcass of a heretofore unknown creature that may be related to the plesiosaur. Who knows what the "unidentifiable carcass" really has? In the meantime, let us not be too hasty in "dumping" the New Zealand Monster "overboard"!

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CRSQ 34(2), September 1997, page 128: The quotation of Bill Gates about human DNA is found on page 188 of his book, *The Road Ahead* (not on p. 228—as reported in the *CRSQ*, Sept. 1997)

CRSQ 34(2), September 1997, page 103: In addition to the previously-noted missing Greek letter *tau* in the formula denominators, line 9 from the bottom of the second column begins with “-A.” and should be “-A τ .”

CRSQ 34(3), December 1997, page 186, third line of the second column: the Standard Error (uncertainty) should be identified with a plus-or-minus sign ($\pm$), not simply a plus sign (+).

CRSQ 34(3), December 1997, page 187, the last line of the last paragraph: delete the second word “the.”

Book Reviews

***The Battle of Beginnings: Why Neither Side is Winning the Creation-Evolution Debate* by Del Ratzsch**
Intervarsity Press, Downers Grove, IL. 1996. 248 pages, \$14.99.

Reviewed by Richard Overman*

This intriguing and well documented book is an attempt by the author “to make the general case that large numbers of the critical arguments from each side against the other do not come to much—either because they are themselves defective or because no one holds the views against which they are directed” (p. 12). Ratzsch places the evolution and creation theories in historical contexts and introduces (summarizes) the theories. Each is followed by the popular misunderstandings of the opposing side. This tit-for-tat discussion is followed by an extensive discussion of the philosophy of science. Ratzsch, professor of philosophy at Calvin College, provides a thorough yet relatively brief history of the philosophy of science ending with a contemporary perspective. Popular creationist and anticreationist (not young earth creationists) mistakes regarding the philosophy of science are discussed. Finally, a chapter entitled, “Theistic Evolution: Catching It from Both Sides” rounds out the book.

The earlier chapters, in which Ratzsch attempts to right the wrongs each side has committed against the other, are interesting and thought provoking. They are, however, fraught with weak arguments and contradictions. The real value of the book, in this reviewer's opinion, is in the later discussions on the philosophy of science, especially Chap-

ters 8 and 9 (Philosophy of Science: The Twentieth-Century Background and The Nature of Science: A Contemporary Perspective). As this is Ratzsch's field of expertise, it is not surprising that this section would be the strength of his book. He points out the empirical science limitations and gives a good historical overview of science philosophy. Ultimately Ratzsch concludes that “Science, then, involves three basic types of components. These are data, theories, and the nonempirical, partially philosophical principles and factors that I shall call *shaping principles*” (italics his) (p. 120). “It turns out that the three basic types of components in science—theories, data and shaping principles—interact with each other, and those interactions do impose some checks and limits” (p. 127). This is similar, but not exactly the same, as the point argued by many creationists that one's assumptions (shaping principles) affects a person's interpretation of data.

The weakest part of the book is the chapter on Theistic Evolution. Ratzsch argues that contrary to creationist objections, theistic evolution is both internally and externally consistent. He also argues that the evolutionist requirement for excluding God from science is not valid. “If in our intellectual endeavors we are attempting to get at the truth as

best we can, then if we have *rational* reasons—from whatever source to believe that God has taken a hand in the origin or ongoing operation of the cosmos, arbitrarily excluding that belief needs some justification” (italics his) (p. 193). What makes this chapter weak, however, is his failure to deal with the most serious problems with theistic evolution. One is the inconsistency between theistic evolution and the order of creation in Genesis chapter 1. Ratzsch states: “Creationists, however, typically advance one further type of objection, and that is that theistic evolution cannot be reconciled with many of the details taught by the early chapters of Genesis (such as the order of appearance of created organisms). Underlying this type of objection are two presuppositions: first, that a faithful and responsible reading of

Genesis requires that it be understood literally, and second, that understood literally, early Genesis actually teaches what creationists think it does. I will not address those issues here. However, I do not think that either presupposition is inherently improper or incoherent” (p. 195). Regarding the problems of death before sin and its ramifications to the cross of Christ, Ratzsch is silent.

Overall this reviewer found the book interesting and enlightening. It did not, however, meet the author’s intended objective. One is left with the very clear impression that the author is sympathetic to evolution and is, most probably, a theistic evolutionist. These impressions are based solely on reading the book as this reviewer has never met, talked to, or even heard of the author prior to reading this book.

***Darwin’s Black Box: The Biochemical Challenge to Evolution* by Michael J. Behe.
The Free Press, a Division of Simon and Schuster, New York. 1996. 307 pages, \$25.00.**

Reviewed by Paul A. Zimmerman *

Michael J. Behe lives in Bethlehem, Pennsylvania, and is Associate Professor of Biochemistry at Lehigh University. He derives the title *Darwin’s Black Box* from the concept of a box such as a computer. On the outside it is relatively simple. Children operate computers and generally think that they understand them. But if one opens the box and exposes the intricate electronic contents the average computer user learns that he understands nothing at all as to what makes a computer function. So it is with Darwin. To him it seemed possible to explain the origin and variety of plants and animals. However, the immense progress made in recent years in biochemistry have opened the black box of living things at the molecular level. What is revealed is an immensely complicated world of chemical machines, finely calibrated, and interdependent, whose origin cannot be explained by mutations and gradualistic paths. Scientists have frequently pointed out the improbability of chemical molecules such as the proteins being formed by chance interactions of similar compounds. As early as 1947 the French biophysicist, du-Nouy, calculated that the time needed to form just one particular protein far exceeded the age of the universe many times over. Many others have reached similar conclusions. The giant molecules involved in cell metabolism are far too complex to be explainable by chance interactions. What Michael Behe has done is to provide an up-to-date survey of modern biochemical research. He competently demonstrates that we now know that within the cell there are many biochemical systems that are so irreducibly complex that they cannot be explained by any evolutionary gradualistic process. Behe defends his thesis by offering many examples of “irreducible complexity.” For example, he analyzes the cilium. This is a structure associated with a cell that looks like a hair and beats like a whip. It either moves the cell or it moves liquid past the cell. Biochemical analysis has revealed

that this seemingly simple mechanism contains over two hundred types of proteins, precisely tailored to make this living machine function. Behe notes, “Darwinian theory has given no explanation for the cilium or flagellum. The overwhelming complexity of the swimming systems push us to think it may never give an explanation” (p.73). In like manner Behe explores the biochemistry of vision, blood clotting, the immune system, and the building system for macromolecules. He refers to other examples of irreducible complexity for which a complete system must be in place for proper operation. They include DNA replication, electron transport, telomere synthesis, photosynthesis, and transcription regulation. Behe has carried out an impressive survey of the literature. On page 176, he makes the remarkable statement, “None of the papers published in the *Journal of Molecular Evolution* over the entire course of its life as a journal has ever proposed a detailed model by which a complex biochemical system might have been produced in a gradual, step-by-step Darwinian fashion.” He takes this as evidence that Darwinism is incapable of explaining the origin of complex biochemical systems. Behe then sets forth his conclusion: Living things, particularly at a molecular level show unmistakable evidence of design. This design calls for a Designer. On page 252 he concludes, As we reach the end of this book we are left with no substantive defense against what feels to be a strange conclusion: that life was designed by an intelligent agent...The simplicity that was once expected to be the foundation of life has proven to be a phantom: instead, systems of horrendous, irreducible complexity inhabit the cell. The resulting realization that life was designed by an intelligence is a shock to us in the twentieth century, who have gotten use to thinking of life as the result of simple natural laws.” Behe is a Catholic, but he approaches his work without any religious bias. His book is well documented and gives evidence of being solid science. He provides special non-technical sections in many of the chapters for the convenience of those who may not be well acquainted with the science of biochemistry.

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Quote — Heaven and earth cry out that they have been created by God.

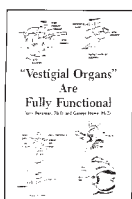
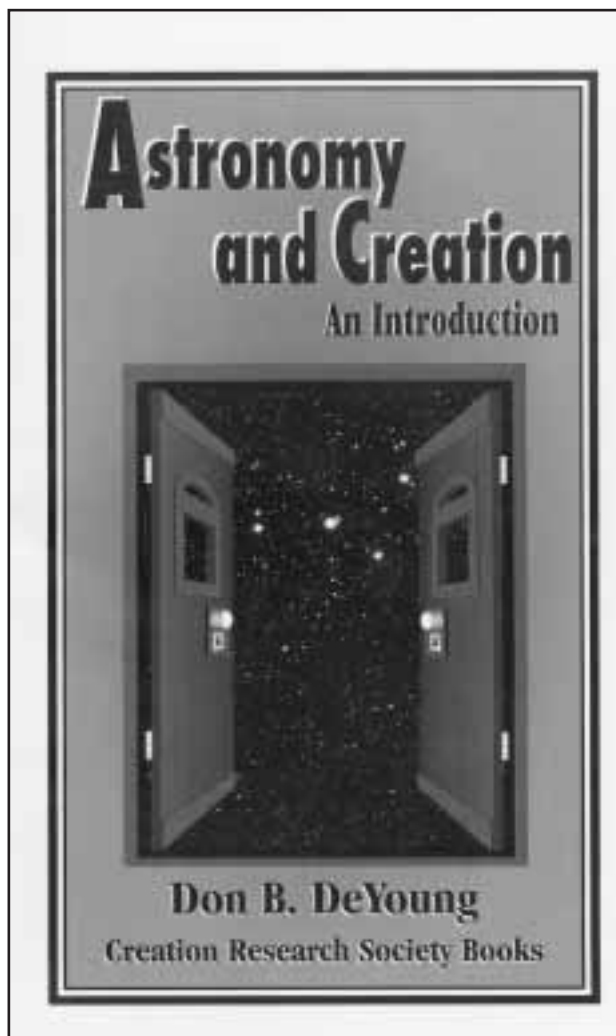
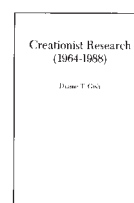
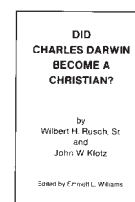
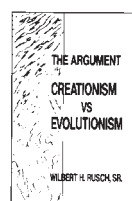
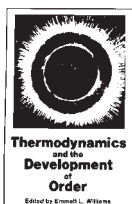
Behold, the heavens and the earth are; they proclaim that they were created; for they change and vary. Whereas whatsoever hath not been made, and yet is, hath nothing in it, which before it had not; and this it is, to change and vary. They proclaim also, that they made not themselves; "therefore we are, because we have been made; we were not therefore, before we were, so as to make ourselves." Now the evidence of the thing, is the voice of the speakers. Thou therefore, Lord, madest them; who art beautiful, for they are beautiful; who art good, for they are good; who art, for they

are; yet are they not beautiful nor good, nor are they, as Thou their Creator art; compared with Whom, they are neither beautiful, nor good, nor are. This we know, thanks be to Thee. And our knowledge, compared with Thy knowledge, is ignorance.

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Balanced Rock

Emmett L. Williams

A megalithic structure, called the Balanced Rock, is located at North Salem, New York. A drawing of this structure was featured on the cover of the December, 1976 *Creation Research Society Quarterly*. An article in that issue (Seaman, 5. 5. 1976. Who came before Columbus? *CRSQ* 13:150-154.) contained evidence to support the thesis that people from Europe or the Near East came to the Americas well before the time of Columbus.

The Balanced Rock was referred to archaeologically as a dolmen by the author. The cap stone, weighing approximately 16.5 metric tons, is considered to be from a geologic formation in New Hampshire. The support stones are of local origin. Another hypothesis for the origin of this structure is that a glacier transported the cap stone about 320 km to its present position, depositing it on the support stones.