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Articles

- Epidemiology and the Creation Health Model** 185
Jeffrey G. Schragin
- Some Evidence of a Recent Gigantic Flood on the Lower Colorado River at Grand Wash Cliffs and Hualapai Plateau, Arizona** 196
Allen Roy
- The Chesapeake Bay Impact and Noah's Flood** 206
Wayne R. Spencer and Michael J. Oard
- Beyond Scientific Creationism**..... 216
John K. Reed, Peter Klevberg, Chris Bennett, Jerry Akridge, Carl R. Froede, Jr., Thomas Lott
- Hox Genes—Evolution's Hoax**..... 231
Branyon May, Bert Thompson, and Brad Harrub
- Photographic Essay—Lichens at VACRC: Lichen Surfaces under the Electron Microscope** 242
Mark H. Armitage and George F. Howe

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Departments

- Book Reviews**
- Doubts About Darwin: A History of the Intelligent Design Movement* by Thomas Woodward 194
- The Design Revolution: Answering the Toughest Questions about Intelligent Design* by William A. Dembski 215
- Darwinism, Design, and Public Education* J.H. Campbell and S. C. Meyer, Editors 230
- The Map that Changed the World* by Simon Winchester 252
- Letters to the Editor** 256
- Instructions to Authors**..... 261
- Membership/Subscription Application and Renewal Form** 263
- Order Blank for Past Issues**..... 264

Notes from the Panorama of Science

- Geology beyond Plate Tectonics** 253
David J. Tyler

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

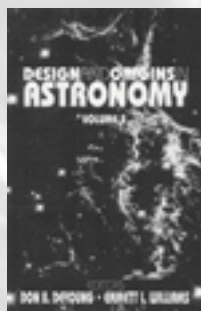
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Geology and Creation: 100 Questions and Answers from a Biblical Perspective

**Don DeYoung. 2004. CRS books,
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Don B. DeYoung and Emmett L. Williams (editors). 2002. Creation Research Society, 163 pages. \$11.00.

This is number 12 in the monograph series and the second volume on astronomy that is a compilation of articles from the *Creation Research Society Quarterly*. Topics include the age of the sun, impact craters in Arizona and on the moon, planets and magnetism, speed-of-light studies, stellar evolution, the destiny of comets, and mysterious dark matter.



Where Darwin Meets the Bible: Creationists and Evolutionists in America

Larry A. Witham. 2002. Oxford University Press, 330 pages. \$25.00 (hard cover).

Author Witham, a reporter for *The Washington Times*, objectively discusses the creation-evolution controversy. The book is comprehensive, and is very important for helping creationists and evolutionists understand the pertinent issues.



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Don DeYoung and John Whitcomb. 2003. Master Books, 144 pages. \$11.00.

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Epidemiology and the Creation Health Model

Jeffrey G. Schragin*

Abstract

The Creation Health Model is introduced as an incremental probability model of developing disease. The basis of the model is established from the Biblical events of Creation, Fall, and Flood. The model is predicated upon the concept of purposeful design. It is checked against emerging information from the fields of cancer epidemiology, cardiovascular epidemiology, and general medical epidemiology. It is concluded that a lifestyle consistent with the Creation Health Model reduces the probability of disease and will result in an improvement in overall individual and societal health. The model is scientifically sound and supports purposeful design and Special Creation. It helps to make health and disease understandable in a context that is problematic for molecules-to-man evolution. It may facilitate the development of predictive models of disease prevention and ultimately may assist in the development of therapeutics. Suggestions for several current-day health issues are given.

Introduction

Health is probably the most important aspect of a person's life and it is determined to a large extent by one's lifestyle choices. A healthy and correctly functioning human body is truly miraculous (Gillen et al., 2001). The complex interaction between the human body and the environment is remarkable and awe-inspiring, strongly suggesting design (Psalm 139:14). Unfortunately, as with any extremely complex system, many things can go wrong. Various degrees of dysfunction lead to disease, sickness, disability, and eventual death, which are now normal and everyday parts of life.

On a societal level, public health is crucially important. Each year there are over 700,000 cardiovascular deaths; 550,000 cancer deaths; 70,000 diabetes related deaths; and 122,000 deaths from chronic obstructive lung disease in the United States (Arias, 2003). Mortality and morbidity have enormous financial impact both in direct costs and in lack of productivity. Estimated healthcare expenditures for 2004 are \$1.779 trillion and expected to rise to \$3.1 trillion in

2012 (CMS, 2002). Public health is a significant economic concern in the United States.

Health and disease are vitally important from both individual and societal perspectives. Questions that arise are how does one maximize the probability of health and minimize the probability of disease and disability? Does a model of origins matter in understanding pathogenesis? Can a health model based on origins facilitate the understanding of health and disease and the development of predictive models for maximizing health? How do the Bible and modern medical science agree with respect to promoting health and minimizing the probability of disease and disability?

In this paper I define the Creation Health Model (CHM). I also investigate the correlation of the model with recent findings from modern medical epidemiology. Examples of common diseases are discussed. This paper is not intended to be a comprehensive review. Rather, I attempt in it to provide a basic framework to study health and disease from a Creationist perspective. This investigation suggests that a Creation model of origins and the CHM are consistent with modern epidemiology. The CHM offers a more comprehensive understanding of health and disease than standard molecules-to-man evolutionary theory. It can likewise assist in the development of predictive models of

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primary prevention of disease, and may ultimately assist in the development of therapeutics.

Definition of Epidemiology

Epidemiology can be defined as the study of the determinants of health and disease in a population (Gordis, 2000). Epidemiology has been used over the years to identify causes of disease, both acute and chronic. Epidemiology is a rich resource that has contributed vastly to medical science. John Snow's classic investigation of cholera and Sir Richard Doll and his colleagues' study of smoking and lung cancer are historical examples of the vitality of epidemiology (Lilienfeld, 1999). Epidemiology is a vibrant field and continues to identify causes of disease and factors that promote health (Oliveria et al., 1997).

Disease prevention is an important part of epidemiology and can be divided into primary and secondary prevention (Gordis, 2000). Primary prevention is concerned with preventing the development of a disease. The most obvious example is abstaining from cigarette smoking to prevent lung cancer. Secondary prevention attempts to detect pre-clinical conditions and intervene early in the natural history of the disease. Screening mammography for the early detection of breast cancer and screening Pap smears for the early detection of cervical cancer are examples. Primary and secondary prevention strategies are used to prevent disease or assist in the early detection of disease. Generally, these approaches are cost-effective and reduce morbidity and mortality.

The Creation Health Model

The CHM is an approach to understanding health and disease from the Scriptural perspective of Creation, Fall, and Flood. The CHM is predicated on the observation that the Earth was designed and created with purposeful intent; the "good" Creation was changed by the Fall of man; and the Flood dramatically modified the distribution of life on the Earth. The foundation for the CHM is found in Genesis 1:29–31: "And God said, 'See, I have given you every herb that yields seed which is on the face of all the earth, and every tree whose fruit yields seed; to you it shall be for food' ...and it was very good" (NKJV). The tenets of CHM are:

- Life was created by the Creator with a specific design: a steady-state life where plants and animals exchanged waste products, painlessly meeting nutritional requirements. There was no pain, suffering, disease or death in the initial Creation. The initial diet was vegetarian consistent with painless

existence, although painlessness was not specifically mentioned.

- The Fall of Man introduced complexities into the steady-state system including the tendency of breakdown and decay and the inevitability of disease and death. The Fall meant disease and death would become a part of life both from endogenous decay and exogenous factors such as pathogenic microorganisms. Avoidance of suffering became impossible in a fallen world.
- The Flood changed the availability and distribution of plant life that was designed to meet nutrition needs painlessly. The exact pre-Flood-post-Flood distribution of vegetation is not known. Presumably, many types of plants were lost. In addition, the distribution of vegetation was significantly changed (Wieland, 2001). Consequently, in the post-Fall world, complete vegetarian nutrition was not as simple as it had been. Meat eating was allowed and even encouraged for the priests and their families, although fat was prohibited (Leviticus 3:17). The reasons for the prohibition of fat were not given; they may have been biological, theological, or both.
- The CHM suggests the tendency to breakdown and decay, disease and death inherent in our world as a result of the Fall is potentiated by a probability that is a function of a person's lifestyle deviation from the initial design plan of Creation. The probability of health can be maximized and probability of disease, disability and suffering minimized by adhering to a lifestyle that is consistent with the purposeful design of Creation. The probabilities of health and disease are understood as variable functions increasing or decreasing in value based on deviations from that initial design. Maximizing adherence to the CHM minimizes sickness and suffering although it does not eliminate them. Certain aspects of the variable probability functions are controllable by individuals, hence, the importance of a comprehensive approach to creation, health, and disease (Table I).

Mathematical Representation of the CHM

The logic of the CHM can be delineated by the mathematical formula:

$$P(D(i)) = \alpha(i) + \beta(i) * (e_1 - e_2) = \alpha(i) + \beta(i) * E$$

where $P(D(i))$ is the probability of disease $D(i)$. This equation is somewhat analogous to logistic regression equations used in epidemiologic research. Its uniqueness is in the assignment of $\alpha(i)$ and $\beta(i)$. i is an index that identifies

Table I: Tenets of The CHM and Their Significance

Event	Significance
Initial Creation	Designed to indefinitely exist in a steady-state, painless, disease-free, death-free earth. Vegetarian diet.
Fall of Man	Tendency to breakdown and decay introduced into the world. Inevitability of disease, suffering and death. Endogenous and exogenous factors involved in disease.
Flood	Availability and distribution of plant life presumably significantly changed. Dietary instructions changed. Meat eating became part of the world. Fat consumption was prohibited (Leviticus 3:17)
Health in a Post-Fall World	Probability of health and disease are functions of the deviation from the plan of the initial design of creation. Deviation is controllable to a large extent by person's lifestyle choices.

a disease. $\alpha(i)$ is a nonzero probability of disease(i) as a result of the Fall. $\alpha(i)$ represents the baseline probability of disease(i) that exists in the fallen world independent of lifestyle or personal characteristics. It corresponds to the tendency to decay in a post-Fall world.

$\beta(i)$ is a nonzero probability representing a person's unique susceptibility to disease(i). $\beta(i)$ represents an individual's unique susceptibility factors such as genetic makeup that add to the baseline risk $\alpha(i)$. Different persons have differing susceptibility to exposures and disease.

E is the total exposure defined as the amount of deviation from a lifestyle consistent with the initial design of Creation. It is composed of two other exposures: $E = (e_1 - e_2)$. e_1 is the amount of exposure to deleterious compounds such as carcinogens, tobacco smoke, infectious agents, etc. Large values of e_1 increase the chance of developing disease. e_2 represents exposure to salutary compounds such as certain phytochemicals, antioxidants, and essential nutrients. Large values of e_2 reduce the chance of developing disease. The CHM suggests a dual strategy, minimizing e_1 and maximizing e_2 , is the best approach to maximize health. It is the contention of the CHM that a Creation model of origins and not an evolutionary model *determines* the essentials of e_1 and e_2 . When the subscripts are omitted and E is treated as a single exposure variable E, it is understood that E is composed of two components, e_1 and e_2 . The potential interactions and synergisms of e_1 and e_2 are complex but never result in an overall value of E that is zero or negative in a fallen world. E is the part of the CHM over which individuals have a large degree of control; it primarily

depends upon lifestyle. For the diseases most prevalent in industrialized societies such as the United States, E may be the most important component of the equation given the inability to set $\alpha(i)$ and $\beta(i)$ equal to zero¹.

Since the Fall no person has a zero probability of disease. Even if a person adhered to a lifestyle that was absolutely consistent with initial design and had a low personal susceptibility, disease in all likelihood and death with certainty would still occur. The goal of the CHM is the minimization of E based on recognition of the good Creation and lifestyle recommendations consistent with it. As such, the CHM suggests that minimizing E will result in minimization of $P(D(i))$ for any given $\alpha(i)$ and $\beta(i)$.

CHM Recommendations

The CHM recommendations for minimizing E and maximizing health are six in number: 1) The diet should consist of natural organic foods including a wide variety of fruits, vegetables, nuts, herbs, and whole grains. Optimally, the diet should consist only of plant-based foods as in the initial Creation. The occasional consumption of fish, however, is allowable. Meat eating should be minimized or eliminated and fats avoided. All processed foods should be avoided. 2) Avoidance of tobacco. 3) Alcohol in only very moderate amounts, if at all. 4) Sexual relations within marriage only. 5) Avoidance of unnecessary risk-seeking behaviors. 6) Regular, moderate exercise. Goals 1 and 6 are strategies to maximize e_2 while goals 2 through 5 are strategies to minimize e_1 .

Nutrition for creation health fitness was previously described (Anderson, 1982). These recommendations for optimal health, based on Scripture, are a reasonable approach to maximize health in our society. The CHM takes this a little further in that it recognizes what was delineated in creation health fitness but still recommends, based on probability considerations, that the diet should strive to be as consistent with the initial creation diet as much as possible.

Meat eating was introduced into the world after the Flood. The CHM in its purest sense suggests optimum health is obtained with a vegetarian diet since this is the presumed diet of the initial Creation and before the Flood. However, the CHM does not proscribe meat eating in its entirety. Scripture indicates dietary patterns changed after

¹ $\alpha(i)$ and $\beta(i)$ for sex-specific diseases such as ovarian cancer or prostate cancer are zero for the opposite sex and $\alpha(i)$ and $\beta(i)$ are zero for diseases for which there is a specific one-to-one correlation with an exposure such as alcoholic liver disease in lifelong teetotalers.

the Flood and there are many examples of meat eating in the Bible. The CHM does suggest the E in the mathematical formula of the CHM increases as more meat is consumed. Therefore, minimizing E requires minimizing or eliminating meat consumption. Even lean meat is not totally fat free and animal fat should be avoided as much as possible. For very small amounts of very lean meat, white meat is preferable to red meats and the risk benefit ratio may be favorable enough not to prohibit it. A large amount of meat consumption, however, is expected to increase E substantially and should be avoided. Non-processed meats should be the ones consumed, avoiding chemicals, hormones, and antibiotics as much as possible.

It is important to emphasize that the CHM is an incremental probability model and not all-or-none. As such, it is not inconsistent with Scripture where God declared acceptable animals for food (Leviticus 11) or Paul's admonition not to judge the diet of others (Romans 14:1–3). The initial creation was vegetarian (Stambaugh, 1991). The Fall and Flood dramatically changed the creation which now currently groans (Romans 8:22) and meat eating was allowed. Scripture does not give recommendations regarding the amount of meat consumption; however, it seems reasonable that a model respecting the initial creation and striving for consistency with it should at the very least minimize meat consumption.

Pain is another area of interest and extremely complex philosophically and theologically. Scripture does not give instructions to minimize pain with eating. It is assumed that the pre-Fall world was pain-free or if pain existed it was minor and served as a caution, preventing harm. Attaining adequate nutrition while minimizing pain is part of the CHM as it relates to consistency with the initial creation. Meat eating generally causes pain to the slaughtered animal, which has the "breath of life" in it. This is somewhat problematic, as the initial creation was pain-free. Consequently, the CHM recommends a pain-free, plant-based diet.

Avoidance of the harmful substances delineated above follows directly as the body is the temple of the Holy Spirit (1 Corinthians 6:19). Polluting the body with tobacco smoke and its carcinogens, poisoning it with large amounts of alcohol, and exposing it to sexually transmitted diseases should be avoided. Consistent with the primary prevention of disease, improved health is a direct consequence of the avoidance of harmful substances.

Problems Since the Fall and Flood

The Fall and Flood introduced disease, suffering, and a limited lifespan into the world. Genesis 6:3 indicates the maximum lifespan in this age is 120 years. The primary goal

is to attain a lifespan approaching that limit with optimal health. The CHM does not suggest that adherence to the model guarantees health and longevity. Optimal health is universally problematic since the Fall and Flood. Disease and death did not exist prior to the Fall. Now they are an inevitable part of everyday life. Despite the certainty of an eventual death, a lifespan of 120 years with reasonably good health is possible because lifestyle, in industrialized society, is the primary determinant of the CHM probability function and lifestyle, to a large extent, is controllable.²

The tendency toward decay and dysfunction means that, even if it were totally possible to completely avoid all known harmful substances and adhere to the CHM, a baseline risk of disease would remain in a fallen world. This corresponds to non-zero $\alpha(i)$ and $\beta(i)$ in the CHM equation. Normal cellular functioning is not without error, and random mistakes occur, some of which may lead to cellular dysregulation. These malfunctions may be the pathogenic mechanism leading to atherosclerosis, cancer, and other diseases.

A plant-based diet is not without prospective difficulties. Pesticides and microorganisms are potential contaminants of fruits, vegetables, and whole grains. Cumulative pesticide exposure with agrichemicals may be problematic over the long term. Pathogenic microorganisms may cause acute infectious diseases or potentially contribute to chronic diseases. The Fall created the difficulties with the plan of plant-to-animal nutrition. Toil and labor is necessary to address these problems (Genesis 3:17–19). Proper food preparation, however, should prevent most of these problems.

An additional problem since the Flood is the possibility of nutritional deficiency with a totally plant-based diet. With the existence and availability of plants significantly changed post-Flood, attaining healthful nutrition became more difficult. For example, vitamin B12 deficiency can cause neurologic and hematologic problems and is a potential concern with a plant-based diet. Supplementation is available to correct deficiencies.

It is unknown what varieties of plants were lost after the Flood. With diligence, complete nutrition is possible with a largely plant-based diet (American Dietetic Association, 2003; McDougall 2002). Potential difficulties with nutrition may not have existed prior to the Flood and it is possible

² This applies to apparently healthy persons who do not have significant genetic or congenital problems. Other persons may have genetic or inherited diseases or susceptibility to disease that may be more important than lifestyle in health; i.e., the magnitude of $\beta(i)$ is large. Then $\beta(i)$ may be more important than E in the CHM probability function. This is also the result of the Fall.

many more species of plants existed. Some of these plants may have facilitated complete nutrition.

Evidence from Epidemiology

The critical question is whether modern epidemiology supports the Scripture-based CHM. If it does, the expectation for optimal health, although not perfect health in a fallen world, would be attained with a lifestyle respecting the Creator and a diet high in plant food. Consistent with this expectation, large amounts of accumulating epidemiologic research data support the conclusion that diet and lifestyle are vitally important (and probably the most important) determinants of health and disease in industrialized society. Table II briefly summarizes aspects of the two most common causes of death in the United States. They are cardiovascular disease and cancer (NCIPC, 2004). If diet is of importance in these diseases, and if it is the garden-type, plant-based diet, then the CHM and epidemiology support Creation. This is a direct expectation if Scripture is correct.

Cardiovascular disease is the nation's leading killer with over 700,000 deaths per year. Diet and smoking have been identified as critically important risk factors. Cholesterol and saturated fat intake are directly related to the risk of coronary heart disease (CHD). Other critical risk factors are blood pressure, diabetes, family history, and central adiposity.

With the exception of family history and personal genetic makeup, the other significant risk factors are directly modifiable. Dietary recommendations for a healthy heart include reducing the intake of saturated fat and increasing consumption of fruits, vegetables, and whole grains. The dietary interventions act directly by reducing the exposure to harmful compounds; i.e., saturated fat, and indirectly by reducing the risk of diabetes and assisting in weight control. The importance of diet in the prevention of coronary artery disease is clear as written by Hu and Willett (2002):

Substantial evidence indicates that diets using nonhydrogenated unsaturated fats as the predominant form of dietary fat, whole grains as the main form of carbohydrates,

an abundance of fruits and vegetables, and adequate omega-3 fatty acids can offer significant protection against CHD. Such diets, together with regular physical activity, avoidance of smoking, and maintenance of a healthy body weight may prevent the majority of cardiovascular disease in Western populations.

In the prior observation they are not merely suggesting that some coronary heart disease will be prevented, but that the majority of it is preventable. Their work is not unique in its conclusion or recommendations. Ornish et al. (1990) offer additional insight into the diet being a key component of coronary pathogenesis. The message is crystal clear: proper diet and abstinence from smoking can significantly reduce the incidence of coronary disease. It is compelling that the only diet, as part of a comprehensive lifestyle strategy, scientifically proven to reverse coronary artery disease is a vegetarian diet, which also minimizes E (Ornish et al., 1998). The evidence from cardiovascular epidemiology is consistent with the CHM.

Cancer is second only to coronary artery disease as a leading cause of death in the United States. It is estimated that there will be over 500,000 cancer deaths in the United States in 2003 (Jemal et al., 2003). Lung cancer will claim approximately 157,200 lives in 2003. There will be an estimated 57,100 colorectal cancer deaths; 40,200 breast cancer deaths; 30,000 pancreatic cancer deaths; and 28,900 prostate cancer deaths in 2003. These are the five leading causes of cancer death in the United States. Other cancers of note include non-Hodgkin's lymphoma with 23,400 deaths and the leukemias with approximately 21,900 deaths. Other organ sites contribute decreasing, yet still significant, numbers of cancer deaths. Obviously, cancer causes a significant morbidity and mortality burden for society.

There are several well-known causes of cancer. Tobacco, the most notorious, is involved in over one-third of all cancer deaths. The attributable risk of cigarette smoking for lung cancer alone approaches 90%. Smoking causes cancers of the tongue, larynx, esophagus, urinary bladder, pancreas, uterus, and leukemia. Other causes of cancer include: ultraviolet radiation, a cause of skin cancer;

Table II: The two leading causes of death in the U.S. in 2001 and E.

Disease	Estimated deaths in 2001	Major elements of E	Major dietary component
Cardiovascular disease	700,142	Family history, smoking, blood lipids, blood pressure, obesity and diabetes	Yes, the majority of cardiovascular disease can be prevented with diet and tobacco avoidance.
Cancer	553,768	Smoking, carcinogen exposure, protective effects of diet	Yes, together with tobacco avoidance, up to 80% of cancer deaths may be preventable.

ionizing radiation, a cause of leukemia and certain solid tumors; chemicals such as benzene which cause leukemia; and a variety of infectious agents that cause various cancers (Adami, 2002).

Primary prevention is the most logical and cost-effective method to reduce the risk of cancer. Primary prevention of cancer is twofold: 1) avoidance of carcinogens, and 2) dietary. For some carcinogens such as tobacco use, overexposure to the sun, and certain sexually transmitted viruses, avoidance is straightforward. For other carcinogens such as ionizing radiation and other environmental exposures including certain infectious agents, avoidance may be more difficult.

Interest in the primary prevention of cancer by diet is substantial. An increasing body of data indicates a diet high in fruits and vegetables lowers the probability of developing a wide spectrum of cancers (El-Bayoumy et al., 1997). Many studies evaluating diet and cancer have shown the risk of cancer to decrease with increasing amounts of fruits and vegetables in the diet (WCRF, 2002). Current research is identifying complex molecules in fruits and vegetables that may have a protective effect such as isothiocyanates (Thornalley, 2002). Although not every epidemiologic study conclusively supports fruits and vegetables in the reduction of cancer incidence, the majority of the data strongly suggests increasing consumption of fruits and vegetables will reduce the risk of developing cancer. Interestingly, this is true for both lifestyle related cancers, such as smoking associated lung cancer (Pillow et al., 1997), non-smoking associated lung cancer (Nyberg et al., 1998), and non-lifestyle associated cancers such as leukemia (Ross et al., 2002). This suggests that, even with carcinogen exposure, a diet rich in fruits and vegetables may offer some protection. The body appears to function more robustly with a high intake of fruits and vegetables as initially designed.

In the aggregate, the majority of cancer deaths may be avoidable. Diet alone may be responsible for up to 30% of cancers (Nasca, 2001; Mathers 1999). It is conceivable that diet (30% or more of deaths) and tobacco use (greater than 30% of deaths) combined may be responsible for at least two-thirds of all cancer deaths. A CHM, if followed, can be expected to reduce the impact of cancer mortality and morbidity substantially. The evidence from cancer epidemiology is consistent with the CHM.

Obesity is now an epidemic in the United States. It is estimated that 30.5% of Americans are obese (defined as a Body Mass Index (BMI) of 30 or greater) and 64.5% are overweight (defined as a BMI above 25) (Flegal et al., 2002). The increasing incidence and prevalence of type II diabetes mellitus is a direct result of the obesity epidemic. Complications of diabetes include nephropathy, retinopa-

thy, neuropathy, an increase in coronary disease (Tierney, 2001), and higher incidence of cancer (Calle et al., 2003). Dietary interventions are first-line treatments for obesity. In addition to reduction in caloric intake, they involve a diet high in fruits, vegetables, and whole grains.

Most major health organizations recommend increasing fruits and vegetables in the diet. The American Heart Association, the American Cancer Society, the National Cancer Institute, the American Diabetes Association, etc., recommend increasing the intake of fruits and vegetables as primary disease prevention. A monograph produced by the American Institute of Cancer Research, which evaluated the dietary evidence for cancer prevention, generally recommends increasing fruit and vegetable consumption to reduce the incidence of many forms of cancer (WCRF, 1997). It follows directly that coronary artery disease, cancer, and obesity and its complications are to a large degree related to diet and, consequently, largely preventable. The preferred diet maximizes fruits, vegetables and whole grains that are natural, unprocessed, organic, and free of man-made pollutants.

This is not to suggest that every epidemiologic study concurs with the findings that a diet high in fruits, vegetables, and whole grains reduces the incidence of disease and mortality. Some studies show little relationship between the consumption of specific foods and the incidence of disease (Terry et al., 2001). Inconsistencies may be explained by confounding factors or methodological problems (Young-In, 2001). It is difficult to perform large-scale epidemiologic studies of diet and disease with accurate measurements of intake being potentially problematic (Van Assema et al., 2002). Nevertheless, the overwhelming preponderance of the data strongly supports a diet rich in plant products as the most healthful. The overall benefits of a plant-based diet are becoming clearer (Rajaram and Sabeté, 2000).

In the aggregate, the CHM and modern epidemiology are in agreement with respect to the primary prevention of disease: diet and lifestyle are the primary determinants of health and disease in industrialized societies. This is supported by the major health organizations. The benefits of a healthy diet are in all likelihood not limited to the common conditions discussed above (Weisburger, 2000). It is compelling that different organ systems have the *same diet* for optimal health. This is an expected observation if people were designed to live in a garden and consume plant foods (Emerson, 1996).

Some CHM Suggestions

There is a great amount of current interest in dietary approaches to health and weight control. Scientific findings

and recommendations, sometimes conflicting, seemingly change routinely. The CHM offers some dietary recommendations that appear applicable to a wide variety of health issues.

Yancy et al. (2003) have described some confusion about the optimum cardiac diet. Questions have arisen concerning the percentage of fat, protein, and carbohydrate in the preferred diet. Ornish has demonstrated that a vegetarian diet can be a vital component of a strategy to reverse coronary artery disease. The only proven diet to reverse coronary disease is a diet minimizing E, consistent with the initial creation. The CHM, as an incremental probability model, offers some guidance with respect to the best dietary approaches for optimal cardiac health: strive for a diet as consistent with the initially created diet as possible. As vegetarianism may be difficult to achieve in our society, a sensible strategy to minimize E is to maximize consumption of fruits, vegetables, and whole grains, minimize meat consumption, and avoid animal fat as much as possible.

The applicability and desirability of dietary strategies for cancer prevention are becoming more apparent. The preferred diet for cancer prevention is essentially the same diet that is recommended for cardiovascular disease prevention. As delineated above, a plant-based diet offers the greatest protection against developing cancer.

Other strategies such as chemoprevention may offer some protection against specific cancers in high-risk persons (You and Bergman, 1998). However, a diet high in fruits, vegetables, and whole grains is suggested by the CHM to be the preferred strategy for comprehensive cancer prevention in the majority of people. When diet is shown to reduce the incidence of cancer, the individual breakdown of the specific nutrients is generally not given and analysis may be difficult (Vainio, 1999). The CHM suggests that there is a balance of vital molecules in fruits and vegetables as designed by the Creator. The best approach to cancer chemoprevention may be a complete diet that includes a wide variety of complex molecules in the correct concentration available in fruits and vegetables. The correct balance of nutrients is defined by the design of fruits and vegetables and allows balance, interaction, or synergism of compounds required for maximum cancer chemoprevention. Any imbalance may preclude optimal cancer preventing molecular activities from occurring within cells. Consequently, the CHM suggests that a dietary approach which includes a wide variety of plant-based foods is the preferred method of cancer "chemoprevention."

This is not to suggest that a specific molecule may not be responsible for reduction in the incidence of a specific cancer such as selenium (Cohen 2002) or lycopene (Giovannucci and Clinton, 1998) for prostate cancer or

tamoxifen for high-risk breast cancer (Fisher et al., 1998). Chemoprevention may be appropriate strategy in a highly selected person. On the other hand, studies have shown that beta-carotene supplementation in heavy smokers *increases* the incidence of lung cancer (Lippman, 2001). Chemoprevention strategies that rely totally on supplementation with a specific molecule may fall short of what is necessary to reduce overall cancer risk.

Obesity is either the number one or number two public health problem in the United States. The formula is straightforward: calories in minus calories out determines weight. The consumption of junk food and high-fat foods tips the balance in favor of calories in. Vegetables are the most nutrient dense foods. Intake of fruits instead of high-calorie snacks can be valuable in weight control. A plant-based diet can be expected to assist with weight control by increasing the intake of salutary compounds. This is not to say it is not possible to be an obese vegetarian. Fruits and whole grains have a large amount of calories. However, it does suggest that obesity is largely diet related and the public health problem will be helped by dietary interventions. Obesity is directly related to type II diabetes mellitus and the mortality from cancer is increased in the obese (Calle et al., 2003).

There is currently great interest in diets such as the Atkins diet. The CHM suggests this diet is probably not viable for the long term since it deviates from the initially-designed, plant-based diet to a large degree. There are too much fat and meat and too few fruits and vegetables. There are numerous other diets, each purporting to yield favorable results. Short-term effects may be acceptable and even desirable if weight loss is attained. The long-term effects may be problematic. In the current era of dietary confusion and sometimes conflicting recommendations, the CHM gives the most sensible answer: eat a wide variety of natural, plant-based, unprocessed foods (Tucker, 2001) as designed by the Creator. The CHM offers a viable dietary approach for the long-term, and maximizes the probability of health.

The true value of the CHM model will be determined by its ability to form a framework on which to make recommendations for maximizing the probability of health. Several suggestions are delineated above. The CHM predicts that the more one adheres to a diet rich in fruits, vegetables, nuts, seeds, and whole grains, the greater probability of health. Modern epidemiology is drawing the same conclusion. The primary difference, however, is that the CHM answers the question "why" this way: *the dependence of good health on plant life is because it was designed that way*. This is a critically important concept for understanding health and disease. It is intriguing to contemplate the CHM as a therapeutic model as well as a preventive model. Obvi-

ously, all elements of e_1 and e_2 are not known. The potential permutations, combinations, interactions, and synergisms of e_1 and e_2 are enormous. The elucidation of additional components of e_1 and e_2 requires more research, especially with respect to elements of e_2 and plant life.

Expectation for a Society Following the CHM

Significant improvement in public health can be expected for a society that adheres to the CHM. Understandably, it is not a trivial matter to adhere to the CHM. Our society consumes too much meat with fat and processed foods are ubiquitous. Tobacco and alcohol use is very common and exercise is insufficient. Dietary adherence to the CHM and avoidance of tobacco, however, can be expected to play a significant role in eliminating up to eighty percent of all cancer mortality and the majority of coronary artery disease. The vast majority of obesity and type II diabetes as well as its complications could be prevented. It is likely that other diseases are related to diet and will be positively influenced by adherence to the CHM. Reduction in alcohol use will result in less cancer, liver disease, and accidents.

The role of alcohol in coronary prevention is somewhat controversial and is not well enough substantiated to support drinking wine. The same beneficial effects can be secured from non-fermented grape products. Sexual relations within marriage eliminate the epidemic of venereal diseases. When consideration is given to all the evidences of design found throughout nature, it is not surprising to see that a health model which considers the Creator will have a significant effect on health and disease. Striving for a lifestyle consistent with the CHM appears to offer the highest probability for attaining health and preventing disease.

The CHM does not eschew medical care. Clearly, modern medicine has a lot to offer for the prevention and treatment of disease. The knowledge base and technological achievements are marvelous. Therapeutics and secondary prevention strategies have improved health substantially. The responsibility of health and the primary prevention of disease, however, rest with the individual and not the institution of medicine. Lifestyle is the most important determinant. Adherence to the CHM minimizes health problems and maximizes good health. Yet, no amount of primary prevention will prevent all sickness and disease. Adoption of the CHM by the majority of the population would significantly reduce demands on our already overburdened healthcare system.

It can be argued that elimination of current day diseases will just delay the inevitability of death and disease, essentially trading one for another. This is true to a certain

extent. With the goal to maximize health, minimize morbidity, and enhance longevity, however, trading a cancer death or cardiovascular death at age 60 or 70 for a natural death at age 110 or 115 after a productive life seems prudent especially if one maintains vitality until the end. With the squaring of the morbidity curve; i.e., death is not preceded by a long period of morbidity and disability (Fries, 2003), this is not an unobtainable goal.

Plants are the Source of Important Compounds

Plants are chemical warehouses containing literally hundreds of different compounds important in homeostasis. Homeostatic compounds are necessary for cellular regulation and differentiation. Sulforaphane in broccoli, beta-carotene in carrots, and lycopene in tomatoes are some examples of compounds that have been shown to be important in cancer prevention. Plants also produce phenols, flavinoids, isothiocyanates, and indoles. In general, fruits, vegetables, and whole grains are free of cholesterol, saturated fatty acids, and trans fatty acids, which are each implicated in the pathogenesis of coronary disease. With all likelihood, there are many more compounds yet to be discovered, whose role in health is yet to be elucidated (Balentine et al., 1999). If humans developed out of a primordial slime under selective reproductive pressures, a critical reliance on plant life for optimal health makes no sense. The dependence of good health on so many of these compounds defies a cogent and sensible evolutionary explanation (Bergman, 1997).

Difficulty with an Evolutionary View

The overall evolutionary model may suggest that animals and plants coevolved and the dependency of good human health on plants is a result of such coevolution. If that is the case, then it is not clear how evolution of plants would have been directed to favor humans. Plant factors that would have been selected are those that abet plant reproduction, not factors critical for human health. In the struggle for survival, why would plants develop compounds vital for human health? The critical dependency of humans on phytochemicals is not explained by natural selection. The intellectual bankruptcy of evolution is again apparent. The only way evolution can be made to fit the observed data is by referring to the transparent and stale argument: that there were selective advantages over vast eons of evolutionary time leading to the current state. However, this really explains nothing and evolutionary theory offers no specific suggestions to improve health and reduce disease.

The data fit perfectly well with Genesis and a Creation

model, implying the CHM is a better explanation of the critical importance of plants in human health. The increasingly apparent dependence of optimum health on plant life does not prove creation and a purposeful design. The CHM does suggest the Creation model, however, rather than overall evolution. Modern epidemiology is increasingly pointing to a plant-based diet as a vital component to health, thus supporting the Bible. The CHM fits the observed data and adds further support to the many evidences of Creation. It helps refute Darwinian evolution as well.

Summary

Modern epidemiology strongly suggests that optimal health depends on a plant-based diet high in fruits, vegetables, nuts, herbs, whole grains, and avoidance of known disease causing activities. The probability of developing a variety of diseases such as coronary artery disease, cancer, and diabetes mellitus can be substantially attenuated by lifestyle choices, especially diet. These observations are not explained adequately within an evolutionary framework.

The CHM is an incremental probability model that suggests the likelihood of developing disease is a function of the lifestyle deviation from the initial plan of Creation. The CHM provides a foundation for understanding the apparent high dependence of humans on plant life for optimal health; i.e., *it was designed that way*. The CHM strongly suggests the dependency of optimal health on plant life is a direct consequence of the initial design of Creation and offers specific suggestions for maximizing primary prevention of disease and attaining a long, healthy life. Epidemiologic analysis of health and disease under a Creationist framework is supported by the data.

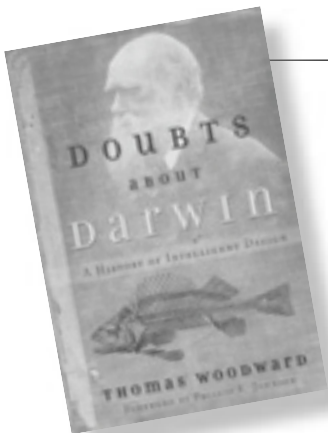
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Book Review

Doubts About Darwin: A History of the Intelligent Design Movement
by Thomas Woodward

Baker Books, Grand Rapids, 2003, 303 pages, \$17.00.

Thomas Woodward, a professor at Trinity College of Florida, teaches history of science, communication and systematic theology. He has produced a fascinating and comprehensive history of the Intelligent Design (ID) movement. Woodward approaches the historical analysis of the ID movement from the locus of modern communication theory. He relies heavily on Thomas Kuhn's enormously influential book, *The Structure of Scientific Revolutions* (1962) to interpret the successes of the ID movement.

Woodward begins his book with a brief introduction to the Intellectual Design movement. In the first chapter he establishes the major players in the movement and such notions as "paradigm shift." Then he presents a brief survey of the first glimmerings of

dissent to the reigning Darwinian orthodoxy. Non-theist dissenters include the 1966 Wistar Institute meeting where mathematicians confronted Darwinian biologists with the improbability of evolution happening by natural selection and random mutations. Also included are the skepticism of French biologist Pierre Grasse, and Stephen Jay Gould and Nile Eldredge's introduction of punctuated equilibrium as a mechanism to shore up the inadequacies of neo-Darwinian theory. A prominent doubter was astronomer Fred Hoyle who argued vigorously concerning the bankruptcy of origin of life scenarios.

Woodward devotes a paragraph to scientific creationism (p. 35), and makes two mistakes (the dates for publication of the Genesis Flood and the founding of the Institute for Creation Research). From the outset the creation science movement is marginalized

as hopelessly bogged down in biblical literalism. It is unfortunate that Woodward falls for the evolutionists' ploy of linking scientific creationism with the Bible. Henry Morris, Duane Gish and others in their early advocacy of creation science sought to stay strictly with scientific issues. Often in debates it was the evolutionists who brought up theological/metaphysical and time issues. If the reader wants to know more about scientific creationism Woodward refers them to Ronald Numbers' *The Creationists* (1992) as "a definitive account" of the creationist movement (p. 253).

Chapter three covers the impact of Michael Denton's critique of neo-Darwinian theory called *Evolution: A Theory in Crisis* (1986). Denton used many of the same arguments against Darwinian evolution the creationists had been making for years, but his agnostic beliefs seem to have blunted the criticisms that he was a stealthy creationist.

Chapters four through six introduce Phil Johnson, UC Berkeley Law professor who is called the father of the modern ID movement. While on sabbatical in England Johnson visited at a London bookstore which displayed Denton's book and also neo-Darwinian Richard Dawkins' *The Blind Watchmaker* (1985). Johnson purchased both books and immediately read them. His problem of selecting an adequate sabbatical research topic was solved. He became immersed in a year-long research effort to test the conflicting views of Denton and Dawkins. Johnson approached the mountains of evidence from the perspective of a well-trained defense attorney and law school professor. He carefully evaluated the evidence and found Denton's case far more compelling. This launched Johnson into presenting his findings before his Berkeley colleagues and eventually his research treatise turned into the book *Darwin on Trial* (1991, 1993). Chapter seven deals with the impact of Johnson on the intellectual landscape. Biochemist Michael Behe read Johnson's book and believed that Johnson made a very strong case. Behe wrote a dissenting letter to the journal *Science* after the publication of a critical notice of Johnson's book. Johnson quickly contacted Behe and before long both men were communicating and working together on common goals.

Chapter eight describes the genesis of *Darwin's Black Box* (1996) by Michael Behe. While Philip Johnson aimed at demolishing the neo-Darwinian view of evolution, Behe introduced what he coined "irreducible complexity." Irreducible complexity is the concept that living organs are made up of a series of integral and vitally connected components. If any one of these components does not function properly the entire organ does not function. By inference these complex organs need a designer to properly function in the first place. Chance, natural selection and random mutations are wholly inadequate to accomplish this feat.

Chapter nine considers the contributions of emerging young ID scholars known as the "four horsemen" — Stephen Meyers, Paul Nelson, Jonathan Wells and William Dembski. The highlight of this chapter is Dembski's "explanatory filter" concept used for detecting whether an object is designed or can be adequately

explained by natural processes. The final chapter summarizes the continuing impact of that the ID movement on the current intellectual landscape. The book concludes with comments by Princeton University professors Andrew Bocarsly and Robert Kaita, several appendices, notes, a selected bibliography and an index.

Thomas Woodward displays his strengths as he constructs this history. First, he uses modern communication theory with its analytical theories and terms such as Symbolic Convergence Theory, factual-empirical narrative, semi-imaginative narrative, and rhetorical vision to explain why Denton, Johnson and Behe were as effective as they have been. Woodward is a long-time observer of the creation movement and he has had access not only to the key ID spokesmen but also to their evolutionist counterparts. As noted earlier scientific creationism is marginalized and in some ways stigmatized because of its supposed biblical literalism. Denton, Johnson and Behe felt they needed to distance themselves from creationists in order to get a hearing from the intellectual establishment. Both Johnson and Behe do this by rearranging the rhetorical playing field. They communicate that both Darwinism and Young Earth Creationism are two opposite "fundamentalisms" (a stigma word). "Note also that, like Johnson, Behe positions himself in intellectual space between and above the two *a priori* positions—the metaphysical materialists and the young earth creationists" (p. 168). One gets the impression that if it were not for those pesky young earth creationist biblical literalists the ID movement would have a much easier time.

The ID movement is made up of many differing beliefs. While Michael Behe deconstructs natural selection as inadequate to explain biological complexity, he states, "I find the idea of common descent (that is all organisms share a common ancestor) fairly convincing, and have no particular reason to doubt it" (p. 159). On the other end are young earth creationists like Paul Nelson and John Mark Reynolds. However most ID advocates stake a middle ground that rejects macroevolution but accepts the supposed billions of years of geological history: "...most Design advocates hold to various forms of a 'progressive creationist' view, which implies that a creator periodically introduced new creatures into the earth along the conventional timeline" (p. 201).

We can be thankful for the success of the ID movement in calling into question the validity of macroevolution just as its older "cousin" (p. 240) creation science has been doing years before using similar arguments. It would be exhilarating to see advocates with the same astuteness and rhetorical power as Denton, Johnson and Behe target the mythological billions of years-long geological timescale for demolition. However as Christians we must be ever mindful that even if we win all the debates the souls of man are of paramount importance to the Creator we serve.

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Some Evidence of a Recent Gigantic Flood on the Lower Colorado River at Grand Wash Cliffs and Hualapai Plateau, Arizona

Allen Roy*

Abstract

In the early 20th century, J. Harlen Bretz concluded from geomorphic evidence that, contrary to conventional wisdom, the Channeled Scablands of eastern Washington had been formed by a colossal Pleistocene flood. Similarities between features of eastern Washington and western Arizona near the Lower Colorado River suggest the possible extrapolation of Bretz' work to Arizona. Dry Falls, Washington and Grand Wash Cliffs, Arizona both exhibit: 1) depth indicators, 2) floodwater scouring, 3) headward channel erosion, 4) backfilled channels, 5) dry water falls, and 6) flood bars. The evidence suggests that floodwaters stripped about 150 meters of sedimentary rock from the Hualapai Plateau and formed a giant waterfall at the Grand Wash Cliffs until headward channel erosion captured the floodwaters, carving the Grand Canyon. Thus it is possible that the Grand Canyon at the Hualapai Plateau and Grand Wash Cliffs area was carved by a cataclysmic flood. It is not clear whether this took place in the late stage of the Genesis Flood, or later.

Introduction

In 1919, J. Harlen Bretz published his first paper on the Channeled Scablands of eastern Washington State (Bretz, 1919). He had come to the remarkable conclusion that a large Pleistocene flood had swept across eastern Washington stripping off the surface loess and underlying layers of basalt, leaving intertwining channels, flood bars, and dry falls.

For the next 45 years Bretz fought a bitter battle against existing strict uniformitarian beliefs. Finally, in 1965, after an extensive field trip through Montana, Idaho, and the Scablands, several geologists of the International Association of Quaternary Research wired Bretz the message, "We are now all catastrophists." (Bretz, 1969, p. 541) But of course, they did not mean catastrophists in the Biblical sense of the word.

Although rapid erosion of Grand Canyon has been sug-

gested for a long time (Newberry, 1861; Blackwelder, 1934; Bowles, 1978; Douglass and Meek, 2000; Lundstrom, 2000; Schmidt, 2000) predominant interpretations all involve slow processes acting over long ages of time. By 1932, Bretz had published 12 papers (see reference section), but his concepts had not been extended to other areas. One such area is the Grand Wash Cliffs and the Hualapai Plateau in Arizona. Geologists who performed the primary research in this region (Longwell, 1936; 1946; Young, 1966; Lucchitta, 1967) made no reference to his work.

Creationists have proposed the rapid erosion of the Grand Canyon (Burdick, 1974; Austin and Whitmore, 1986; Holroyd, 1987; 1990; Austin, 1988; Brown, 1989; Williams, et. al., 1992; Oard, 1993; Austin, et. al., 1994) and some (Austin, Oard and Williams, op cit.) noted similarities between the Lower Colorado River and eastern Washington. This paper is the beginning of a much needed closer look at erosional and depositional features of the Grand Wash Cliffs and Hualapai Plateau area, which may be analogs to the Channeled Scablands, and may have been created by a flood similar to the Bretz Flood (I suggest the use of "Bretz

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Figure 1. The Channeled Scablands of eastern Washington State appear as the black intertwining lines crisscrossing the map. The Bretz Flood started at the upper right then flowed southwestward between the Columbia River to the north and west and the Snake River to the south. The gray areas show approximately where the floodwater ponded behind restrictions to the flow. The floodwater exited at bottom center following the Columbia River Gorge to the Pacific Ocean.

Flood” rather than “Missoula Flood” or “Spokane Flood” in honor of J. Harlen Bretz and his work).

Synopsis of the Bretz Flood

During the post-Flood Ice Age, a lobe of ice blocked the Clark Fork River where it empties into present-day Pend Oreille Lake, near Sandpoint, Idaho, creating Glacial Lake Missoula. Eventually the great ice sheets began to melt. Meltwater and rivers fed Lake Missoula, and it attained a depth of nearly 607 m (1,990 ft). The glacial ice that dammed Lake Missoula was then breached, resulting in catastrophic discharge of the water overland to the sea (Figure 1). The floodwater spread out westward across the Spokane Basin, followed the Columbia River Valley, and then overtopped hills on the south side of the valley. The raging water rushed across eastern Washington, eroding the loess (surface soil) and gouging the underlying basalt to create the Scablands.

Of particular interest is Dry Falls, a spectacular feature that may be typical of such large scale flooding. A channel nearly 50 m (165 ft) deep exited the Upper Grand Coulee,

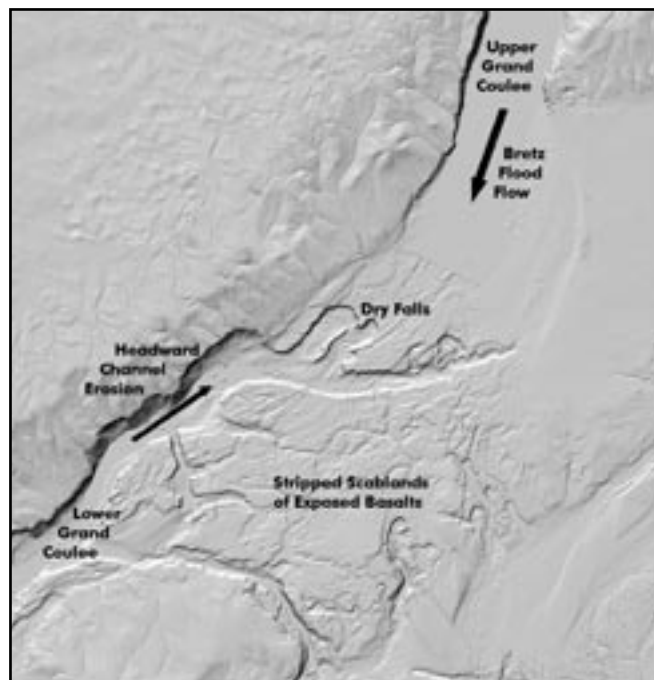


Figure 2. A channel nearly 50 m deep exited the Upper Grand Coulee, at top center and stripped the loess leaving exposed basalt. The floodwater channeled again well below where Dry Falls is now. Headward erosion through the scabland formed Lower Grand Coulee. Had the floodwater continued its headward erosion, it would have continued through the Upper Grand Coulee, previously formed by headward erosion.

eroding loess and basalt, and forming a large scabland area (Figure 2). High flow velocity resulted in the plucking of large blocks, causing coulees to be eroded headward through and around the scablands. Flood bars formed in areas of slack flow. At peak flow, this area probably looked like gargantuan rapids.

The magnitude of the Bretz floods strongly suggests that all these features were formed beneath the surface of the floods, and that there were no true waterfalls in eastern Washington during the maximum spate of each flood. (Allen, Burns, and Sargent, 1986, p. 114).

As the flow began to dissipate, water drained into the coulees as waterfalls, seen today as 90-m (295-ft) cliffs and blue lakes marking the site of the cataracts, subsequent waterfalls, and accompanying plunge pools (Figure 3).

Where as some have envisioned several floods across the Scablands as illustrated above by Allen, Burns, and Sargent (1986, p. 144), Oard (2000; 2003) shows that the evidence best fits a single Lake Missoula and associated flood.



Figure 3. This is a digitally produced panorama of Dry Falls. The Bretz Flood flowed from the Upper Grand Coulee at top center down toward the lower left. There are stripped Scablands both above and below Dry Falls. Vertical exaggeration: 1x.



Figure 4. Location of Grand Wash Cliffs.

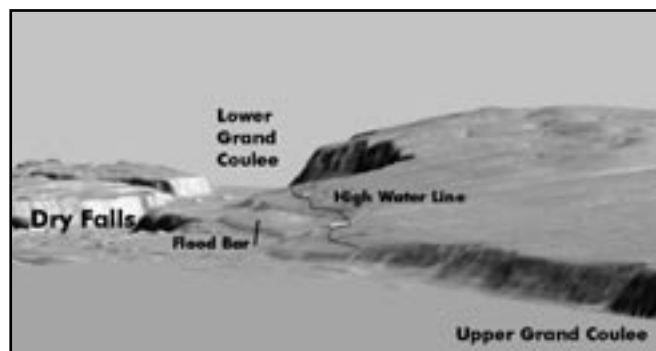


Figure 5. This digital view is from upstream of Dry Falls looking toward Lower Grand Coulee. The depth of the floodwater is indicated by shoreline markings about 50 meters high on the hillside and cliff (lower right). A further indication of the depth is a slack-water flood bar 31 meters thick and 2.3 kilometers long at the foot of the hillside next to Dry Falls. Vertical exaggeration: 2x.

A Comparison of Dry Falls and the Grand Wash Cliffs Area

Along the Colorado River in the region about the Grand Wash Cliffs (Figure 4) certain erosional and depositional features can be found that appear to be comparable with those formed by the Bretz Flood at Dry Falls.

Depth Indicators

At Dry Falls, the depth of the floodwater is indicated by shoreline markings about 50 m (165 ft) high on the hillside along side Dry Falls (Figure 5). Below the high water indicator the slope of the hillside is foreshortened (i.e., made steeper by the floodwater). The cliff in the lower right had been cut by earlier headward erosion that created the Upper Grand Coulee. A similar feature is found on the Hualapai Plateau above the Grand Wash Cliffs near the mouth of the Grand Canyon (Figures 6 and 7). This eroded cliff structure that curves across the plateau for 3 km (1.9 mi) exposes some of the “Paleozoic” strata which comprise the Hualapai Plateau. The top of the eroded cliff, ~150 m (492 ft) high, likely indicates the high water elevation above the Hualapai Plateau in this area. This is about three times the depth of the water at Dry Falls.

Geomorphic Scouring

In the scablands above and below Dry Falls, there are areas of exposed basalts (Figures 2 and 3) that were scoured by the floodwaters. A similar feature exists on the Hualapai Plateau above the Grand Wash Cliffs.

The Hualapai Plateau consists of *an erosion surface* that slopes gently northeast and is cut into Paleozoic rocks ... and, locally, into Precambrian rocks... (emphasis added) (Lucchitta, 1972, p. 1940; cf. Figure 7).

About 50 meters (165 ft) of sediments on the Hualapai

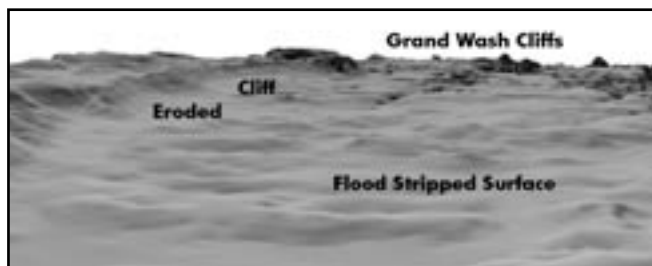


Figure 6. This panorama across the Hualapai Plateau above the Grand Wash Cliffs shows an eroded cliff 150 meters high. This cliff stands beside the large flood stripped surface between it and Grand Canyon to the right. The top of the cliff likely indicates the floodwater depth above the Hualapai Plateau. Vertical exaggeration: 1x.

Plateau were apparently scoured away by sheet erosion leaving the eroded cliff structure (Figure 8).

Headward Channel Erosion

Lower Grand Coulee, which ends at Dry Falls, was formed by headward erosion during the Bretz Flood (Figure 2). A similar erosional feature, the Lower Granite Gorge of Grand Canyon, starts at Grand Wash Cliffs and extends up into the plateau lands. It also may have formed by headward erosion as floodwater flowed across the Hualapai Plateau and over

the Grand Wash Cliffs (Figure 7). As the canyon eroded into the plateau it might have captured and channeled the floodwater off of the plateau. This redirection of the flow would have reduced the amount of water falling over Grand Wash Cliffs, until all the water would eventually have been captured in the canyon, and no water would be falling over the cliffs. The “falls” would essentially be moving upstream with the head of the channeling erosion.

Several tributary canyons extending southwest from Lower Granite Gorge were likely cut at this time on the

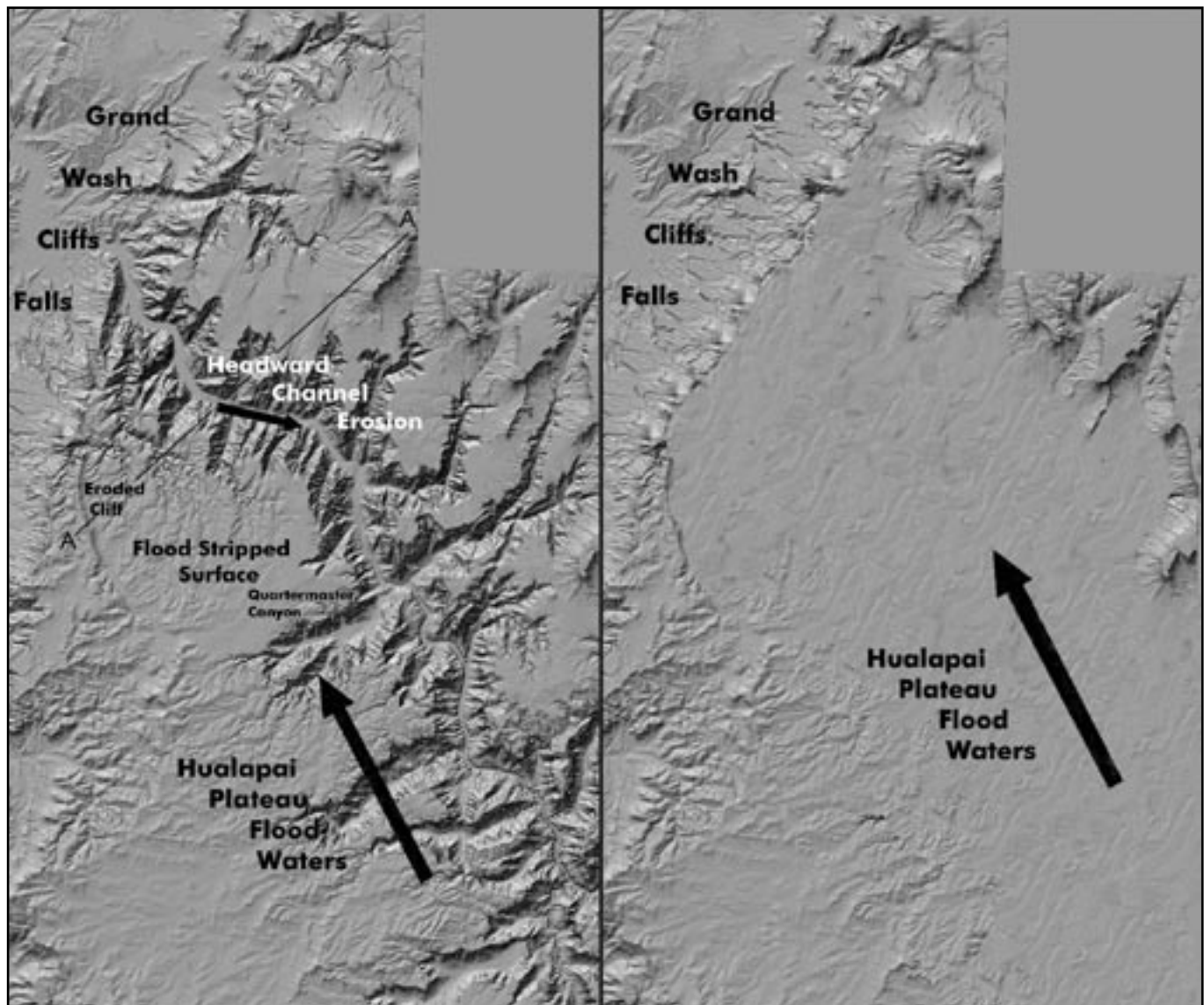


Figure 7. The left hand DEM shows the Hualapai Plateau, Grand Canyon and the Grand Wash Cliffs as they exist now. The right shows what the Hualapai Plateau may have looked like during initial stages of flooding. Water flowed across the Hualapai Plateau above the Grand Wash Cliffs and sheet-erosion created the eroded surface area. The Hualapai Plateau slopes slightly to the north. The waterfall over Grand Wash Cliffs was some 1050 meters high. Headward erosion carved this section of the Grand Canyon from a channel forming at Grand Wash Cliffs. Vertical exaggeration: 1x.

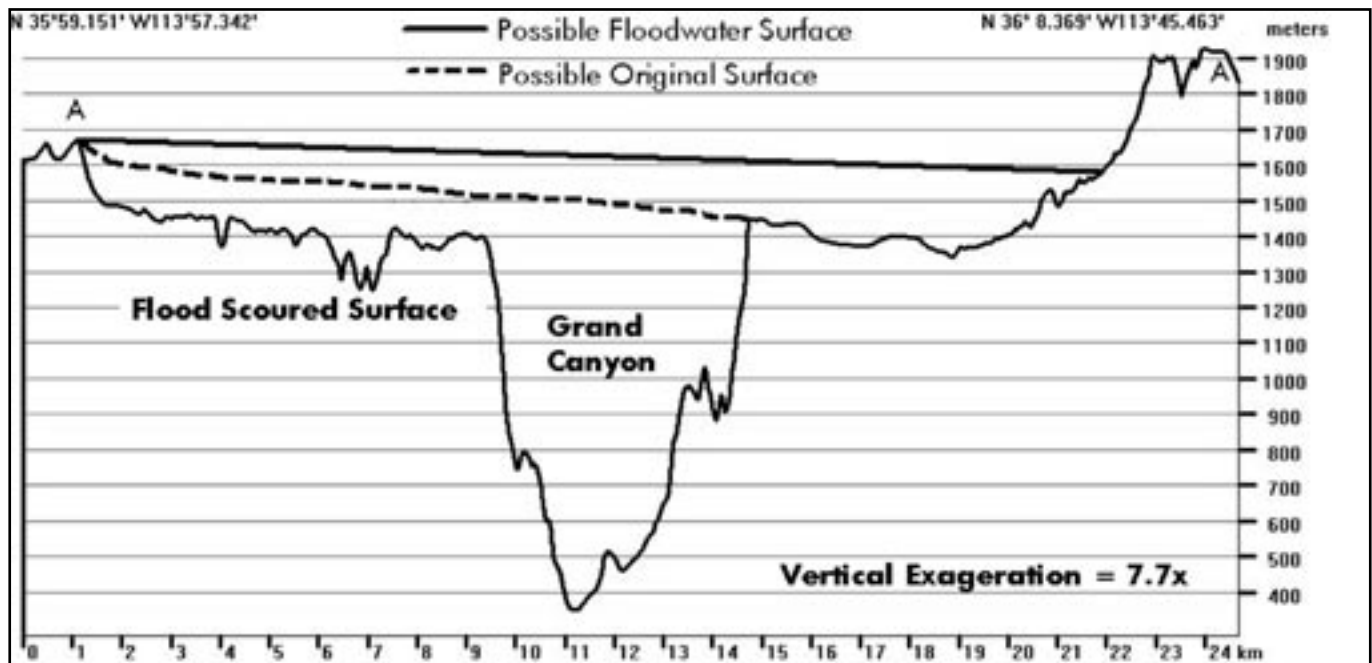


Figure 8. Cross-section A-A' from Figure 7, left panel. The dashed line is thought to be the original surface of the Hualapai Plateau before floodwater eroded it to its present elevation. Because the current was turning right, sheet erosion was most effective to the left. Grand Canyon was later carved by headward erosion.

northward-sloping Hualapai Plateau. Each successive tributary canyon to the east would have cut off the flow on the plateau to those farther west. Then, once the headward erosion of the Lower Granite Gorge followed the Hurricane

fault northward (Young, 1970, p. 113), there would be no more water on the Hualapai Plateau and the southwestern tributaries would cease to be cut. They would have been subsequently filled with sediment-laden water as happened during the Bretz Flood (see below).

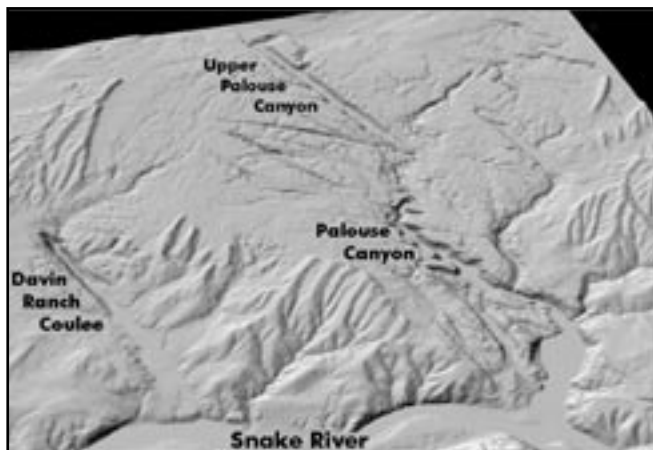


Figure 9. The Davin Ranch Coulee is approximately eight kilometers west of Palouse Canyon. Both canyons were cut by the Bretz Flood (from the top right) as it spilled into the Snake River Basin. Eventually, Upper Palouse Canyon captured most of the floodwater. The inactive Davin Ranch Canyon was backfilled with conglomerate. Vertical exaggeration: 1x.

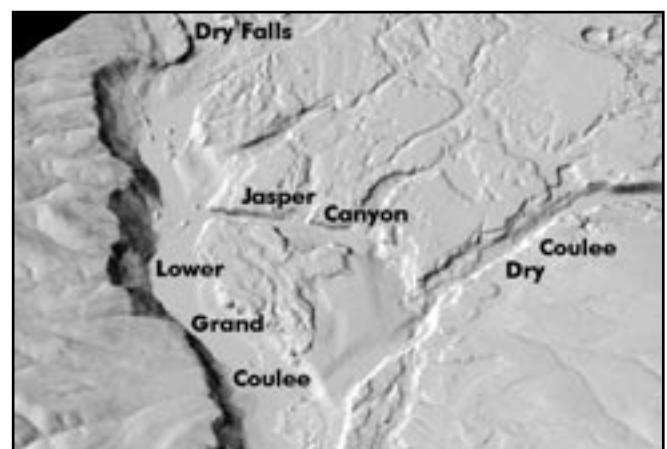


Figure 10. At Dry Falls the Bretz Flood was channeled into the Lower Grand Coulee, stopping the flood from flowing across the channeled scablands to Jasper Canyon and Dry Coulee. The flood in the Lower Grand Coulee backfilled Jasper Canyon and Dry Coulee with conglomerate bars. Vertical exaggeration: 1x.

Backfilled Channels

Davin Ranch Coulee, approximately 8 km (5 mi) west of Palouse Canyon, was cut by the Bretz floodwaters at the same time as Palouse Canyon (Figure 9). But, Upper Palouse Canyon eventually captured most of the floodwater. Water in the Snake River Canyon then backfilled the inactive Davin Ranch Coulee with conglomerate. Similarly, Dry Falls captured floodwater for the Lower Grand Coulee (Figure 10) and Jasper Canyon and Dry Coulee were backfilled with conglomerate.

In Arizona, Meriwhitica Canyon (Figure 11) is backfilled similar in style to the Davin Ranch Coulee. The Hindu Canyon/Lost Man Creek channel conglomerate has its counterpart in the Jasper Canyon/Dry Coulee fill. It is

possible that Peach Springs Canyon, Milkweed Canyon and Spencer Canyon were all filled after Lower Granite Gorge captured the proposed Hualapai Plateau flood. Lucchitta (1972, p. 1941) concluded that the conglomerate fill in these canyons “could have come only from Precambrian rocks in the present basin and range province to the west and southwest.” According to Young (1966), these canyons were cut early by run-off from hypothetical mountains to the south and filled with conglomerate from the same source, rather than forming at the same time as the Grand Canyon. This interpretation was developed because Grand Canyon is thought to be younger than the Hualapai Limestone of the Muddy Creek formation at the mouth of Grand Canyon, dated at 5 to 6 Ma (Lucchitta, 1979, p. 82). Likewise,

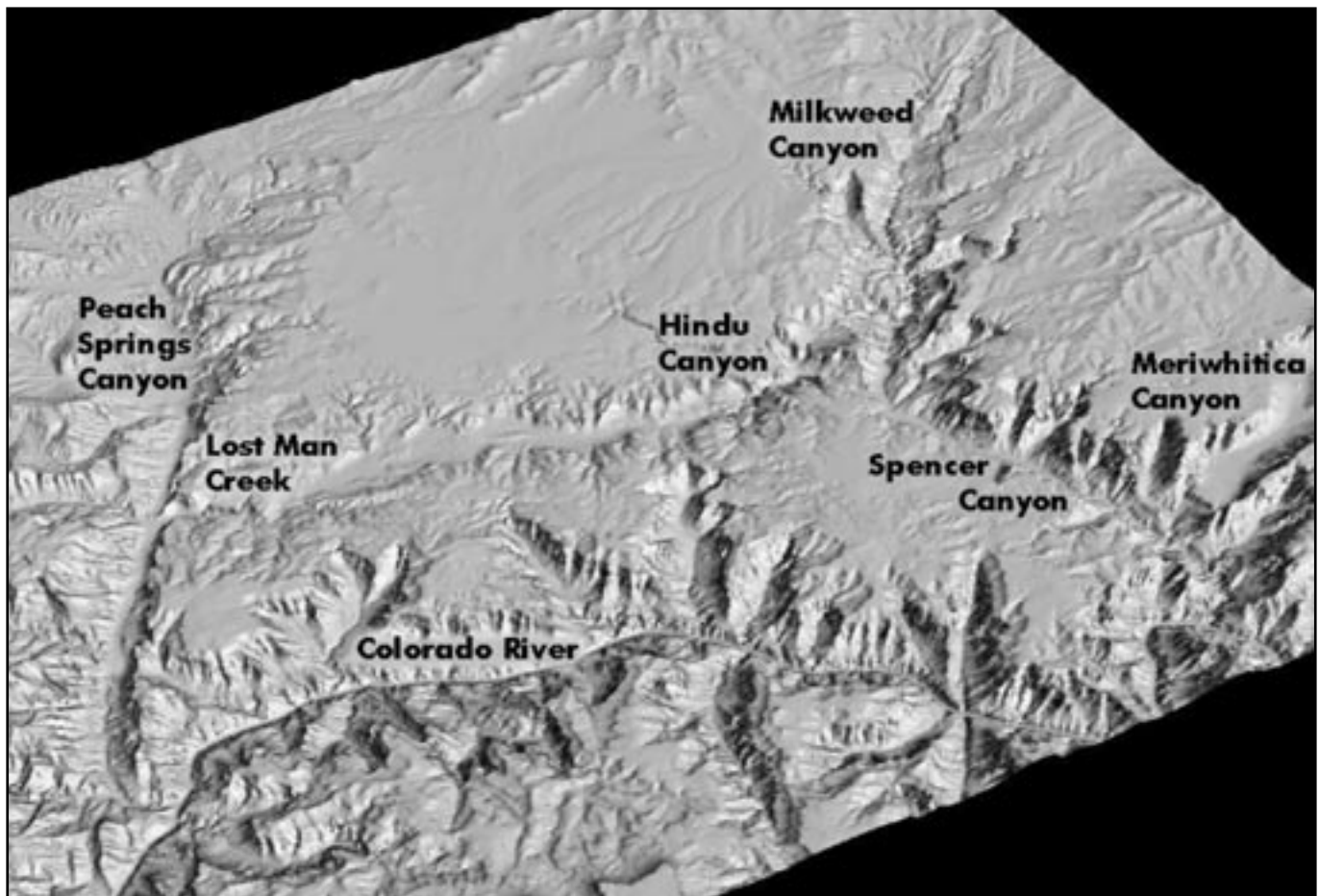


Figure 11. View from the southwest across the Hualapai Plateau from the Lower Granite Gorge of the Grand Canyon. Peach Springs, the Hindu Canyon/Lost Man Creek, Milkweed, Spencer, and Meriwhitica canyons were backfilled with arkosic conglomerates, limestones, red siltstone and claystone sediments, probably after the Lower Granite Gorge eroded headward (to the left) past the mouths of the canyons. Peach Springs and Milkweed Canyons still have portions of the backfill in the upper part of each canyon. The Hindu Canyon/Lost Man Creek Channel and Meriwhitica Canyon backfill remains because the drainage basins are much smaller than the basin of Peach Springs or Milkweed Canyons. Vertical exaggeration: 1x.

the Hualapai Limestone is considered younger than the Peach Springs Tuff, dated at 18.3 Ma (Young, 1970, p. 110), and the Peach Springs Tuff must be younger than the canyons and conglomerate because it covers both. Therefore, based on isotopic dates, the canyons containing the conglomerate must be older than Grand Canyon. And, consequently, the “Colorado River tributaries are developing on these Cenozoic [sic] deposits and have partially exhumed the older channel system in the major canyons which are tributary to the Colorado” (Young, 1970, p. 110). However, I consider isotopic dating to be a useless tool and so do not thereby limit my search for interpretations that fit the observations.

Rock exposed in Grand Canyon is of the same type as the arkosic conglomerates, limestones, red siltstone and claystone found in the side canyons. So, Peach Springs Canyon, the Hindu Canyon/Lost Man Creek channel, Milkweed Canyon, Meriwhitica Canyon and even Quartermaster Canyon (Figure 7) could just as easily have been filled by detritus from the headward erosion of the Grand Canyon as from the hypothetical mountains proposed by Young.

After the tributary canyons were filled with sediments, lava flows and volcanic tuff (Peach Springs Tuff), covered them. Then, local detritus from the Music Mountains would have washed northward across the lava flows of the Hualapai Plateau. After the carving of the Grand Canyon, rainfall and associated local flooding may have begun re-excavating the side canyons as tributaries to the Colorado River. Peach Springs and Milkweed canyons still have significant portions of the sediment fill in their upper reaches. The Hindu Canyon/Lost Man Creek Channel and the Meriwhitica Canyon fill have likely remained largely in place because those drainage basins are much smaller than those of Peach Springs or Milkweed canyons. The relative size of the proposed flood event at the Hualapai Plateau can be estimated by comparison to the Jasper Canyon/Dry Coulee system fill, which is 5.7 km (3.5 mi) long, with that of the Hindu Canyon/Lost Man Creek Channel, which is 14.3 km (8.9 mi) long. Also, the backfill in the Davin Ranch Coulee is 5 km (3 mi) long, while in Meriwhitica Canyon it is over 9 km (5.5 mi) long.

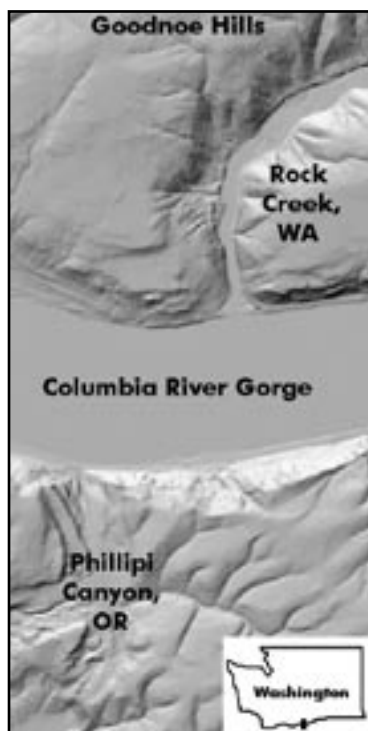


Figure 12. Rock Creek and Philippi Canyon are on opposite sides of the Columbia River Gorge about three kilometers apart. Vertical exaggeration: 1x.

Dry Waterfalls

The Dry Falls cliffs, some 90 m (295 ft) high, stand as stark reminders of the Bretz Flood that carved the Upper and Lower Grand Coulees (Figure 3). At the Grand Wash Cliffs, much of the original cliffs have been eroded away due to the headward erosion of the Grand Canyon. However, Figure 7 gives an indication of what the Hualapai Plateau may have looked like before this section of Grand Canyon was carved. The fall of the water down the Grand Wash Cliffs was some 1,050 m (3,444 ft), more than 12 times the height of Dry Falls.

Flood Bars

Giant flood bars formed during the Bretz Flood in areas of slack water throughout its drainage area (Figures 3 and 5). Two of those bars are found in the Columbia River Gorge near Goodnoe Hills, WA (Figure 12). In this part of the gorge, the flood reached a depth of about 260 m (853 ft). At the mouth of Rock Creek, WA, a bar 150 m (490 ft) high and 1.1 km (3,600 ft) long was formed in slack water backing up into Rock Creek Canyon (Figure 13). The

bar consists of unsorted conglomerate with local angular clasts mixed with well-rounded river rock from upstream.

A second flood bar is located a little over 3 km (1.9 mi) away, in Philippi Canyon, OR (Figure 14). It contains the same mixture of rock and sand as the Rock Creek bar. Water from the Bretz Flood overflowed the Columbia River Gorge through Philippi Canyon, spilling over into the nearby John Day River Canyon. Exotic river rock was found just below the still-discernable high water mark of the Bretz Flood in Philippi Canyon. Many other side canyons of the Columbia River Gorge have similar flood bar deposits.

On each side of the mouth of Grand Canyon, two flood bars formed in eddies against the Grand Wash Cliffs (Figure 15) similar to those in the Columbia River Gorge. The one on the north side of the river (on the left) is over 377 m (1,237 ft) high and 5.7 km (3.5 mi) long. This flood bar is described as a debris fan by Lucchitta:

The west-draining canyons are short and steep. Where they debouched into the Grand Wash trough, the washes that carved the canyons have deposited fans of locally derived material. One such fan emerges from Pierce Canyon, whose mouth is only 1.5 miles (2.5 km) north

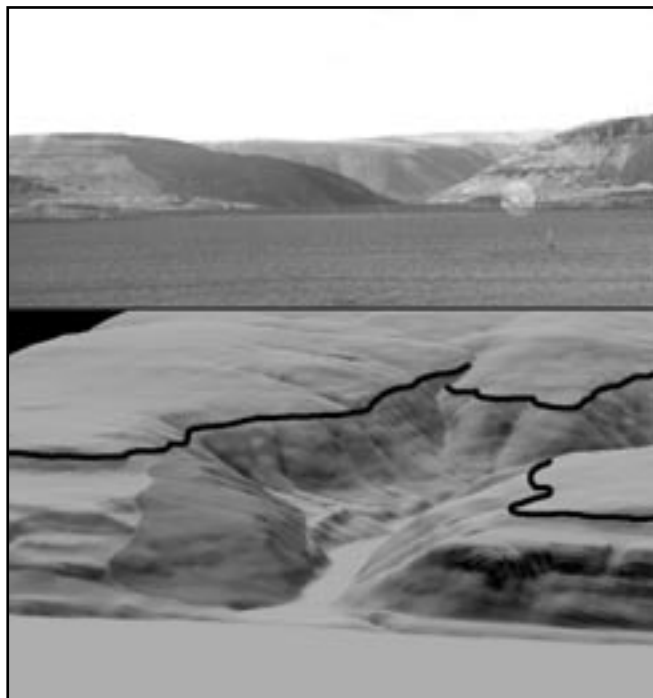


Figure 13. Rock Creek flood bar (darkened area to left in both photo and image) extends into Rock Creek Canyon about 1.1 km (3,609 ft) and reaches up the canyon about 150 m (492 ft). The highest elevation of the Bretz Flood is shown by the black line on the image. Note the large truck (circled) for scale. The flood flowed from right to left. Vertical exaggeration: 2x.

of the Grand Canyon. The fan was deposited across the mouth of the present Grand Canyon. This could not have happened if the Grand Canyon and the Colorado River existed in their present location at the time. (Lucchitta, 1990, p. 327).

However, in similar nearby deposits that have also been interpreted as debris fans, I have found common river rock whose source could not be locally derived nor be debris fan constituents. Because Lucchitta believes that the deposition in Pierce Canyon is a debris fan, he concludes that it could only have been deposited before the river flowed through the area separating the smaller “debris fan” on the south side from the large one to the north.

The smaller flood bar on the south side of the river is about 246 m (800 ft) high and 1.2 km (0.75 mi) long. Longwell (1936, p. 1457) described and interpreted these formations as “coarse, cemented fan deposits, well exposed in cliffs on both sides of the river...”

A comparison with the Bretz flood may give an approximate amount of time for the floodwater on the Hualapai Plateau to cut and fill the side canyons. Down stream from

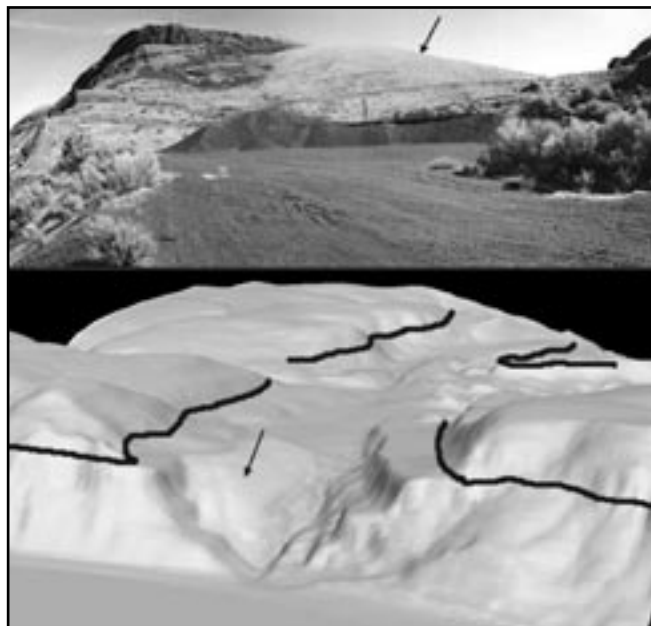


Figure 14. The Philippi Canyon flood bar in a photo (above) from a borrow pit at the mouth of the canyon and in an image (below). The black line shows the highest elevation of the Bretz Flood. The floodwater flowed left to right down the Columbia River Gorge. Vertical exaggeration: 2x.

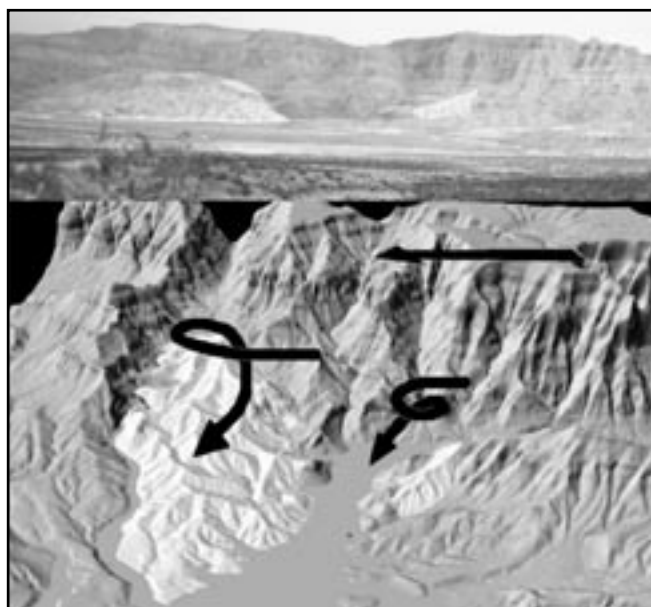


Figure 15. Flood bars on either side of the mouth of the Grand Canyon at the Grand Wash Cliffs are highlighted. The bars probably formed in eddies on either side of the mouth of the Grand Canyon (see image below). The bar on the left lies in a canyon eroded into the cliffs prior to the carving of the Grand Canyon. Highlighting done with Polaroid PhotoMax® Pro. Vertical exaggeration. 1x.

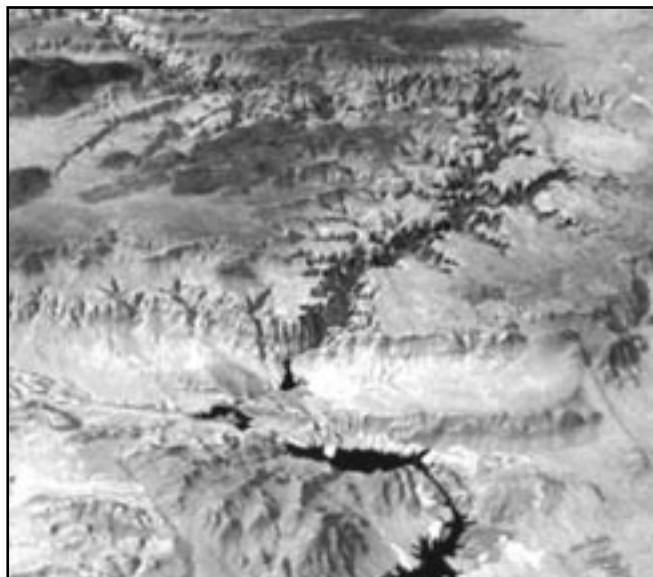


Figure 16. Satellite image of Grand Canyon and the Grand Wash Cliffs area showing the eastern portion of Lake Mead in the foreground with Grand Wash Cliffs sweeping upward behind. The Grand Canyon twists its way back through plateau lands to the top. Image is available free from <<http://aria.arizona.edu/>>.

Dry Falls, the Bretz floodwater ponded due to the restriction at the Wallula Gap narrows. It has been estimated that it took approximately 100 days for the Bretz floodwater to flow through Wallula Gap (Shaw, et. al., 1999, p. 608). This means that all the erosion and deposition caused by the Bretz floodwaters flowing across the scablands was limited to less than 100 days. Since we find similar structures at the White Wash Cliffs and Hualapai Plateau carved by floodwaters, then similar time constraints in terms of days may be applicable. The greater quantity of erosion and deposition at the Hualapai Plateau than at Dry Falls is offset by the greater quantity of water. Thus we may estimate the length of time that floodwaters were on the Hualapai Plateau in terms of hundreds of days rather than millions of years.

A Proposed Reconstruction of the Lower Colorado River Flood

Prior to the breaching of the Coconino/Kaibab Plateau, there was no Lower Colorado River. Westward of the Grand Wash Cliffs was isolated basin and range topography. At some time, a large quantity of water began flowing onto and across the top of the Hualapai Plateau, stripping off sedimentary strata. A giant waterfall formed on the Grand Wash Cliffs in the vicinity of present-day Pierce Ferry. Grapevine Wash was filled with water and sediment. Then, Wheeler

Ridge was overflowed in several places, and Greggs Basin and Grand Wash began to fill with water (Figure 15).

At the Grand Wash Cliffs, the floodwater quickly channeled, eroding headward, and formed what is now the Lower Granite Gorge of the Grand Canyon. Several side canyons were formed in the Hualapai Plateau helping to channel the floodwater from the plateau. These were backfilled at some point during the carving of Lower Granite Gorge. The two flood bar deposits at the mouth of Grand Canyon, composed of "...limestone and sandstone fragments derived from the Paleozoic formations in the [Hualapai] plateau" (Longwell, 1936, pp. 1434–1435) were deposited at this time. I propose that the Lower Colorado River, from Grand Wash Cliffs to Yuma, Arizona (and beyond), was formed as basin after basin was flooded to overflowing during the catastrophic carving of Grand Canyon. The source of the Hualapai Plateau floodwater is currently unknown.

Conclusion

Similarities exist between geomorphic features found at Dry Falls, Washington, and Grand Wash Cliffs, Arizona. Because the features at Dry Falls are now understood even by uniformitarian geoscientists as having been formed during catastrophic flooding conditions, I consider similar features found at Grand Wash Cliffs and the Hualapai Plateau to have formed by similar events. Thus it is possible to interpret the development of Grand Canyon at the Hualapai Plateau and Grand Wash Cliffs area as carved by a cataclysmic event not long ago. Further research in these areas is encouraged.

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Notes

Figures 2, 3, 5, 6, 7, 9, 10, 11, 12, 13, 14, and 15 were generated by the free software, MicroDEM®, developed by Professor Peter Guth of the Oceanography Department, U.S. Naval Academy, along with his students. A copy of the program can be downloaded from <http://www.usna.edu/Users/oceano/pguth/website/microdem.htm>. The map data are DEMs (Digital Elevation Models) provided by the USGS and available for free download from Geo-Community at <http://data.geocomm.com/dem/demdownload.html>. Some figures were modified with graphics and text using Polaroid PhotoMax® Pro.

The Chesapeake Bay Impact and Noah's Flood

Wayne R. Spencer and Michael J. Oard*

Abstract

The largest impact structure in the United States, 85 kilometers (km) in diameter, was discovered under Chesapeake Bay, centered near the small town of Cape Charles on the eastern shore of Virginia. Evidence that the feature is an impact structure includes shocked quartz, concentric normal faults, gravity anomalies, and the presence of tektites. The Chesapeake Bay impact structure cuts through 1 to 2 km of sedimentary rock classified by uniformitarian scientists as Mesozoic to Eocene and is covered by hundreds of meters (m) of other mid- to late-Cenozoic strata, including the Exmore breccia. The impact likely occurred in water on the continental shelf. From an evolutionary perspective, the crater is dated at 35.5 million years, or late Eocene, but there is evidence that the impact was much more recent. We address the relationship of this impact to the Creation-Flood model, and conclude that the impact occurred during the Abative Phase of the Recessional Stage of the Flood, the mid- to late-Flood, according to Walker's biblical geological model.

Introduction

In recent years, some creationists have addressed evidence of impacts on Earth throughout the geologic record (Froede and DeYoung, 1996; Froede and Williams, 1999; Oard, 1994; Spencer, 1998a; b, 1999). Remnants of impact craters, called astroblemes, can be found in all types of rock and all through the geologic column (Spencer, 1998a; 1999). Approximately 160 impact sites on Earth have been documented. The presence of special shocked minerals, gravity anomalies, magnetic anomalies, circular or concentric fault structures, and a variety of indications of catastrophic erosion and deposition phenomena identify these as impact structures. Sedimentary strata, generally understood by creationists to have formed in Noah's Flood, may contain astrobleme structures, meteorites, impact-shocked minerals,

tektites and other impact-related features. This implies that impacts occurred during the deposition of Flood sediments. There are also a few impact structures in Precambrian basement rock, suggesting that impacts began at the onset of Noah's Flood. Some impacts occurred in the post-Flood period, as suggested by DeYoung (1994) for the Barringer crater in Arizona.

The timing and character of impacts in the solar system and on Earth have been topics of debate and discussion by creationists (Faulkner, 1999; 2000; Faulkner and Spencer, 2000; Froede, 2002; Hovis, 2000; Spencer, 1994; 2000; 2002). Various possibilities regarding the timing of impacts have been suggested, including during the Creation week of Genesis 1, at or following the time of the Fall (Genesis 3), and within Noah's Flood. Spencer has argued that impacts took place within the Flood and that the same event affected not only the Earth, but other objects in the solar system as well (Spencer, 1994). Faulkner has suggested impacts took place in the solar system during the Creation week and on the Earth and Moon at the time of the Flood. Froede and DeYoung (1996) proposed the breakup of a planet in the asteroid region that generated

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impacts in the inner solar system.

In this article, we will analyze a newly discovered large impact structure in the United States. This feature is known as the Chesapeake Bay impact and is now considered one of the largest impacts ever discovered. We will place the impact within the Creation-Flood model.

The Chesapeake Bay Astrobleme

In 1991 and 1992, a group of researchers from the U.S. Geological Survey reported evidence of impact-shocked minerals, glassy material, and concentric normal faults in the region of Chesapeake Bay, Virginia (Poag, Powars, Poppe, et. al., 1992; Koeberl, Poag, et. al., 1996). The presence of shocked minerals and glassy material is a strong indication of impact, especially since there is no indication of igneous or volcanic activity in the vicinity. Though evidence in the early 1990s strongly suggested an impact, no crater structure was known in the region at that time ex-

cept a smaller one that is 10–15 km (6–9 mi) in diameter. This is the Toms Canyon crater (Poag et al., 1992; Poag and Poppe, 1998) northeast of Chesapeake Bay along the edge of the continental slope. Subsequent studies of the region included single channel and multichannel seismic reflection profiles of the bay as well as a number of boreholes that reached depths of 728 m (2,388 ft) (see USGS web site, <<http://geology.er.usgs.gov/eespteam/crater>>). Boreholes intersect the basement in some areas at a depth of 681 m (2,234 ft) (Poag, Hutchinson, and Colman, 1999, p. 151). Based on seismic reflection profiles, the sedimentary rocks dip seaward. The dip begins gently at 9 m/km below the coast section, but increases to a rate of about 58 m/km along the continental margin (Poag, 1997, p. 46).

In these studies, a large crater was discovered below southern Chesapeake Bay, centered at approximately 37° N latitude and 76° W longitude, on the Delmarva Peninsula near Cape Charles, Virginia (Figure 1). The crater averages 85 km (53 mi) in diameter, but the outer rim has slumped

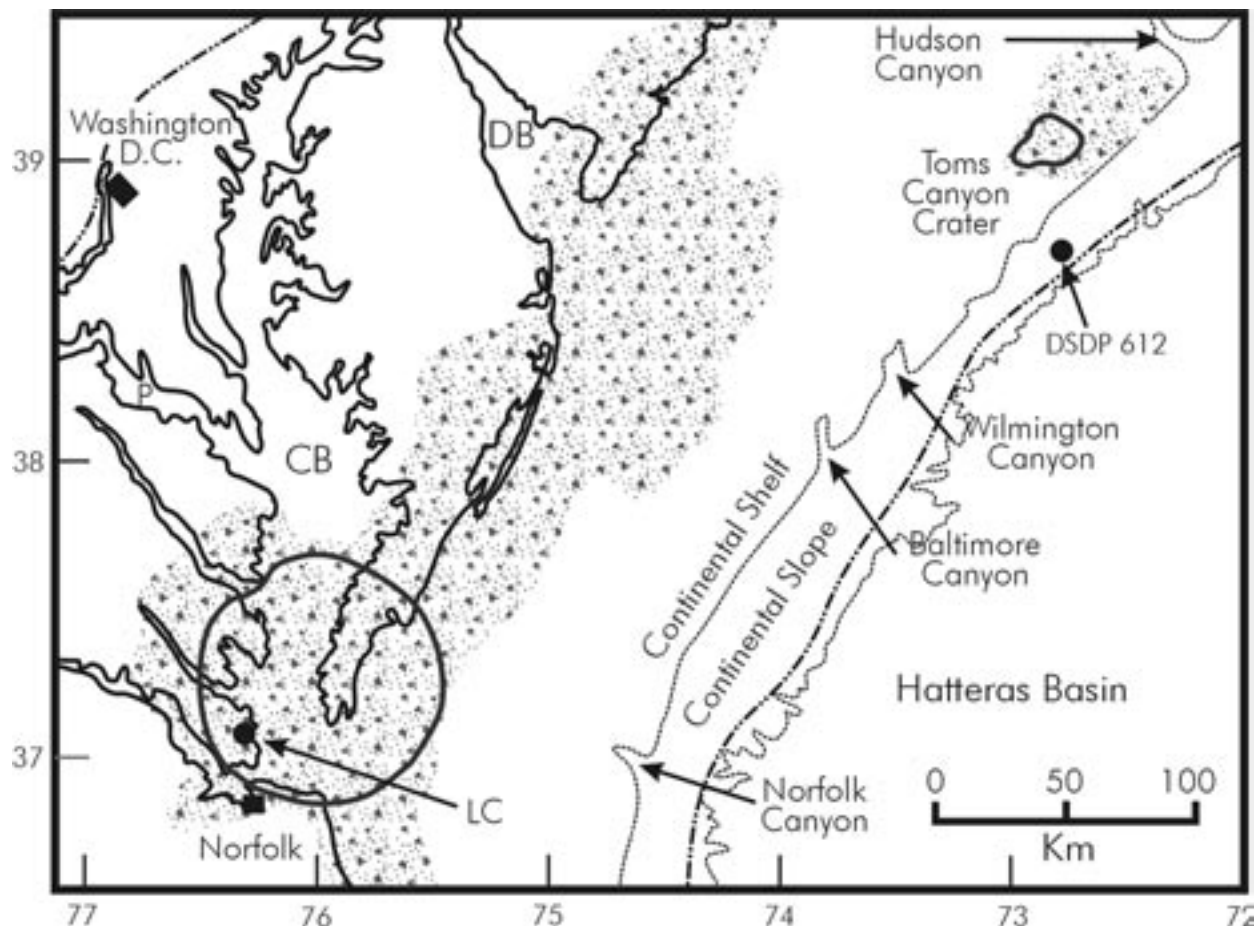


Figure 1. Plan view of Chesapeake Bay crater along the Atlantic coast. Dashed lines represent boundary of Baltimore Canyon Trough. Shaded areas represent approximate extent of breccia from Chesapeake Bay impact and from Toms Canyon impact. LC = Langley corehole (see Table I), CB = Chesapeake Bay, DB = Delaware Bay, P = Potomac River. Modified from Poag (1997).

heavily into the impact basin forming a scalloped margin (Poag, 1997; Poag, Hutchinson, and Colman, 1999). The structure encompasses an area from Virginia Beach to Newport News to the mouth of the Rappahannock River on the west (USGS web site; Poag, 1997). The geographic area encompassed by the structure is roughly 6,400 km² (2,471 mi²), about double the area of Rhode Island. The buried crater structure lies at a depth of approximately 400–500 m (1,312–1,641 ft) under the ground surface (near sea level). The depth of the structure itself is roughly 1.3 km (4,265 ft), based on the probable depth of the inner basin. Southeast from the center of the crater, the edge of the continental shelf is about 130 km (81 mi) away from the outer rim. Seismic profiles reveal that numerous high-angle normal faults and a few low-angle reverse faults disrupt the basement inside the crater. Outside the crater, the surface of the basement is generally smooth. The North American tektite strewn field is now attributed to the Chesapeake Bay impact (Poag et al., 1994).

The structure possesses a circular basin around the edge, called an annular trough, with a central peak ring, approximately 35–40 km (22–25 mi) in diameter, and

possibly another central peak inside the major peak ring (Poag, Hutchinson, and Colman, 1999) (Figure 2). Gravity measurements show a notable negative anomaly, circular in shape, that corresponds to the inner peak ring structure (Poag, 1997, p. 58). The underlying basement rock in the annular trough region includes a number of concentric normal faults that indicate large-scale slumping from what would be the outer rim area inward and downward.

There are certain unique characteristics of the Chesapeake astrobleme that distinguish it from some other impact sites on Earth. First, since the impact likely occurred in water, a large amount of water would have been vaporized, generating a very significant aerosol plume. Vaporized and fragmented rock and sediment would be entrained with the steam explosion to produce the plume. The efficiency of an impact in forming the crater structure in the target rock depends on the depth of the water compared to the size of the impactor. Greater water depths tend to make the crater structure smaller and with lesser relief, as more of the energy of impact is transferred into the water. The Chesapeake Bay crater is of nearly the same size as the Acraman impact crater in Australia and the Popigai crater in Siberia. For the

Acraman structure, the impactor has been estimated to be about 4.7 km in diameter, assuming it was a chondritic asteroid (Williams, 1994). Because the sediments under the Chesapeake site were likely of a weaker material than those at the Acraman crater, it may be reasonable to estimate the size of the Chesapeake impactor in the range of 3–5 km (~2–3 mi) in diameter, depending on its velocity. Since the size of the impactor was perhaps significantly more than the water depth, most of the energy would go into forming the crater structure and producing a powerful tsunami. The tsunami and the backwash gen-

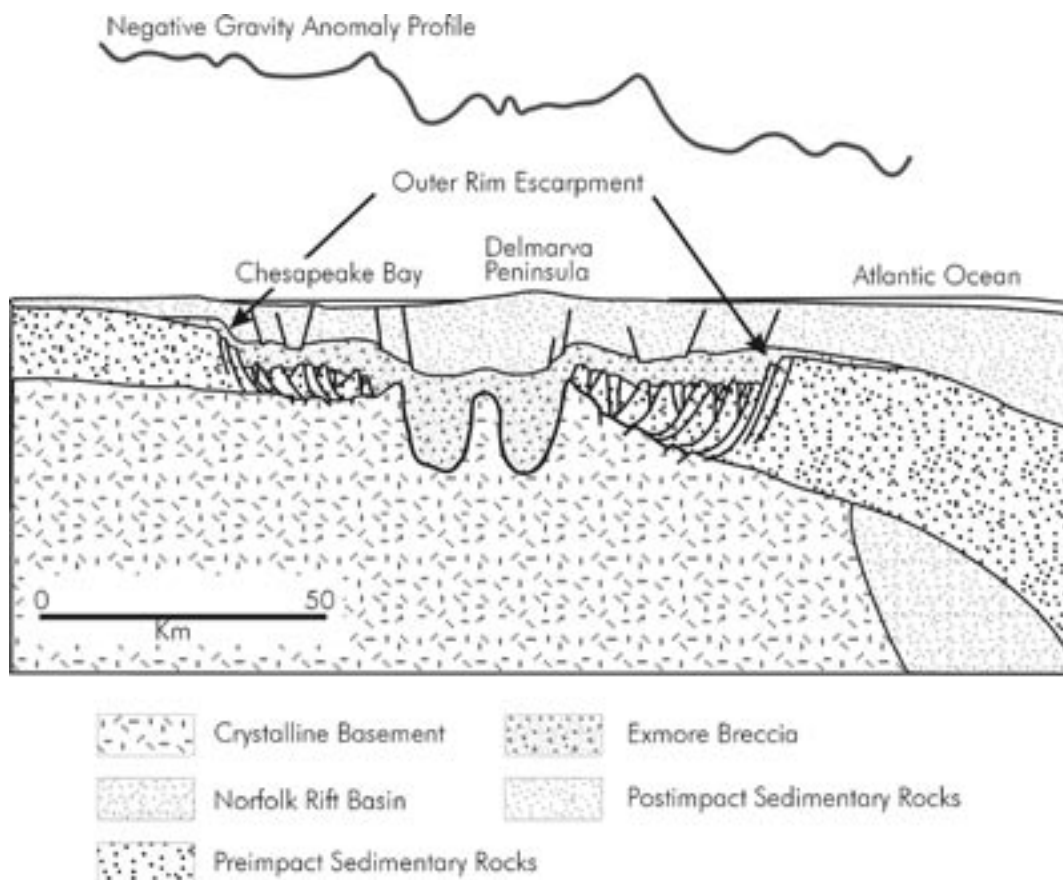


Figure 2. Cross section of Chesapeake impact structure. Modified from Poag et al. (1999).

erated from it seem to have eroded off the crater rim itself and caused the deposition of breccia that fills the crater.

The Uniformitarian Date of the Astrobleme

Evolutionary scientists have arrived at the generally accepted date of the impact from studies of nearby core samples and seismic data. They argue that the crater is of the same age as the Toms Canyon impact crater northeast of Chesapeake Bay and the same age as core samples from Site 612 of the Deep Sea Drilling Project (DSDP) from the New Jersey continental shelf (Koeberl, Poag, Reimold, et al., 1996). The Chesapeake Bay crater is thus dated as 35.5 million years based on radiometric dating of tektites from the DSDP Site 612 core samples and from correlation of microfossils such as foraminifera from the crater with those in nearby deposits.

In relation to the standard evolutionary geologic column, the crater structure cuts through strata ranging from middle or upper Eocene down to early Mesozoic and older igneous basement rock. Much of the stratigraphic information of the pre- and post-impact sedimentary rocks comes from the Virginia coastal plain. These formations seem to be relatively widespread sheets (Koeberl, Poag, and Reimold, 1996) and probably are generally representative of the sediments around and above the crater, except for three formations found mainly within the crater. Table 1 presents a stratigraphic section based primarily on the Langley corehole near Hampton, Virginia. This core was drilled to 635.1 m (2,083 ft) in the annular trough, approximately midway between the outer rim and the inner basin. The coastal plain and continental margin deposits around the impact crater are underlain by igneous and metamorphic basement rocks broken up in places by rift basins filled with sedimentary rocks (Powars, 2000). The long axes of the rift basins are parallel to the coast and the Appalachian Mountains. This basement rock consists of granite or greenstone, a metamorphosed basic igneous rock similar to basalt but extruded at significantly higher temperatures. Uniformitarian geologists date the rift sediments as Triassic or Jurassic. The pre-impact sedimentary rocks thicken seaward into the Baltimore Canyon trough. This trough is located below the continental shelf and slope and extends from Cape Hatteras to Long Island with an area of 200,000 km² (77,220 mi²), all covered with sediments that obtain a maximum thickness of 18 km (11 mi) in the northern part of the trough (Pickering, Hiscott, and Hein, 1989, p. 264). These sedimentary rocks are siliciclastic rocks with minor limestone, dated by uniformitarian scientists as Middle Jurassic to late Eocene (Poag, 1997).

The lower portion of the crater is filled with what is called the Exmore breccia. Such a feature is not characteristic of continental craters but seems to be common in craters along continental margins. If the eastern part of North America were significantly covered with water at the time of the impact, then a strong tsunami would have been generated and spread outward from the crater traveling a long distance inland over what is now the continent before depositing sedimentary materials. Thus, extensive impact deposits would not be found surrounding Chesapeake Bay. However, there would be a backwash as the water flowed back into the excavated crater. This backwash appears to be responsible for many features of the strata in and around the crater, such as the Exmore breccia. The shape of the inner peak ring structure and its dimensions suggest that it was filled extremely rapidly with the breccia, probably in just a few minutes. This is indicated by the physics of central peak and peak ring formation (Melosh, 1989) as well as from the very high sedimentation rates that were involved (Poag, 1997).

Further evidence that the backwash deposited the Exmore breccia is that it contains clasts of a wide variety of materials in a gray, silty, sandy and clayey matrix, sometimes not completely consolidated (Powars, 2000). Poag (2000, pp. 16–17) provides an interesting description of the breccia:

Suddenly, the drillers were pulling out bright, multicolored core segments, which resembled psychedelic barber poles. The dominant constituent of this garish deposit was grayish green sand, whose color came from an abundance of iron-rich glauconite. Imbedded within the glauconitic sand was a kaleidoscopic array of larger clasts, ranging from dime-sized pebbles to six-foot boulders. The clasts changed rapidly and randomly downcore through nearly every color and hue of the rainbow.

The breccia also contains marine fossils that would be classified from Cretaceous to Eocene. Indeed, some of these fossils would be classified as Upper Eocene in age, but no strata have been identified as a possible source for these fossils anywhere in Virginia and no Upper Eocene sedimentary clasts have been found in the breccia cores. This could suggest some fossils and fragments in the breccia have been transported long distances. Some clasts are rounded and some are angular with some over 3 m (10 ft) in diameter (Poag, 1997; Powars, 2000). Outside the outer rim of the crater, the Exmore breccia ranges from 10 to 30 m (33–98 ft) in thickness. It may have extended as a once continuous deposit farther outside the outer rim in some areas. Much of it has apparently been eroded. A short distance inside the outer rim it thickens to over 300 m (985 ft) and also seems to fill the inner basin. The Exmore breccia is up to 1,200 m (3,937 ft) thick in the central part

Stratigraphic Unit	Chesapeake Area Strata Names	Depth (feet)	Description of Strata
Pleistocene	Tab Formation (Columbia Group)	0 to 11	Paleochannels cut into older units; oxidized muddy sand, muddy & sandy gravel, cobbles of chert & quartz up to 4 inches in dimension. No fossils in this from the Langley core but shells found in other areas.
Pliocene	Chowan River Formation, Yorktown Formation	11 to 76.3	Calcareous, muddy, very fine to fine quartz sands, clays, silts, common micro- & macrofossils
Miocene	Eastover Formation	76.3 to 223.8	Muddy, very fine to medium sands, fossils include dinoflagellates, ostracodes, & mollusks
	Lower Chesapeake Group, Calvert and St. Marys	223.8 to 470.9	Shelly sands, silts and clays with microfossils
Oligocene	Old Church Formation and Delmarva Beds	470.9 to 601.3	Shells, glauconitic & phosphatic quartz sands in clay-silt matrix, microfossils
Eocene	Chickahominy Formation	601.3 to 774 (up to 227 ft thick in other locations)	Dry, clayey silt, fine sand, iron sulfides, extensive burrows. Fauna include planktonic foraminifera, calcareous nanofossils, coral, shells
	Exmore Breccia (upper Eocene) Lower Pamunkey Group	774 to 1,470	Breccia within crater. Breccia clasts from < 1 inch to 30 feet in dimension. Clay and sandy mixtures, varied clasts (some rounded, some angular). Clasts consist of clay, limestone, & cross-bedded sand. Upper part in a sandy matrix. Shocked quartz present at 820 feet. Pollen and mollusk fossils, wood present.
Cretaceous	Upper Cenomanian Formations Potomac Group	1,470 to 2,054.7	Mega-slump blocks, feldspar and quartz sands, clay-silt clasts, chert and granodiorite pebbles
Paleozoic	Basement metamorphosed granodiorite at Langley core	2,054.7 to 2,083.8	Below crater; granite in some other locations

Table I. Stratigraphic section based on the NASA Langley Corehole, Hampton, Virginia. From Johnson, Kruse, and Vaughn, 1998, pp. 507–510; Powars, 2000; Powars, Bruce, Bybell et al. 2001. This corehole lies approximately midway between the outer rim and the inner basin.

of the crater (Poag, 1997; Powars, 2000). The total volume of the breccia is estimated at 4,300 km³ (Poag, 1997, p. 62). Because this breccia is so permeable, it is described as a hypersaline aquifer, which has been known from the early 1900s. The groundwater in this aquifer is about 50% saltier than seawater (Poag, 1997). The reason for the existence of this hypersaline aquifer is uncertain (Poag, 1997, p. 69).

The breccia covering the Chesapeake crater structure provides strong evidence of its impact origin. It contains shocked quartz and what is known as “impact glass,” which is believed to be melted and metamorphosed basement rock. A number of core samples show indications of shock. Planar shock deformation features tend to occur along certain characteristic crystal orientations, and the particular sets of planes involved allow calculation of the pressures. The highest shock pressures indicated from the Chesapeake samples are in the range of 20 to 60 gigapascals (Koeberl, Poag, Reimold and Brandt, 1996; Poag, Gohn, and Powars, 2001). Some quartz grains from the breccia samples exhibited six different sets of these planar deformations (called lamellae).

Another unique feature within the Chesapeake crater indicating an impact in water is the mega-slump blocks (or megablocks) found in the annular trough region outside the inner peak ring (Poag, 1997; Poag, Hutchinson, and Colman, 1999). These large blocks represent fractured pre-impact (Cretaceous) sedimentary rocks that slumped into the crater. These slumps have created the bulges and embayments in plan view along the outer rim of the crater. They are also believed responsible for removing practically all evidence of a raised lip at the outer rim. Some of these blocks are over a kilometer in length. Many fractures and large faults are found in this rock, some of which reach downward into the basement material. These blocks are over 300 m (985 ft) high over much of the annular trough region. Some of the faults appear to be normal and some have apparently rotated into the crater. The vibrations and initial shock waves from the impact may have caused many of the fractures, making the crater bowl structure and terraces vulnerable to erosion and movement. The liquid water column ejected upward by the steam explosion and waves from the backwash very likely caused most of the crater sides and floor to be broken and eroded into the trough region. This has left the outer rim escarpment a very sharp single-step structure around much of the impact rim, though on the northern rim the structure seems to be terraced (Poag, Hutchinson, and Colman, 1999). Such large megablocks in the annular trough region are not normally found in craters located on the continents. These faults and large blocks seem to be a result of the impact having occurred in water.

The post-impact sedimentary strata are 300–500 m (985–1,641 ft) thick above the crater and are dated from late Eocene to Quaternary within the uniformitarian timescale (Poag, 1997, p. 45–46). The stratigraphy is based on seismic reflection profiles and borehole data. The stratigraphy above the crater differs somewhat from the stratigraphy in the Chesapeake Bay area outside the crater rim, especially the lower strata. Seismic reflection profiles indicate that the first three of the overlying formations and the very lowest part of a fourth overlying formation are constrained only within the crater rim. The upper formations are about 140 m (460 ft) thick over the crater and are regionally extensive outside the crater, thickening substantially eastward toward the Baltimore Canyon trough.

Evidence That Contradicts the Uniformitarian Timescale

From a young-Earth viewpoint, the impact would have occurred around 5,000 years ago, while the uniformitarian model assumes an age of 35.5 million years. This is a radical difference in time. Is there any evidence to suggest which timescale is better supported by the data? A possible argument that the Flood timescale is more nearly correct comes from analyzing the fallacies regarding the compacting and subsiding of the Exmore breccia for the supposed 35 million years of uniformitarian time (Poag, 1997, pp. 71–74). In fact, it is still subsiding as indicated by one of the fastest rises in sea level anywhere in the world along the Bay coast (Poag, 2000, p. 112)! Only part of this rise could be due to eustatic sea level rise, so most, if not all of it, is likely due to the continued subsidence of the Exmore breccia. Furthermore, this continuous sagging likely predetermined the location of Chesapeake Bay (Poag, 1997). Moreover, a block along the west rim seems to have slumped down during the late Pliocene of the uniformitarian timescale (Johnson, Kruse, Vaughn, et. al., 1998), well after the impact. It seems paradoxical that such subsidence and slumping could continue for 35 million years. Surely, the breccia and slump blocks should have settled long ago. We believe such evidence is more indicative of a recent impact and rapid sedimentation in the crater and the continental margin.

Dating the Impact within a Flood Framework

How can we place the Chesapeake Bay impact within the Creation-Flood model? First, we must place the impact within the time frame of the Flood. The Exmore breccia appears consistent with the impact having occurred concurrently with erosional processes of Noah's Flood. Such

thick breccia would not be expected to be only near the crater and coastline, considering the size of the impact, if the continent were exposed as it exists today at the time of the impact. With the continent not submerged, a monstrous tsunami hundreds or possibly even a few thousand meters high would have been created racing onshore along the Atlantic coast (Poag, 2000, p. 50; Ward and Asphaug, 2000). We would expect copious breccia spread hundreds of kilometers inland. However, breccia has not been observed inland more than about 25–30 km (~15–19 mi) from the crater rim. If the continent were submerged during the impact (even partially), this might significantly change how sediment would have been deposited on the continent by the tsunami and post-impact giant waves. If the Chesapeake impact occurred during a period of great erosion from the continent, such as in the Recessive Stage of the Flood, the eroded material would tend to be found in the crater cavity and along the continental margin, as observed. Thus the distribution of the breccia argues for the event occurring as Floodwater receded, while a significant fraction of the continent was still submerged.

This evidence is further supported considering the energy of the impact. The Chesapeake Bay impact released 100 times the combined energy of all existing nuclear weapons! Such an impact is estimated to have had the kinetic energy equivalent to approximately 10 trillion tons of TNT (Poag, 2000, p. 96), while the total potential energy yield from the world's entire nuclear arsenal is 100 billion tons of TNT. Though the impact occurred in one region of the world, its environmental ramifications would have been worldwide, including a drop in temperature similar to a nuclear winter due to ejected dust and aerosols.

In order to further refine the timing of the impact within the Flood time frame, we applied the particular biblical geological model of Walker (1994) because it is based strictly on the Bible (Figure 3). The model has defining criteria for its various stages and phases that allow it to be related to observations of the rock record. In Walker's model, the time from the onset of the Flood to the point where the water depth reached its peak, the Inundatory Stage, is estimated at 60 days. The draining of the Floodwater off the future continents, the Recessional Stage of the Flood, is about

300 days. Other creationists believe the Inundatory Stage was 150 days and the Recessional Stage was 220 days (Oard, 2001a, p. 7).

In Walker's model, the continental shelf, slope, and rise sediment were formed by sheet flow off the continent during the Abative Phase of the Recessional Stage of the Flood as the continents and mountains were rising and the ocean basins and valleys were sinking down (Oard, 2001a):

Regional scale sediments would be expected during the Abative Phase [sic] as the flood waters began to move in large sheets from the continents. Local scale sediments would be formed during the Dispersive Stage as the receding waters separated into complexes of lakes and ponds connected by flowing water courses (Walker, 1994, p. 591).

Thus, the continental margins are typical features of the

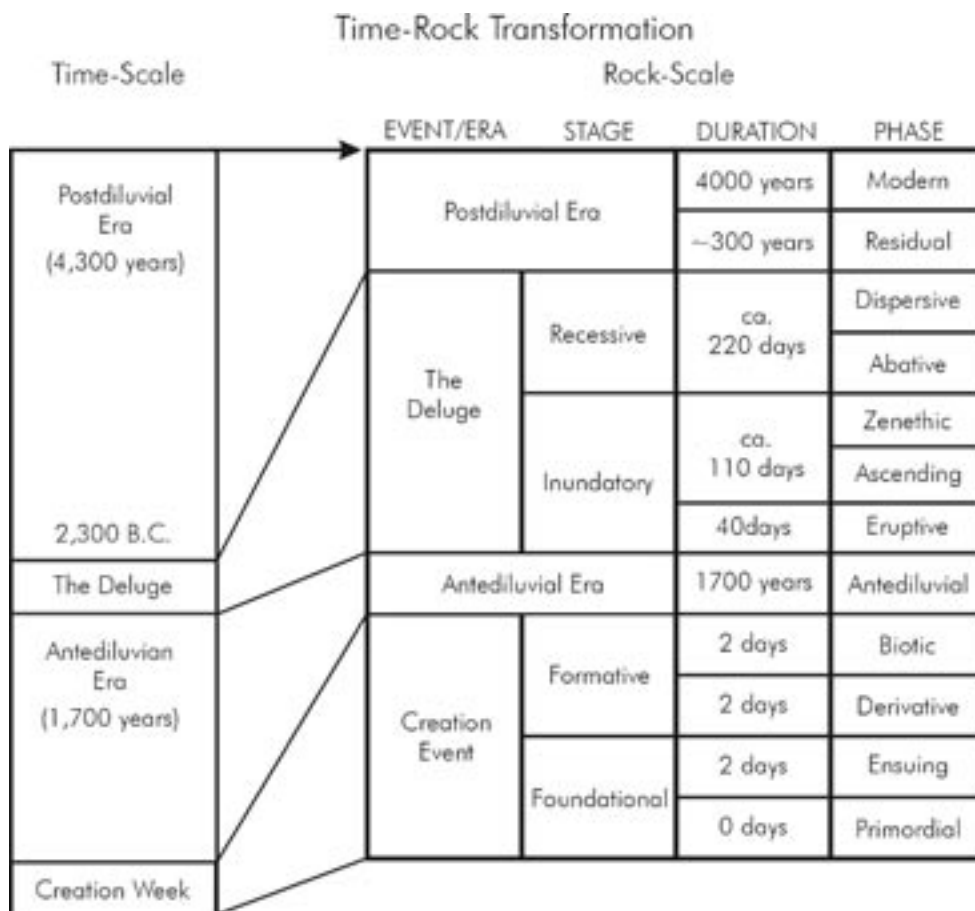


Figure 3. Walker's biblical geological model (permission from Walker with modifications by Peter Klevberg, especially in the timing of Flood stages and phases).

Abative Phase of the Recessive Stage. The very shallow and wide continental shelf and the steep drop-off of the continental slope are paradoxical features within the uniformitarian scheme, because longshore currents and mass wasting should have produced a gradual descent to the deep sea (King, 1983, pp. 199–200). During the Abative Phase of the Flood, currents perhaps thousands of kilometers wide flowed off the rising continents, likely at high speed at times. These currents would be expected to erode the surface of the rising continents and deposit the sediments in deeper water at the edge of the continents where the currents would decrease in velocity and rapidly deposit the sediments. We argue that these off-continent currents explain the formation of the pre- and post-impact sediments along the east coast of Virginia. Thus, the impact would have probably occurred during the Abative Phase of the Flood.

When the continental margin is examined by seismic reflection profiles, the post-impact sedimentary rocks, 300 to 500 m (985–1,641 ft) thick, are continuous and generally horizontal above the crater, although dipping gently inward into the crater with short offsets caused by numerous normal faults (Poag, Plescia, and Molzer, 2002). The offsets are attributed to differential compaction of the breccia and slump-block motion near the outer rim (Poag, Hutchinson, and Colman, 1999; Johnson, Kruse, Vaughn, et al., 1998, p. 507). These strata are also continuous with the generally horizontal strata along the coastal plain and continental shelf along much of the Atlantic margin (Poag, 1997; Klitgord, Hutchinson, and Shouten, 1988). Occasional onlapping strata imaged by seismic reflection along the continental shelf indicate the sediments came from the continent (Poulsen, Flemings, et al., 1998). These post-impact sediments thicken and extend significantly seaward by deposition from sheet flow off the continents.

A second reason for believing the impact occurred during the Abative Phase is that very few submarine canyons have been detected in the continental shelf sediments. Submarine canyons, mostly developed after the formation of the continental margin, are typical Dispersive Phase or channelized flow geomorphological features (Oard, 2001b). This indicates that nearly the entire continental margin was deposited before the submarine canyons were cut. For instance, Fulthorpe, Austin and Mountain (2000, p. 817) state:

High-resolution multichannel seismic reflection profiles confirm that middle-late Miocene continental slope canyons off New Jersey are rare, in contrast to their prevalence on the slope today.

The rarity of submarine canyons within the continental margin sedimentary rocks is a problem for uniformitarian scientists because numerous canyons should be cut over

the 125 million-year period the continental margin was supposedly formed. It also indicates that the impact must have occurred before the Dispersive Phase, which would place it in the Abative Phase.

Conclusions

The Chesapeake Bay impact excavated thick Mesozoic and early Cenozoic sediments, penetrated into basement rocks, and was covered by mid- and late-Cenozoic marine sediments. The geologic context of the crater and the unique characteristics of the structure suggest a large impact from space occurred in water. Many impact related features have been discovered, such as shocked quartz. Following the impact, a tsunami eroded the crater area and post-tsunami giant waves and backwash deposited a large volume of breccia and other materials in the crater. The breccia can only be found near and within the crater, likely because of strong erosive currents coming off the continents after the impact. An additional 300–500 m (985–1,641 ft) of generally continuous, horizontal sediment was deposited above the crater structure after the impact. The volume and character of the sediments in and around the Chesapeake structure point to the impact occurring during Noah's Flood.

Erosion from the continents and deposition along the continental margin from receding Floodwater in the Abative Phase of the Flood provides an explanation of the Exmore breccia and the sediments covering the crater. It appears the continent was largely or at least partially covered with water at the time of the impact. The Abative Phase of the mid-to-late-Flood in Walker's model is proposed as the time frame in which the impact occurred.

Impacts were probably most prolific during the early period of the Flood and that much of the evidence was erased by the violence of the Flood. We have presented evidence in this paper proposing that impacts continued into the mid- to late-Flood period based on what we found regarding the Chesapeake Bay Impact Crater. The evidence supports the young-Earth Flood model of Earth history.

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Book Review

The Design Revolution: Answering the Toughest Questions about Intelligent Design

by William A. Dembski

Inter Varsity Press, Downers Grove, IL, 2004, 334 pages, \$22.

Author Dembski is the widely recognized leader, tireless writer, and experienced debater for the increasingly popular Intelligent Design (ID) movement. He has assembled 44 chapters in order to answer the main questions about ID. The work was designed as a handbook for replacing the now-outdated Darwinism with another *scientific theory*, namely ID.

ID applies to natural systems which cannot adequately be explained by “undirected natural forces [chance] and that exhibit features which in any other circumstance we would attribute to intelligence” (p. 27). It is important to emphasize that known mechanistic processes cannot explain the systems. Probability considerations are pertinent. “The universal probability bound of 1 in 10^{150} is the most conservative in the literature...any specified event as improbable as this could never be attributed to chance” (p. 85). The origin of life is an excellent example of this.

Many opponents of ID have termed certain intricacies as only “apparent design.” These critics (including the late S.J. Gould) have pointed to particular body structures such

as the eye, pharynx, the back, wisdom teeth, or pelvis, etc. saying that these organs are suboptimal and not perfectly designed. But Dembski points out that certain tradeoffs often are necessary because of the total pattern of which these organs are a part. So what we find is best for the organism but may be somewhat of a compromise termed constrained optimization. Not only does Dembski deal with a host of challenges such as these, but also he projects future goals including penetration into the educational system with textbooks.

Most chapters of *The Design Revolution* are relatively short and without notes or complete references. There is a six-page “select bibliography” and three-page author index, but no subject index. Some chapters are readily understandable by an ID novice, but others will challenge those with stronger backgrounds in philosophy, sciences and mathematics. In paving the way for the ensuing demise of Darwinism this book will engage all those having an interest in origins.

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Beyond Scientific Creationism

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Abstract

Scientific creationism's surprise attack rocked the late Twentieth Century intellectual establishment—acolytes of the worldview of Naturalism. Who could possibly imagine that religion would mount an *empirical* attack on evolution and its handmaiden, uniformitarian history? But that was decades ago, the shock has worn off, and surprise alone will not finish the job. Empirical arguments developed by an unfunded, outcast minority cannot penetrate the hidebound armor of modern Naturalism despite its many empirical flaws, because at its core Naturalism is not an empirical construct but an integrated worldview. To finish the job started by the scientific creationists, that worldview must be shown to be contrary to truth and thus destroyed. We advocate the primacy of formal over empirical arguments because: (1) they transcend disciplinary boundaries, (2) Naturalism is highly susceptible in that arena since its virulently anti-Christian exterior rests on presuppositions derived from Christian theology, and (3) a formal approach is consistent with Christianity's historical strengths (and Naturalism's inherent weaknesses) in theology and philosophy. A well-founded formal attack would also by example correct derivative and serious modern misunderstandings about the nature of knowledge and truth. Once Naturalism is demonstrated formally invalid, empirical research can take its proper role of building science and exploring natural history within the default, superior Christian worldview. Some Intelligent Design advocates have initiated this argument with great effect against biological evolution, but they fall short because they fail to recognize uniformitarianism as foundational to modern Naturalism.

Introduction

We have been educated by our modern intelligentsia to believe that Western history consists of a glorious classical age of Greco-Roman culture, followed by 1,000 dark, dirty, and dangerous years of Christian superstition. As the story goes, this unhappy state of affairs lasted until a hardy group of fearless intellectuals rediscovered classical thought, introduced the world to science, and brought the light of the Renaissance. After a prolonged struggle against ignorance (with a few nasty religious wars thrown in), they finally reached the intellectual nirvana of the Enlightenment. The same intellectual elite would have us believe that only fundamentalist morons spout their humorous (or is it dangerous?) nonsense, usually in the

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dark rural recesses of the “Bible Belt.” It makes for high drama, but:

The reason that we didn’t know the truth concerning these matters is that the claim of an inevitable and bitter warfare between religion and science has, for more than three centuries, been the primary polemical device used in the atheist attack on faith. From Thomas Hobbes through Carl Sagan and Richard Dawkins, false claims about religion and science have been used as weapons in the battle to “free” the human mind from the “fetters of faith” (Stark, 2003, p. 123).

It was against this backdrop that scientific creationism burst on the scene in the last half of the Twentieth Century. Naturalists¹, convinced that such troubles were behind them, were shocked, and decades of complacency led to embarrassing defeat in a series of early debates spearheaded by Dr. Henry Morris and Dr. Duane Gish. Their embarrassment was only slightly less than their anger and they quickly labeled creationists as the epitome of anti-intellectual superstition. But victory and defeat in these types of battles are not measured in tenure, publications, and grants within an entrenched elite, nor in judicial decisions, nor even in the number of pandering Christian academics. As the evolutionists are fully aware, they are measured by the surprising (to them) numbers of the general public who still have not bought into their worldview.

So what has been gained over the past decades? As with most issues, the news is mixed. There is no doubt that the topic of origins has become an issue for lively debate rather than a relic of the past. A minority of religious colleges rejects evolution and some even deny uniformitarian history. So do many individual Christians, but their leaders are often at odds with them, as is reflected by rifts in conservative denominations—rifts that run (with few exceptions) between the laity and the elite. A few organizations promulgate the creationist message and publish scientific journals, as opposed to the thousands supporting Naturalism. No secular educational institution presents creationism

as a serious alternative. Most prominent Christian colleges and seminaries (even those of conservative denominations) reject a young age for the cosmos, and do well to express polite doubts about Neo-Darwinian evolution. In spite of the labor of the pioneers, the edifice of evolution still strongly resists biblical history as it always has. It could be argued that progress has been made within the church, but not the world.

If the modern creationist movement was such a shock to the secular establishment, why has it not made greater inroads into modern education? What will it take to complete the revolution begun by those courageous scientists and engineers? The tide is clearly not advancing as it once did, and it is the Intelligent Design proponents, not the creationists, who are creating the greatest turmoil at present among secularists. The first generation is passing the torch to the next and as we look ahead, we must consider a more effective strategy for our time so as not to lose the ground already gained. While a commitment to truth remains constant, flexibility in method is often needed. We suggest that it is time for such flexibility: if Naturalism is not defeated as a worldview, then we face the possibility that creationism may end as an historical footnote; an oddity of late Twentieth Century American culture.

We propose a method that we believe will rekindle the intellectual revolt against secular mono(a)theism—a belief that heartily deserves a place amid the ruins of failed ideas. To this end, we propose:

- that the debate must be broadened beyond the empiricist boundaries of scientific creationism because Naturalism, though empiricist in its epistemology, is not itself an empirical construct;
- that Naturalism is vulnerable to formal arguments because it rests on Christian presuppositions that wait like hidden explosives for the detonating spark of logic;
- a method to find and ignite these formal flaws, and finally;
- that advocates of Intelligent Design recognize uniformitarianism as a foundation of modern Naturalism (although we applaud them for attacking Naturalism as a worldview).

¹ Naturalism, as used in this paper, is the worldview which comprises metaphysical materialism, epistemological positivism, and historiographic uniformitarianism. While Naturalism could be subdivided into Secular Humanism, Marxism, and even Cosmic Humanism (i.e., Noebel, 2001), the structure with regard to the nature of being, the mode of knowing, and history is similar enough in all to treat Naturalism as perhaps a “mega-worldview” for the purposes of the origins debate. Evolution has the distinction of being both integral to this worldview and one of its most effective weapons.

Historical Overview

Victory of Uniformitarianism and Evolution

The “discovery” of “deep time” was one of the most significant events in the history of modern thought. James Hutton (1726–1797) and John Playfair (1748–1819) paved the way for Sir Charles Lyell (1797–1875) and his *Principles of Geology*, the bible for uniformitarian geologists of that

day. Lyell's uniformitarianism is remembered by its famous though imprecise maxim, "the present is the key to the past," and the often misunderstood quote of James Hutton:

If the succession of worlds is established in the system of nature, it is in vain to look for anything higher in the origin of the earth. The result, therefore, of our present enquiry is, that we find no vestige of a beginning,—no prospect of an end. (Hutton, 1788, p. 304).

Lyell went on to become internationally famous, and a leader of the Nineteenth Century scientific establishment, even though:

Lyell's great treatise is not, as so often stated, a textbook summarizing all prevailing knowledge in a systematic way, but a passionate brief for a single, well-formed argument, hammered home relentlessly (Gould, 1997, pp. 104–105).

Lyell's "passionate brief" prevailed, and by 1850 the idea of a global flood was widely rejected. Once the Mosaic account of the Flood had been overthrown, the stage was set to attack the creation of fixed species. This task fell to Charles Darwin (1809–1882), Lyell's protégé. The voyage on the *Beagle*, *The Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life*, and *The Descent of Man*, collectively mark the trailhead to evolutionary dogmatism.

Huxley, Spencer, Haeckel, Gray, and a host of others championed Darwin's ideas, presenting the issue as one of enlightened science versus outmoded religion. This false representation was widely accepted (as it is today) and was aided by such men as Archibald Geikie (1905) in his book, *Founders of Geology*. Geikie presented Hutton, Playfair, and Lyell as bold empiricists struggling to overcome a blind religious catastrophist elite. Even avowed Marxist and Harvard paleontologist, the late Dr. Stephen Jay Gould, recognized Geikie's presentation of the "empiricist myth" as "cardboard," (Gould, 1997, p. 67), but the fable prevails. Few today recall that Darwin's most vigorous critics in the late Nineteenth Century were scientists like Louis Agassiz and Lord Kelvin. In that tradition, modern anti-evolutionary efforts have also been led by scientists, both secular and Christian. Darwinian evolution and uniformitarian geology became the dogma of modern scientific education advocated by the professional scientific class, a group wielding undeniable cultural influence. Following the public relations coup of the Scopes Trial, the evolutionary establishment became so firmly entrenched that the Darwinian Centennial celebration in 1959 was primarily an exercise in self-congratulation by the intellectual elite of the day.

Epistemological Background of that Victory

The triumph of Enlightenment Naturalism included: (1) a

divorce between philosophy and theology; (2) the abandonment of ancient common sense; and (3) the appropriation of parts of philosophy by science. Science continued its intellectual conquest until eventually even history was swallowed: a key step, since history has always been recognized as a bulwark of Christian faith (Schlossberg, 1983). The philosophical steps that led to our present state followed a progression from supernaturalism to Naturalism (Sproul et al., 1984; Schaeffer, 1982; Adler, 1993; and many others). Adler (1965) diagnosed four problems that have plagued modern thought and laid a foundation for modern Naturalism:

- A tendency to reject the wisdom of the past and engage upon individual, convoluted system building (e.g., Descartes, Kant);
- A tendency to retain old errors in new systems, such as the medieval concept that philosophy could supply sure and certain knowledge;
- A tendency towards what he called "suicidal epistemologizing"—making epistemology prior to instead of posterior to other branches of first order philosophy and focusing on what cannot be known instead of what is known; and
- A tendency towards what he called "suicidal psychologizing"—substituting the psychologizing of common experience for common experience itself as a philosophical method.

What Locke did was to make the simple but disastrous error of obliterating all first intentions by treating all ideas as if they were primarily *objects* of the mind or *second intentions* employed by the mind to consider its own ideas... Ideas ceased to be *that by which* we know the world about us, and became *that which* we know—almost all that we know....

I need not dwell here on the far-reaching consequences of this fundamental substantive error—the subjectivism and the solipsism...together with all the skeptical excesses that it led to, and the epistemological puzzles and paradoxes that confronted those who tried to hold onto the most obvious features of our experience after they had been psychologized into myths and illusions (Adler, 1965, pp. 268–269).

In addition to these errors and their virtual destruction of first order philosophy, Adler (1965) noted a tendency on the part of philosophers to ape science and mathematics, not recognizing that although philosophy (*sensu stricto*) has an empirical function, it does not share the investigative aspects of science or the precision of abstract mathematics. He notes the frustration of philosophers relative to these disciplines:

This sense of inferiority has, in turn, two further results. It has driven some philosophers to make all sorts of mistaken

efforts to imitate science. It has led others, such as the positivists in our own century, *to turn the whole domain of first-order inquiry over to science...* (Adler, 1965, p. 272, emphasis added).

It is not coincidental that “modern science” (*per* Schaeffer, 1982, pp. I:223–227) was first known as “natural philosophy.” That moniker conveyed two deep insights: (1) natural science had a method and area of inquiry distinct from the broader domains of philosophy and theology, and (2) natural science was not “neutral” but intrinsically dependent upon a philosophy of life or worldview. To follow the path of natural science was to limit oneself to empirical inquiry due to the nature of the subject matter, not to claim that the empirical was the totality of reality. This first break was healthy; it has been termed the “scientific revolution,” and its history is well documented (Morris, 1984, pp. 25–33; Schaeffer, 1976). What followed was not healthy: a radicalization of science which blurred the boundaries of the method and domain of science and which lost its perspective of subordination to a foundational worldview (Klevberg, 1999). This distortion was called “modern modern science” by Schaeffer (1982, pp. I:229–231, 308–310), and calls for its correction have been voiced elsewhere (Plantinga, 1990; Middelmann and Wilder-Smith, 1980; Schlossberg, 1983).

Christianity rests upon the Bible. The Bible in turn rests upon confidence in history in general and in revealed history in particular. The fatuous cliché, “the Bible is not a textbook of science,” merely distracts from the fact that it is the only reliable textbook of ancient history. Naturalists have always seen that more clearly than Christians and it is little wonder that Naturalists strive so hard to replace biblical history with “scientific history.” The recent flare-up over the introduction of a book advocating the Christian historical perspective on the Grand Canyon (Vail, 2003) is an excellent illustration of their intensity in this battle.

Over the past two centuries, the obstacle of Christian theology has become less and less relevant among the educated elite. With the bulwark of theology out of the way, first-order philosophy virtually committed suicide through the reactions and counter reactions to a number of “start from scratch” system building efforts. Thus a vacuum was created begging for a different kind of knowledge. The stunning progress of science and technology filled it, but science, not satisfied, has attempted to swallow all empirical ground previously held by philosophy, history, and theology. With minimal opposition, it is little wonder that Naturalism so easily succeeded.

The Worldview of Naturalism

Today, Naturalism is the dominant worldview of Western

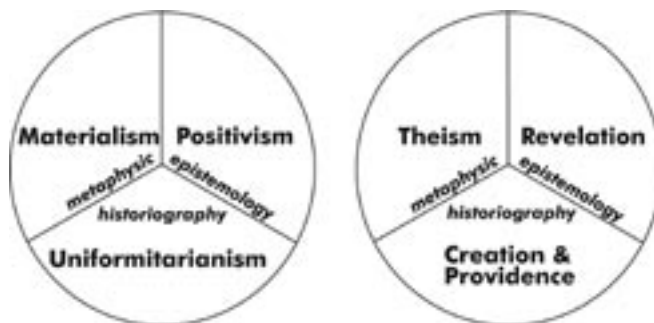


Figure 1. The worldviews of Naturalism and Christianity are contrasted by a triad of metaphysics, epistemology, and their basis for history.

intellectual culture. Its advocates trace its roots to ancient Greece and Rome, but Enlightenment Naturalism is a post-Christian absence of conscious faith in which ultimate reality is reduced to physical matter (Figure 1), a metaphysic that is paradoxically a denial of metaphysics. The reductionistic nature of Naturalism is perhaps one of its most profound weaknesses, a weakness conveniently obscured by the rapidity of scientific and technological advancement (Plantinga, 1967; Schaeffer, 1982, pp. I:309–310). In classical terms, Naturalists jettisoned Plato and Aristotle for Democritus. The position and motion of matter/energy cause everything that has happened, is happening, or will happen. God is a false myth, the supernatural a dream, the soul an illusion, and the afterlife nonexistent. In short, only fools or weaklings cling to religion.

Since reality is defined as matter and motion, there is no essential difference between mind and matter. This corollary has created many thorny philosophical issues for proponents of Naturalism, such as that of human freedom in the face of an inevitable determinism (Øhrstrøm, 1990). A crucial corollary to metaphysical materialism is the epistemological primacy of science. No God means no revelation, and thus theology is a waste of time. Reality is restricted to physical phenomena, and knowledge consists of the best human understanding of these phenomena. The logical connections between metaphysical materialism and epistemological positivism are an important point of internal consistency in Naturalism. Science, and only science, offers hope for sure and certain knowledge. David Hume captured the spirit of positivism early on in his famous conclusion:

When we run over our libraries, persuaded of these principles, what havoc must we make? If we take in our hand any volume; of divinity or school metaphysics, for instance; let us ask, “Does it contain any abstract reasoning concerning quantity or number?” No. “Does it contain

any experimental reasoning concerning matters of fact and existence?" No. Commit it then to the flames: for it can contain nothing but sophistry and illusion (Hume, 1777, section 12).

Following the empiricist trail of Hume and his predecessors, Auguste Comte (1798–1857) became the progenitor of modern positivism. Comte proposed the evolution of knowledge: from primitive theology, on to philosophy, and finally positive science. Although extreme forms developed in the Nineteenth Century have been widely repudiated, the general concept remains the dominant epistemology of modern scientists today.

Most scientists today are positivists, claiming, along with Comte, that all valid descriptive knowledge of reality belongs to science.... The dogmatic claims of positivism are widely prevalent at the end of the twentieth century, not only among scientists, but also among all those who have been miseducated in our colleges and universities, as well as in the unthinking multitudes who are overly impressed by the achievements of science and technology (Adler, 1993, p. 76).

One of the diagnostic features of positivism is its swallowing of other disciplines, such as history.

This attempt to make history scientific originated in the positivism of Auguste Comte. The term positivism was used to contrast the reliable methods of natural science with the ethereal speculations of metaphysics; and while later positivistic historians may not accept other parts of Comte's philosophy, the term itself is not too inaccurate. The aim is to discover laws by empirical observation (Clark, 1994, p. 99–100).

Because of its belief that reality is matter in motion and is understood through the method of positive science, Naturalism faces a profound dilemma regarding history. It needs a strong theory of history to support the concept of evolution and natural history (its heavy artillery in the war against Christianity). *But the logical consequence of a strong positivism appears to preclude history, since only knowledge based upon observation is valid.* Furthermore, any theory of history needs nonscientific presuppositions.

The basic propositions are, first, that the present relics of the past cannot be interpreted as historical evidence at all unless we presume that the same fundamental regularities obtained then as still obtain today (Flew, 1997, p. 49).

Science applies special forms of observation to physical phenomena (i.e., experimentation with controlled repeatability). Experimentation is impossible with reference to the singular events of the past. However, in order to argue against Christianity, Naturalists must be able to both accurately describe history and interpret it (Figure 2). We are often puzzled by events of 100 years ago. Historians fight



Figure 2. Meteor Crater, Arizona. Crater, viewed from the rim. 1891. For many years, scientists argued the origin of this feature. Photograph by G.K. Gilbert. Image courtesy of the United States Geological Survey.

over those that happened thousands of years ago in the midst of abundant textural and archeological evidence. How then can there be confidence when Naturalists glibly make a leap of faith back in time three to six orders of magnitude further? Any sane consideration of the enterprise forces us to conclude that it has moved from the realm of the merely difficult to that of the impossible.

Only one thing can salvage history for Naturalism—unlimited extrapolation. What then can lay such a foundation from the (observable) present into the (unobservable) past? Lyell, who was known as a great observer of geologic phenomena, held to a strict uniformity of rate and process because he understood the philosophical meaning of uniformitarianism. Uniformitarianism offered to save history for science by abducting it from the Bible. But over time, uniformitarianism has lost the philosophical purity it once enjoyed. One of the generally ignored aspects of the development of geology is the slow, but dramatic erosion of the concept as proposed by Hutton and Lyell. Two centuries of examining the Earth's crust have demonstrated that geologic processes operated in the past in ways unknown and unobserved today (Figure 3). Observation (supposedly the most valid basis for knowledge) has invalidated the basis for a credible history for Naturalism, but no one seems to have caught on. That itself is incredible!

To escape the contradiction, geologists today recognize that rates and even processes differed in the past, but resort to a bait-and-switch defense of uniformitarianism as "methodological" to preserve their ability to interpret the past (Gould, 1965; 1984; Klevberg, 2000, pp. 36–38; Reed, 2001). Methodological uniformitarianism is nothing more than the assertion that the laws of nature operate consistently through space and time, a fundamental axiom of science predating Lyell by centuries. But Lyell defended



Figure 3. Grand Canyon National Park, Arizona. Grand Canyon, viewed from in front of the El Tovar Hotel. August 30, 1905. Radically varying interpretations of Grand Canyon between uniformitarian and creationist geologists illustrate the role of interpretive templates. Photograph by R. Arnold. Image courtesy of the United States Geological Survey.

much more than “methodological” uniformitarianism; he safeguarded a uniformity of rate and process (Figure 4).

The difference between Lyell and his intellectual children is that Lyell was a better philosopher. He fought catastrophism because it supported the dominant worldview of Christianity. He could not afford any concession to Cuvier or Moses without risking all. An atheistic view of history requires the extrapolation of scientific certainty into deep time, which in turn requires strict uniformity. But



Figure 4. Niagara Falls, New York and Canada. American Falls, viewed from Goat Island. 1895. Niagara Falls was one of Lyell’s examples of steady rate uniformitarianism. Meyer and Williams (1999) documented its failure to do that from strictly empirical grounds. Photograph by G.K. Gilbert. Image courtesy of the United States Geological Survey.

modern scientists are not sensitive to these philosophical distinctions. Since the Naturalists have long ago won the debate, scientists no longer feel the need to avoid any stain of catastrophism. But ignorance cannot make the problem go away. Thus, they are stuck on the horns of their dilemma: Lyell’s uniformitarianism is philosophically necessary, but empirically discredited.

Naturalism Assailed by Scientific Creationism

Most creationists date the revival of modern scientific creationism from the publication of *The Genesis Flood* in 1961. Soon after, the Creation Research Society was founded. By the early 1970s, Drs. Morris and Gish were unveiling scientific flaws in evolution in debates held around the United States, and then internationally. Since then, the modern creationist movement has grown to include a variety of individuals represented by at least three principal organizations, all committed to (1) a traditional interpretation of Genesis 1–11, including creation in six 24-hour days, (2) a young Earth, and (3) a global flood responsible for most of the rock record that uniformitarian scientists assert took billions of years to form. These organizations include the Creation Research Society, founded in 1963; the Institute for Creation Research, founded in 1972; and Answers in Genesis, founded in 1993. Numerous local organizations also work hard to propagate the creationist message.

Modern creationism initially attracted attention because of the emphasis on a *scientific* rebuttal of evolution and uniformitarianism—a method that would prove impossible if there were any truth to Naturalists’ claims of a science-versus-religion conflict. But there were also problems. The scientific approach led to friction between creation scientists and some professional theologians. The theologians were biased against the conservative denominational affiliations of the creationists and hesitated to associate with those the academic establishment had labeled “anti-intellectual.” Many sincere theologians were indifferent to the age of the Earth and the length of the creation days, ignorant of the role of uniformitarianism and blind to its challenge to biblical authority. Thus, the early attacks on Naturalism emphasized scientific evidence against evolution.

What has come from the past decades? Thankfully, many individuals have recovered proper confidence in the Bible as an authoritative revelation. Furthermore, Christians have seen the once-invincible aura of uniformitarian history founder on incisive critiques and contrary data. However, no mainline Protestant or Orthodox denomination nor the Roman Catholic Church actively defends a young Earth or special creation as opposed to evolution. Few evangelical denominations do either, and many are rent by strife over the issue. Apart from a few brave teachers,

no public university or school condones teaching even a comparative evaluation of creationist and evolutionist natural history. Relatively few private universities do either, and some of the most virulent anti-creationist rhetoric emerges from “Christian” institutions. No major seminary and only a few small ones teach a recent creation and universal Flood. Despite the inroads of the 1970s and the continuing laudable efforts of individuals and organizations, progress on the creationist front appears to have slowed.

Unfortunately, the efforts of such stalwarts as Dr. Henry Morris and Dr. Duane Gish that created such turmoil among Naturalists have given way to those who seek a compromise between the “extremes.” The most recent trend in that direction is that of Intelligent Design (ID): prestigious scientists and scholars present complex evidence for the creation, but they either tactfully avoid the young-Earth controversy or affirm its contrary. They are welcomed with comparative relief by theologians who were placed in very uncomfortable positions only a few decades back. One of the leaders of this movement is Dr. Phillip Johnson, author of several popular books (Johnson, 1993; 1995; 1997). He epitomizes both the positive and negative aspects of the Intelligent Design movement. Positively, he has done something that the “scientific” creationists neglected: a logical critique of evolution as it resides within the worldview of Naturalism. Negatively, he has failed to see the internal linkage between Naturalism’s epistemology—positivism—and its justification of history in uniformitarianism. We seek to correct this oversight. In summary, scientific creationism was an appropriate argument to start the battle, but it is not the major theme that will ultimately lead to victory.

Requirements for Victory

In the final analysis, Christians recognize that proper theology teaches us to strive for faithfulness, while God provides victory or defeat (II Chronicles 20:15). However, it is certainly reasonable to expect victory, especially when warring against ideas raised up against God (II Corinthians 10:5). No creationist can afford to minimize the spiritual dimension of these battles. What follows is an intellectual strategy that is consistent with biblical truth and hopefully with biblical wisdom. Most of the following points warrant much greater discussion. Therefore, this section is merely a broad outline for recovering a sound, biblical view of natural science and natural history.

Understanding via Worldview

If the correct interpretation of Genesis is to regain broad acceptance in the church and grudging respect—or at least fear—outside the church, then the true extent of

the obstacles must be recognized. The frontal attack on Darwinian biology and Lyellian geology has rekindled hope, but few have yet to acknowledge the true extent of the opposition, which like an iceberg lurks mostly beneath the surface. Worldviews are the mythologies that underlie culture. Christianity is a worldview. It has been challenged not by improper science, but by a competing worldview that has used science as a cloak to hide its moldy philosophical and theological skeleton. Scientific creationism has torn that cloak, but as long as the bones beneath cling together, there will be no true victory. The next step is to disarticulate those bones. A few have seen that clearly (Johnson, 1997; Noebel, 1991; Schaeffer, 1982); it remains for the rest of us to get aboard.

Creationists need a clear appreciation of the extent of the battle. Scientists commonly shy away from theology and philosophy, and creation scientists rightfully distrust the theologians who have abdicated origins and history. However, we are all theologians by default; it only remains whether to be competent or incompetent ones. The coming generation of creationists must fight a worldview, not simply empirical data and derivative theories. Modern militaries recognize the effectiveness of the “combined arms” model; creationists also need a broad array of intellectual weaponry. Proponents of “Intelligent Design” have seen this more clearly than creationists. We hope that as creationists are willing to learn that approach from these advocates, that they will be open in turn to learning from creationists the need to derail uniformitarian natural history.

Destroying the Foundations

How does one go about attacking a worldview? First, one must recognize that it is an integrated entity that spans the breadth of intellectual disciplines and is held together by the glue of faith. Thus, a worldview cannot be totally destroyed; it can only be rendered foolish in the eyes of most. Finding and attacking presuppositions or logical foundations is a method that goes immediately to the vitals. We recognize three cornerstones of modern Naturalism: (1) metaphysical materialism, (2) epistemological positivism, and (3) a uniformitarian justification of history (Figure 1). Logical connections exist among each of these. The first two are linked as follows: if reality is matter, then science is the means to comprehend reality.

But Naturalism was shaped by its own early history. Rising in opposition to Christianity, it needed to destroy the Christian monopoly on history. Uniformitarianism provided a philosophical justification for the abduction of history by science. If the present could be perfectly extrapolated into the past, then science could rescue history from its revelatory shackles. Lyell opened the door. That is the

connection the Intelligent Design advocates have missed, and that is why despite their brilliant attacks on materialism and positivism, they will not topple Naturalism until history is anchored back in its Christian moorings.

What about evolution? Evolution in one sense is not the foundation of modern naturalism, but in another sense is. It does provide the underlying mythology for modern Naturalism, but destroying evolution will not ensure the destruction of Naturalism. In any case, it has proven itself the most effective weapon against Christianity over the past two centuries. Scientific creationism blunted the blade, but did not break it. That probably will not take place until the worldview that nurtures it is uprooted.

A Full Orbed View of Origins and History

Origins and Earth history, however controversial, comprise only one facet of the Christian worldview. Because it belongs to a larger whole, it must be constrained and fenced by other truth. This constraint becomes more powerful when we see that there is a hierarchy of knowledge. What is the basis for deriving such a hierarchy? We suggest that the weighted dependence of one branch of truth on another as a good criterion. The Bible is at the apex, because truth is inherent in God, and man's comprehension of truth relies on God's revelation (and all the more given the effects of sin). Men have labored for millennia to systematize and apply revelation in the discipline of theology. Theology depends on the Bible, and thus is subordinate to it. Philosophy correlates the wisdom of common experience with theological axioms, and is thus subordinate to theology. Philosophy and theology provide axioms for other empirical disciplines and are thus superior to them. It is only out of our understanding of reality and knowledge by theology and philosophy that we find axioms that make science possible. The same is true of history.

History requires philosophy. Not only is the need for philosophy seen in the earlier difficulties and puzzles, but it is also seen, where some people do not expect it, in the very definition of history.... The definitions of history, listed above, all reflect the philosophy of their authors. Those authors who have reflected but little on philosophical problems give looser definitions. Those who have puzzled through many difficulties become more pedantic, more careful, more accurate. Implicit in their formulations are their views of man, of society, of God, and therefore of knowledge... whatever his definition and extended views of history are, there must always be an underlying and controlling philosophy. It can be ignored, but it cannot be avoided (Clark, 1994, p. 21–22).

History, however, has a significant advantage over other disciplines. Its boundaries, method, and significant content

are readily available in the Bible, thus providing a validation of that fraction of history within the Christian worldview.

It is difficult for even thoughtful Christians to escape the presuppositions of the age. Positivism is a relevant example. Many do not adequately distinguish between science and history and elevate science to the level of Scripture. We commonly see statements to the effect that science is the “67th book of the Bible.” Another popular Christian position recognizes the primacy of Scripture, but sees only vague distinctions between science and history. For example, we often see a distinction drawn between “operations science” and “origins science.” While this position is closer to truth, neither appears to see clear boundaries between disciplines, because they have abandoned the philosophical basis that allows such demarcations. Three theological axioms are required to clear up this mess: (1) the unity of truth, (2) the multiplicity of human knowledge, and (3) the priority of the end (truth) over the means (method).

These points are somewhat paradoxical: on one hand is the need for the clear boundaries between various disciplines, and on the other, the need to reassert the unity of truth and its primacy over method. There is not room for a thorough discussion of this topic in this paper (*c.f.*, Clark, 1991; pp. 197–228; Morris, 1984; Schaeffer, 1968a; 1968b; 1972), but we would offer one trail through the tangle of modern thought. In both the manifestations of positivism cited above (the equivalence of general and special revelation and the labeling of origins studies as science), there is the recognition that science plays a role in natural history, although in the latter case there is also the correct recognition that natural history is not quite the same thing as controlled experimentation. We believe that this dilemma can be resolved by the application of the eminently sane “mixed question” approach of Adler (1965) to origins and history—two areas that demand such an approach. With this strategy, methodological differences between different areas of knowledge are retained, while allowing roles for more than one discipline. Combined with this approach is the need to subordinate method to the goal of all knowledge—truth. Thus “biblical” creationism does not produce a different quality of truth from “scientific” creationism; rather our quest for the truth about origins integrates knowledge from the Bible and science, as well as philosophy and history. Defining validity by method is a trick of Naturalist epistemology to denigrate absolute truth. We see it commonly in the dismissal of the Christian worldview as “religion” and its own as “science.” The unspoken assumption is that the method of science provides hard truth and that of religion, only wishful thinking. *It is this method-based, rather than truth-based, approach to knowledge that has allowed Naturalists to separate science from Scripture and then*

set them in opposition to each other.

Figure 5 is a diagram differentiating among the various empirical disciplines, correcting the positivist error that any empirical discipline is science (for more details on this arrangement, see Adler, 1965). This error has supplied Naturalism with a tremendous advantage especially in the confusion of history and science. Clear thinking recognizes that:

Similarly, when scientists (such as geologists, paleontologists, and evolutionists) sometimes attempt to establish the spatial and temporal determinants of particular past events or to describe a particular sequence of such events, they cease to be engaged in scientific inquiry and become engaged in historical research, sometimes called natural history.

Though both history and science are investigative modes of inquiry that submit their conclusions to the test of experience (i.e., the data obtained by investigation), history by its method can answer questions that science cannot answer; and science by its method can answer questions that history cannot answer (Adler, 1993, p. 15).

Creation and the Fall

It is easy to get caught up in defending the history of Genesis, and to forget the significance of the events. One that creationists would do well to remember is the Fall and its effects on mankind. Genesis states that after Adam rebelled, it took little more than 1,500 years for all people, with the exception of Noah's family, to give themselves completely to evil. Romans 1–3 summarizes the teaching of all of Scripture when it states that no one is righteous, that man's natural state is to suppress the truth, and that only God's action can overcome this terrible prejudice. Although this is not the place for an expanded debate on the noetic effects of sin, we simply note that the Bible teaches that all men apart from God are strongly biased against God, His truth, and His people.

What does this mean for creationism? First, it should provide clear expectations for the role of empirical arguments on either side. On one hand, evolution and uniformitarianism did not triumph, nor do they continue to enjoy victory, based only on empirical argumentation. Rather, their empirical arguments provide a justification for a deeper, ongoing bias against the Creator and His truth.

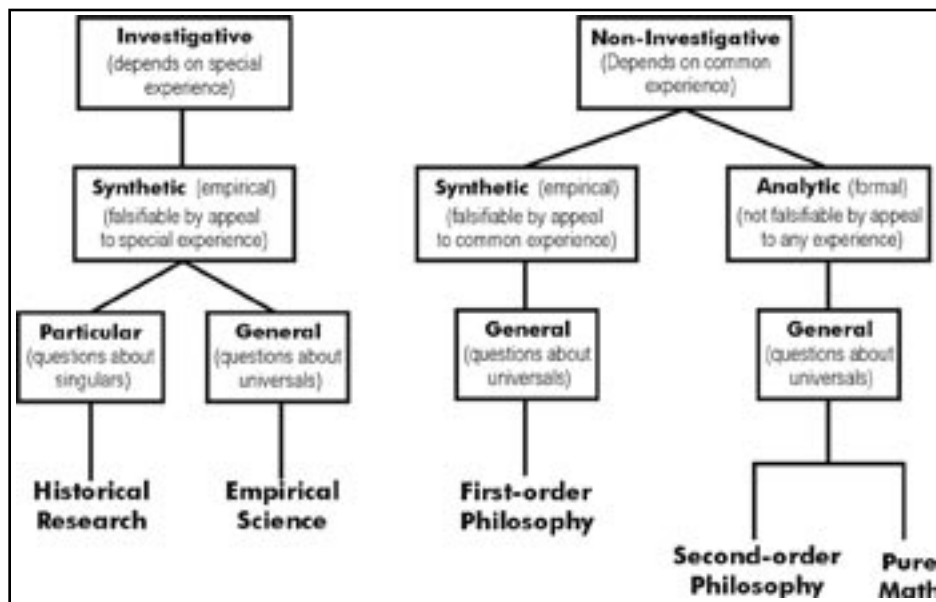


Figure 5. Adler's (1965) divisions of the disciplines. See his discussion for a complete explanation.

Naturalists are committed to their worldview not because of its intellectual supremacy, but because they are committed to its opposition to Christianity. Thus, creationists will not convert the masses that reject God by some "silver bullet" of empirical truth. Should we abandon science or natural history? Of course not! However, we should recognize the true purposes of our research: (1) to support the church in its apologetic task against unbelievers, (2) to fight against the lies of our enemy, and (3) to carry out the command of God to exercise dominion over His creation.

Formal vs. Empirical: A Necessary Transposition

We noted above the need to destroy the foundations of Naturalism. If Naturalism is the full-orbed worldview that we assert it to be, then such a task cannot be done empirically. It is impossible to empirically overthrow axioms and assumptions. Instead, creationists must make the difficult transition from their primary attack, that of empirical argument to the mode of formal, logical argument. This style will strengthen the Christian attack, because it attacks a point of weakness in Naturalism from a position of strength in Christianity.

A mark of Naturalism's success is the degree to which its epistemology of positivism has dominated thought over the past two centuries. What is positivism? Adler (1992, pp. 31–32) noted:

I know that there are enough varieties of positivism to

permit the professors to retain their individuality, but I insist that behind the multiplicity of technical jargons there is a single doctrine. The essential point of that doctrine is simply the affirmation of science, and the denial of philosophy and religion.

Theology and philosophy have always been strengths of Christianity. Early proponents of Naturalism required a means to neutralize these powerful defenses. Instead of taking them head on, Naturalists found that science could be distorted to make them supposedly irrelevant. Ironically, it was the success of Christian theology that defined a “background” role for theology in its relationship to science and made this attack possible (Clark, 1991; Reed, 2001; Schaef-fer, 1976). Once science was established in the forefront of empirical knowledge, it was easy to assert the irrelevance of theology and the primacy of empiricism. Over decades of inculcation, even large numbers of sincere Christians have accepted the claims of positivism. Perhaps, its strength has even influenced the “scientific” creationist approach to the problem of evolution and uniformitarianism.

How should Christians view science? Science is only one aspect of the totality of Christian knowledge that is summed up in the term “revelation.” By means of general revelation, man comes to understand himself, nature, and God through the action of his created mind as he apprehends and comprehends himself, nature, and God. But man’s mind is finite, fallen, and fighting against the knowledge of God (Romans 1–3). God graciously provides special, direct revelation that supplies absolute truth about Himself, man, and nature through the Scriptures, often correcting human errors in natural knowledge. The revelatory basis of Christianity justifies a strong view of truth. For centuries, philosophers have ignored the Bible and consequently struggled with truth and certainty. Their historical problem has always been how contingent, limited, fallible humans can achieve absolute, unlimited, and infallible knowledge. At present, they appear to have settled for the abolition of knowledge in favor of emotion (so-called “postmodernism”).

If Christians retreat from the authority of the Bible, they are swept into that endless philosophical morass. If men depend upon God for knowledge, then acquiring knowledge is not an exploration of the unknown, but the discovery of God’s creation that is already known by God. Human limits that result in incomplete knowledge do not mean that truth does not exist, since the infinite God guarantees a unity of truth. Because truth is consistent even when it is not known comprehensively, science is possible. Even today, scientists operate on that assumption as researchers work individually, assuming that their conclusions can eventually be integrated with those of distant colleagues.

Thus, the Christian view of truth is essential for science. That being so, science must accept the entire package, and learn to respect its place within Christian epistemology, submitting itself to special revelation and limiting itself to its proper boundaries.

History holds a special role in the Christian worldview, because the Bible uses history and its lessons as much of its medium of truth. Man exists in the context of history and God reveals Himself in the same medium. Thus, like Naturalism, the Christian view of history is closely tied to its epistemology. But the differences between revelation and positivism breed equally severe differences in their outlooks on history (Figure 1). Revealed history is trustworthy and true precisely because it is revealed. The revealed record may not include exhaustive explanations of all events, but it contains sufficient explanations of events that God (who knows and understands all things perfectly) deems important. Because human beings learn well through stories and examples, much of Scripture consists of historical narrative and explanation. Because God is personal and has intervened in space and time, His written revelation of Himself is largely historiographic. Any denial of the importance of history contradicts the validity of the Christian worldview.

The Formal Argument and Its Advantages

The formal argument against Naturalism rests on that worldview’s dependence on science. Science will ultimately betray Naturalism, because science is the child of Christian faith. Although science has been turned to the “dark side,” its internal logic screams for close links to Christian theology. Recent studies in the history of science demonstrate this historically, and the dependence of science on theological axioms demonstrates logical links. For example, scientists assume that the laws of nature are not restricted by space or time. This cannot be a “scientific” conclusion since it has not been and cannot be tested empirically in every location at every time in the entire universe.

The fatal flaw of Naturalism lies in this fact: the axioms of science rest squarely in the Christian worldview. In essence, Naturalists have merely purloined the presuppositions of Christianity. It is as though they were crusading against faith while unknowingly wearing large, red crosses on their backs!

“... Christian theology was essential for the rise of science.

In demonstration of this thesis I first summarize much recent historical work to the effect that that not only did religion not cause the “Dark Ages;” nothing else did either—the story that after the “fall” of Rome a long dark night of ignorance and superstition settled over Europe

is as fictional as the Columbus story. In fact, this was an era of rapid and profound technological progress by the end of which Europe had surpassed the rest of the world. Moreover, the so-called “Scientific Revolution” of the sixteenth century was the normal result of developments begun by Scholastic scholars started in the eleventh century. (Stark, 2003, p. 123).

What this means for creationists is that there are limits to the effectiveness of “scientific creationism.” To debate only on scientific grounds is to accept the epistemology of Naturalism, supporting the very worldview we are trying to destroy. Christians must reject positivism and uphold revelation. There is another advantage to the Christian way. The debate over origins has always been restricted to “experts” because the public bought the lie of positivism. Christianity opens the floodgates. No longer must believers not trained in one of the sciences cower behind closed doors. Any Christian willing to think with logic and in terms of worldviews can participate effectively in the origins/history debate. We can eliminate the home field advantage of the Naturalists, where the debate was restricted to specialists engaging in “factoid fights”—still too often the common currency of dispute today.

So how does it work? First we must consider the relative positions of theology, philosophy, and science, and the basis for ordering those relationships. All Christians should realize and proclaim that the origins/history debate is a debate between worldviews, not between competing-but-somehow-otherwise-neutral scientific theories. Next, we must look at the two worldviews from a different perspective. Many books detail the differences between them, but a more profitable line of investigation is to look instead to their similarities. These similarities are present because the fathers of modern Naturalism were steeped in the Christian worldview and assumed many of its truths without reflection. While modern Naturalism may present itself as an independent competitor to Christianity, antithetical in every way, in reality, it is not. Its Enlightenment founders were more “Christian” than they realized. Therefore, many of the paradigms of Naturalism are supported by presuppositions that are Christian.

Early proponents of Naturalism could not have realized that they were making Christian axioms part of their program. Since presuppositions usually are the part of the iceberg below sea level, most people then (and now) never noticed their existence. If we shine the light of truth on the hijacking of Christian axioms by Naturalism, the Naturalists will have only one way out. They must provide self-consistent substitute presuppositions (with appropriate justifications) to replace the pilfered Christian ones. If they cannot do so, then their worldview will be demonstrably

flawed, having failed formal truth tests of consistency and coherence. At that point, the origins/history debate must be settled wholly inside the Christian worldview.

What will that mean? First, the means by which any questions are answered must be consistent with the Christian worldview. Naturalism ignores revelation and theology; Christians cannot do that. As a consequence, the Bible and sound theology must provide necessary constraints for scientific and historical investigations. Next, it means that the big questions must be answered before the small ones. By that we mean that questions pertaining to the meaning of Scripture or theology take precedence over those of science or natural history, because the Christian worldview includes an implicit hierarchy of knowledge.

But, first things first. What are the formal flaws in Naturalism? What follows is a concise summary of several such contradictions from previous work (Reed, 2001).

Nature Can Be Known

Science developed when people began to understand nature within the Christian worldview during the medieval period. The Scholastics were forced to choose between the rational universe of Aristotle and that of the Bible, freely created by a transcendent, infinite, eternal, and unchanging God.

No Christian could ultimately escape the implications of the fact that Aristotle’s cosmos knew no Jehovah. Christianity taught him to see it as a divine artifact rather than a self-contained organism. The universe was subject to God’s laws; its regularities and harmonics were... a result of providential design. The ultimate mystery resided in God rather than in Nature.... The only sort of explanation science could give must be in terms of descriptions of processes, mechanisms, interconnections of parts. Greek animism was dead.... The universe of classical physics, in which the only realities were matter and motion, could begin to take shape (A.R. Hall as cited in Glover, 1984, p. 83).

This new paradigm gave the world a mechanistic flavor. God was a superior engineer and man could comprehend His marvelous works. Since God created freely, creation could not be understood by fixed rational principles, but by critical reflection on observation and revelation. Final cause existed in the will of God, was relegated to theology, and left science unencumbered by teleology.

Modern Naturalists reject the Christian doctrine of creation, but retain the derivative mechanistic method of studying it. Thus they have kept the empirical tradition without being able to justify its use. Also, they cannot explain final cause in its historical context. They reject both Aristotle’s view that purpose is inherent in nature and the Christian view that purpose is imposed upon nature. Thus,

their only logical alternative is that purpose does not exist relative to nature, but if purpose does not exist neither is there any purpose in their science (or their lives) nor is there a logical basis for expecting nature to act purposefully, a feature often observed.

Man Can Know It

If nature is a scientific wonderland, can anyone play? If scientific thinking comprehends physical reality, there must be a connection between human thought and nature. How can scientists act as objective observers unless they transcend nature? How can they transcend nature if they are simply a part of the system? During the formative years of modern science, those questions posed no problem because man: (1) was created in the image of God, (2) was an immortal spiritual being, transcending nature, and (3) had the promise of dominion over the creation, implying the ability to comprehend it.

Naturalism attempts to preserve man's scientific potential by making him the pinnacle of evolution and holding out the possibility of future evolution into "gods." But man, the pinnacle of evolution, is still a part of the system; without the *imago dei* there is neither transcendence to support objective study, nor does wishful thinking about future godhood secure the promise of dominion. The internal logic of Naturalism is better reflected by those who assert the place of plants and animals to be equal or superior to that of man. Thus, Naturalism traps man within nature without any of the attributes that permit him to be a scientist, but still he practices science—because he believes that it disproves Christianity.

Knowing and Time

History in the worldview of Naturalism seems doomed to determinism, rendering it and man's study of it of no consequence. Faith in the value of history and in man's central role results from a thoroughly Christian appreciation of the relationship between God and man played out on the stage of time. Part of that relationship is the freedom of man relative to nature (see above). Naturalists have removed God, but cling to their own significance through the pursuit of "missions" in life. They never ask why they should bother to "save the whales" in a deterministic world. This misplaced mission-oriented character of man reveals yet another stolen Christian presupposition. This inability to live within the confines of a worldview at odds with God's created world is what Schaeffer (1982, pp. I:129–142) called the "point of tension." And tension it is—Naturalism has no valid basis for history.

Similarly, concepts of linear, unidirectional time, the idea of progress, and of transcendent purpose in history

are derived from theology. Naturalism shares with Christianity a concept of "creation" (the Big Bang), followed by a period of conservation of the created order, followed by the end of the universe as we know it (oscillation to another big bang). Similarly, Naturalism has stolen the idea of progress from Christian theology. The Bible presents history as moving from the starting point of Creation to a purposeful end (Judgment). Inherent in the biblical presentation of redemptive history is the idea of progress, man moving toward the fulfillment of ultimate perfection on a new Earth. Naturalists assume linear, progressive time in evolution, but are stymied when pressed for a goal. "Increasing order and complexity" seems quite devoid of any purpose or moral imperative. But the comparison of these similarities—millennia old in Christianity; centuries in Naturalism—certainly suggests that Naturalists have been caught once again with their hands in the cookie jar of Christian axioms.

Grasping History

The primary historiographic axiom of Naturalism is uniformitarianism, a logical necessity that allows unlimited extrapolation of observation (positivism) backward in time. Logic demands the pure uniformitarianism of Hutton and Lyell.

But Lyell held a complex view of uniformity that mixed this consensus about method with a radical claim about substance—the actual workings of the empirical world. Lyell argued that all past events—yes, every single one—could be explained by the action of causes now in operation. No old causes are extinct; no new ones have been introduced. Moreover, past causes have always operated—yes, always—at about the same rate and intensity as they do today. No secular increases or decreases through time. No ancient periods of pristine vigor or slow cranking up. The earth, in short, has always worked (and looked) just about as it does now (Gould, 1997, p. 105).

The only problem is that observation, the *sine qua non* of positivism, contradicts this view of history. How did he get away with it, and more importantly, why do his disciples continue to?

Lyell then pulled a fast one—perhaps the neatest trick of rhetoric, measured by subsequent success, in the entire history of science. He labeled all these different meanings as "uniformity," and argued that since all working scientists must embrace the methodological principles, the substantive claims must be true as well. Like wily Odysseus clinging to the sheep's underside, the dubious substantive meanings of uniformity sneaked into geological orthodoxy—past an undiscerning Cyclops, blinded with Lyell's rhetoric—by holding fast to the methodological principles

that all scientists accepted (Gould, 1997, p. 119).

Reed (2001) argued that Lyell's trickery was not valid. But avoiding for now that level of analysis, there is a more fundamental dilemma faced by Naturalists—the Christian origin of the uniformity axiom that underlies any definition of uniformitarianism. It does not matter what kind of tortuous explanations of “catastrophic uniformitarianism,” have made their way into geologic literature, we only need to realize that Naturalism cannot justify faith in invariant natural law apart from God. Positivism demands justification via observation, but the universal axiom of uniformity cannot be so demonstrated. Lyell got away with it. Today we know better, and Naturalists are once again left needing a justification that does not exist in their worldview.

Finding the Juncture of Truth and Reality

The fundamental assumption of knowledge in general and science in particular is the conjunction existing among human knowledge, reality, and truth. Creation, and only creation, supports this very basic requirement. God is ultimate reality, and if God tells us to understand Him and enjoy an intimate relationship with Him, then it stands to reason that man can understand reality. If God created the physical universe, then His image-bearers could be expected to acquire a valid, though not comprehensive, understanding of nature. Absolute knowledge exists; God has it. Thus, while we do not know everything, what we know is guaranteed to be true if it corresponds to God's knowledge. Revelation provides the means to test correspondence.

To put it in practical terms, how can we justify the multimillion-man research effort of science? Most scientists assume that the parts will fit after the work is done. This bold assumption makes sense in the Christian worldview: man's similarity of thought is guaranteed by the image of God as is the unity of truth. But why should there be an integrated truth to discover in Naturalism, and even if there were such a thing, how could man put it together? There cannot even be any assurance that what scientists think has any relationship to truth or reality. The last four hundred years of philosophy have emphasized the uncertainty of knowledge apart from revelation: scientists have been far too busy operating (usually unconsciously) in the Christian worldview to keep up.

In summary, Naturalism is formally invalid because it relies on axioms antithetical to its methods and conclusions. Naturalism sprouted from the soil of Christian presuppositions. Larceny is profitable as long as no one notices, but when the spotlight is aimed in the right direction, the long arm of logic must act. The formal weaknesses of Naturalism are reflected in the success of Dr. Phillip Johnson's works. We contend that unless Naturalism can recreate these axi-

oms and justify them in a way that is consistent with the rest of its worldview, creationists should be screaming that the entire worldview is false and should be ignored in discussions about origins or Earth history. All of the empirical data in the world cannot save Naturalism from formal flaws.

The philosophy which forbids you to make uniformity absolute is also the philosophy which offers you solid grounds for believing it to be general, to be almost absolute. The Being who threatens Nature's claim to omnipotence confirms her in her lawful occasions. Give us this ha'porth of tar and we will save the ship. The alternative is really much worse. Try to make Nature absolute and you find that her uniformity is not even probable. By claiming too much, you get nothing. You get the deadlock, as in Hume. Theology offers you a working arrangement, which leaves the scientist free to continue his experiments and the Christian to continue his prayers (Lewis, 1961, p. 106).

Quo Vadis?

The battle against Naturalism irrevocably changed late in the Twentieth Century. Resting on a string of successes that dated back to the Enlightenment, evolutionists were stung by their weaknesses against the frontal assault launched by the scientific creationists. Evolutionist after evolutionist fell in debates on university campuses. They were even forced into court to explain to sympathetic judges that the Christian brand of origins was just religion, while theirs was science, the mother of air conditioning for the courtrooms, computers for the clerks, and convenient polyester robes. In short, they were on the defensive for the first time in more than two centuries. It was difficult to argue that the laws of Thermodynamics and gaps in the fossil record were just some of that “ole time religion” that had managed to find its way out of its closet. Courtroom successes revealed only the sympathetic religious commitment of Naturalists on the bench.

But just as the evolutionists began to adjust and use their advantage of an overwhelming number of entrenched academics, they were rocked by a new challenge. Qualified scientists who were not creationists began to argue that evidences of “intelligent design” existed in nature. They did not argue the age of the universe or the Earth, which eliminated some of the more popular arguments against the scientific creationists (radiometric dating, age of starlight, etc.). Even worse, a lawyer named Johnson began to write books poking holes in their assumptions and challenging their worldview. Those books were written for an educated general audience and roused significant interest in university settings. But Johnson has not advanced a creationist argument for a young Earth or a universal flood.

As time passes, it becomes evident to more people that issues of origins have more to do with worldviews than with science. The focus of the Intelligent Design movement on evolution has been especially telling, and the outmoded ideal of the white-coated, objective investigator with an answer for every question has slipped into the past. As with any intellectual revolution, a host of confusing compromises has been advanced, muddying the waters for many sincere Christians and interested unbelievers.

The environment is ripe for a new attack on Naturalism by creationists. The times, however, call for a formal attack, not another empirical one. No special education or training will be necessary for the public to see the glaring contradictions in Naturalism. Unless they abandon reason, they will be forced to admit (grudgingly and under compulsion of the truth) that Christianity again has the high ground. Total victory is unreasonable since the inherent biases of fallen human beings will believe anything, even a failed worldview, as long as it is not Christianity. More importantly, it is time to extend the formal critique of men like Phillip Johnson to the third cornerstone of Naturalism—uniformitarianism. This was the first triumph for Naturalism in the Nineteenth Century and remains the most deeply entrenched.

Acknowledgments

Only God has a monopoly on truth. We acknowledge our heartfelt admiration and intellectual indebtedness to the pioneers of the modern creation movement, to Dr. Phillip Johnson and the other Intelligent Design proponents, and to the centuries of Christian thinkers who developed the worldview that has provided the advantages that we enjoy. We are *not* accusing the scientific creationists, who have our profound respect and gratitude, of error. All we are saying is that it is time for the creation movement to look forward. There should be no change in the Bible's teachings about Creation and the early history of the Earth, although we do call upon the Intelligent Design proponents to recognize the Bible's clear teaching of a global flood, the role of uniformitarianism in Naturalism, and the necessity of a biblical natural history based on those truths. Furthermore, we strongly encourage the continued empirical investigation and publication in scientific disciplines by creationists within the framework proposed in this paper.

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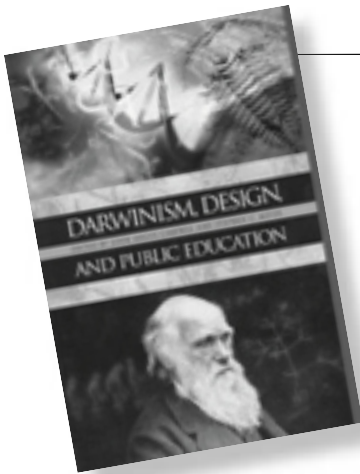
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Book Review

Darwinism, Design, and Public Education

by J.H. Campbell and S. C. Meyer, Editors

Michigan State University Press, East Lansing, MI, 2003, 634 pages, \$21.

This is another of the many books published by the intelligent design (ID) movement. It is unique in that not only is it published by a secular university publishing company but also one part is

dedicated to criticisms of the ID movement, mostly by evolutionists or anti-Design advocates.

The chapters by ID proponents, especially Stephen Meyer, take evidence for design to a new level. I especially liked the rigorous analysis with extensive documentation of the Cambrian explosion by Stephen Meyer, Marcus Ross, Paul Nelson, and Paul Chien. Other evidence for intelligent design is provided by articles on information, specified complexity, and irreducible complexity. Biology textbooks undergo a devastating critique for their false icons and misrepresentations of the controversy.

The book delves deeply into the philosophy of science, the difficult definition of science, the various confusing definitions of evolution, legal issues, and especially public education. ID advocates make a strong case that public education should be teaching the origins controversy. The chapter entitled “Teach the Controversy: Is it science, religion, or speech?” by David DeWolf, Stephen Meyer, and Mark DeForrest was especially insightful. DeWolf and DeForrest are lawyers who teach at Gonzaga University in Spokane, WA.

Most of the critics of ID in Part IV were disappointing. The knowledgeable reader should have no trouble seeing the superficiality of their arguments. They rarely challenge the ID arguments in depth but instead rely upon rhetorical arguments. The major case seems to be that it is “religion”

versus “science.” The assumption is that the philosophy of naturalism should be part of science, including the unobservable and unrepeatable prehistoric past. Phillip Johnson, who somehow is the last author in the “critics” part, sums up the major hurdle for the ID movement, “The greatest hurdle by the intelligent design (ID) movement is to overcome the prejudice that says that to attribute anything in biology to a Designer is to engage in ‘religion’ rather than ‘science’” (p. 549). Most of the other critics, some of whom were not even scientists, prove this concern.

As with all ID books, the young earth creationist (YEC) needs to be discerning in reading this book. The critics and a few of the ID advocates have the habit of publishing such statements as, “One of the cardinal points of his [Gish’s] theory is that Earth is only a few thousand years old, whereas geology has long ago demonstrated that the real time frame is measured in billions of years” (p. 195). I do not really think such YEC critics have examined the age of the earth, radiometric dating methods, and the Flood in such depth to make such statements. The ID movement is challenging the power elite on the obvious evidence for a Designer from biology (Rom 1:20). It would be most interesting if ID proponents would subject the other issues to the rigor they apply to the philosophy of naturalism and evolutionary biology. I can understand that such an expansion of the ID agenda goal would be problematic for Phillip Johnson’s wedge idea but it would be worthwhile to engage YEC about these matters. The Creation Research Society plans to carry this book on its web and in its new catalog, but with a disclaimer.

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Hox Genes—Evolution’s Hoax

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Abstract

Since the advent of molecular science, Darwinism has leaned heavily on genetic mutations to augment weaknesses observed in natural selection. Today, much of the evolutionists’ attention has focused on a set of genes referred to as homeobox (Hox) genes, which are pieces of DNA that either promote or inhibit other genes that play a role in the development of a particular organism. Using this information, scientists have been able to produce organisms with superfluous ectopic appendages, wings, or eyes on various regions of their bodies. This has caused evolutionists to proclaim that they have uncovered an adequate mechanism supporting the concept of evolution by mutations. However, Hox genes are far from the “magic bullet” that many have described them as being. While a mis-expressed Hox gene can alter phenotypic expression, it does not do so in a “biological vacuum.” Numerous other genes and proteins are needed downstream in order to produce phenotypic characteristics. Additionally, Hox genes are unable to produce new material—something that is essential for macroevolution. The data generated from researchers investigating Hox genes provide many insights into cellular physiology and development; however, the data do not support or confirm evolutionary theory.

From “Hopeful Monsters” to Genetic Mutations

For most of the past century, Neo-Darwinism has prevailed. It is “neo” (new), in that it has made the addition of genetic mutations a necessity for biological evolution. But this raises the question: Why must an addendum be made, except to serve as an inadvertent admission that the old theory of natural selection, or “survival of the fittest,” is not sufficient? As the late eminent professor at Harvard, Stephen Jay Gould, observed: “The essence of Darwinism lies in a single phrase: natural selection is the creative force of evo-

lutionary change. No one denies that selection will play a negative role in eliminating the unfit. Darwinian theories require that it create the fit as well” (Gould, 1977, p. 28). Gould was correct when he said that no one denies the conceptual process where the “unfit” are eliminated. This truism—which suggests that the “survivors survive”—is an obvious truth that creationists do not deny. An animal that is adapted poorly to its environment will be disadvantaged when it comes to survival. Eliminating weaker animals ensures that genetic defects cannot be spread throughout a species. However, Darwin’s General Theory of Evolution requires natural selection to go beyond simply sifting out the “unfit” and, as Gould commented, “create the fit as well”—something that it is unable to do. Colin Patterson, the late senior paleontologist at the British Museum of Natural History, appropriately noted in a radio interview:

No one has ever produced a species by mechanisms of natural selection. No one has ever gotten near it and most

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of the current argument in neo-Darwinism is about this question: how a species originates. And it is there that natural selection seems to be fading out, and chance mechanisms of one sort or another are being invoked (Patterson, 1982).

The chance mechanisms discussed in the above quote are the premise for the Neo-Darwinist movement. Seeing that the efficacy of natural selection was waning, yet unable to properly support it with any factual evidence, evolutionists turned to the geneticists for help. In so doing, they resurrected an old theory about systemic mutations—a theory that had been ridiculed and rejected for decades due to its lack of scientific support. The original theory, by the late evolutionary geneticist Richard Goldschmidt, suggested that evolution could produce “hopeful monsters.” It was a concept opposed to the general dogma of Darwin’s slow and progressive evolution, and one that instead proposed that speciation occurred in one giant macroevolutionary step. This theory was formulated due to the absence of any intermediary fossils, which are required to facilitate the enumerable transition phases of the gradual evolutionary theories. Goldschmidt commented on his initial proposal of “hopeful monsters” in his book, *The Material Basis of Evolution*, in which he wrote:

I used the term “hopeful monster” to express the idea that mutants producing monstrosities may have played a considerable role in macroevolution. A monstrosity appearing in a single genetic step might permit the occupation of a new environmental niche and thus produce a new type in one step (Goldschmidt, 1940, p. 390).

However, the scientific community never embraced Goldschmidt’s views, which deviated from the most commonly held evolutionary theory and invoked an even greater random occurrence than previous models. The “hopeful monsters” were, in actuality, “hopeless imaginations.” Even Goldschmidt’s evolutionary colleague, Stephen Jay Gould, berated such a notion by saying that Goldschmidt had “made a grand, not a paltry error,” and that such a concept was a “manifestation of this deeply fallacious genetic theory,” which, according to Gould (2002), should



Figure 1. Three dimensional representation of homeodomain of Hox protein.

be dismissed as a “colorful term” for a “historical curiosity” (p. 457). Gould’s stunning criticism did not stop there, but also was present in the introduction he was asked to write for a reprinting of Goldschmidt’s book, in which he declared: “*The Material Basis of Evolution* is the major work of his full-fledged heresy” (Goldschmidt, 1940). The suggestions of a “hopeful monster,” and the principle of reasoning behind it, are wholly based on evolution, but Gould’s demeaning comments also must be taken with the proverbial “grain of salt.” He himself repeatedly admitted consternations with his own theories:

The fossil record with its abrupt transitions offers no support for gradual change. All paleontologists know that the fossil record contains precious little in the way of intermediate forms; transitions between major groups are characteristically abrupt (Gould, 1977, pp 22, 24).

He reiterated this thought three years later in the journal *Paleobiology* in an article titled “Is a New and General Theory of Evolution Emerging?”

The absence of fossil evidence for intermediary stages between major transitions in organic design, indeed our inability, even in our imagination, to construct functional intermediates in many cases, has been a

persistent and nagging problem for gradualistic accounts of evolution (Gould, 1980, p. 127).

Somehow it seems to elude evolutionists that the “absence of fossil evidence” for transitional organisms simply demonstrates there never were any such transitional forms.

Structural vs. Regulatory Genes

In 1865, Austrian monk Gregor Mendel introduced to the world his theory of heredity, through his study of garden pea plants (*Pisum sativum*). In 1906, William Bateson introduced the branch of biology known as genetics, which is founded on many of the precepts established by Mendel’s research. The term “gene” was coined three years later by Wilhelm Johannsen (Keller, 2000). At first, of course, the term lacked a definition, and biologists’ understanding of it was marginal. However, through the advancements in the new and blossoming field, much of the basis of mod-

ern genetics was fashioned. Today, the gene is defined as a “self-replicating unit of heredity; a portion of DNA (i.e., a sequence of nucleotide units) that encodes a protein” (Schwartz, 1999, p. 406). As the definition states, genes are portions of the deoxyribonucleic acid (DNA), which holds the genetic coding—a sort of blueprint for the design of the body. On a single strand of DNA, there can be numerous portions (genes), each specifying the design of a unique aspect of the body plan.

At one point it was thought, even by the eminent geneticist Thomas Hunt Morgan, “that all genes are acting all the time in the same way.” However, he even noted that “this would leave unexplained why some cells of the embryo develop in one way, some in another, if the genes are the only agents in the results. An alternative view would be to assume that different batteries of genes come into action as development proceeds” (as quoted in Keller, 2000, p. 56). The concept set forth by Morgan concerning the problem of the one-gene—one-enzyme view was left unanswered for three decades. Finally, in 1959, Francois Jacob and Jacques Monod made what has been dubbed as the “most original discovery” in the field of genetics (Morange, 2001, p. 95). From their bacterial studies, they surmised that there must be at least two classes of genes: structural and regulatory. Their theory sought to answer the problem: “What caused gene expression in an organism’s structure?” Evelyn Keller, in her book, *The Century of the Gene*, acknowledged this problem as the “Achilles’ heel not just of the one-gene—one-enzyme hypothesis but of the very notion of gene action” (Keller, 2000, p. 56). Until this point, the process by which an organism’s anatomy was constructed had remained a mystery. However, by 1961, Jacob and Monod had identified the “regulator gene,” which they said “controls the rate of transcription of certain specific structural genes without itself contributing any structural information to the proteins” (as quoted in Keller, 2000, p. 56). Simply stated, the “regulator genes” are responsible for “directing” the information, and do not participate in the physical formation of any body structures. This laid down a clear separation between the two classes of genes—those known to make up an organism’s structure (structural genes) and those responsible for gene expression (regulatory genes).

The regulatory genes (also known as developmental or control genes) are responsible for the major developmental decisions in the body—as opposed to specific details of engineering (Tedeschi, 1997). These genes are responsible for a variety of spatial and time-dependent functions. They have been found to be crucial contributors in setting up the directional gradient of developing embryos, whether anterior-posterior, dorsal-ventral, or radial. Later in the

organism’s development, regulatory genes help to supervise the formation of the body’s diverse tissues, such as muscles and organs. Along with the basic symmetry of the organism, these genes also control the “position-specific adult structures” such as body segments, limbs, wings, sensory organs, etc. (see Martindale and Kourakis, 1999). Finally, regulatory genes do not always have a direct impact, but can pass their instructions indirectly by controlling numerous other regulating genes. French scientist Michel Morange, in his book *The Misunderstood Gene*, summarized the role of regulatory genes when he wrote: “Developmental genes do not directly construct the organism; rather, they provide cells with the relevant properties that enable them to interact in order to construct the organism” (Morange, 2001, p. 98).

Homeobox (Hox) History

The breakthrough by Francois Jacob and Jacques Monod fueled the hopes of many scientists who were engaged in a variety of genetic experiments. One of the experiments, built upon the work of Jacob and Monod, focused on the common fruit fly (*Drosophila melanogaster*). Nobel laureate Thomas H. Morgan popularized *Drosophila* as an excellent test subject in the early part of the twentieth century, due to its brief life cycle, ease of culturing, high fecundity, and economic feasibility (Lewis, 1998). In the 1980s, researchers began to probe the molecular structure of the DNA in genes. They developed a technique where by a probe could be attached to the specific section of DNA for which they were searching. To their surprise, the probe located about a dozen sections, which they referred to as homeotic genes (Spice, 1999). It was through this research that the now-famous homeobox genes were first discovered and classified. Although initially found in the *Drosophila* experiments, similar Hox genes also have been found in every species subsequently investigated, including (but not limited to), worms, fish, crustaceans, mice, and humans.

Homeobox genes (most popularly known by their abbreviated name, “Hox” genes) are a “class of highly conserved regulatory, or control, genes” (Schwartz, 1999, p. 406). As regulatory genes, they are part of a hierarchical network that controls the expression of the body’s structural genes (and thereby, the development of an organism’s body). Hox genes are vital for any developing organism, as they serve in an “advisory position” for the other genes. Evolutionists have come to depend heavily upon regulatory genes, especially the Hox cluster, as the main mechanism of mutation. Evolutionists are using mutations in Hox genes as a new mechanism for evolution, thus, bolstering punctuated equilibrium, which was the pet theory of Stephen Jay Gould.

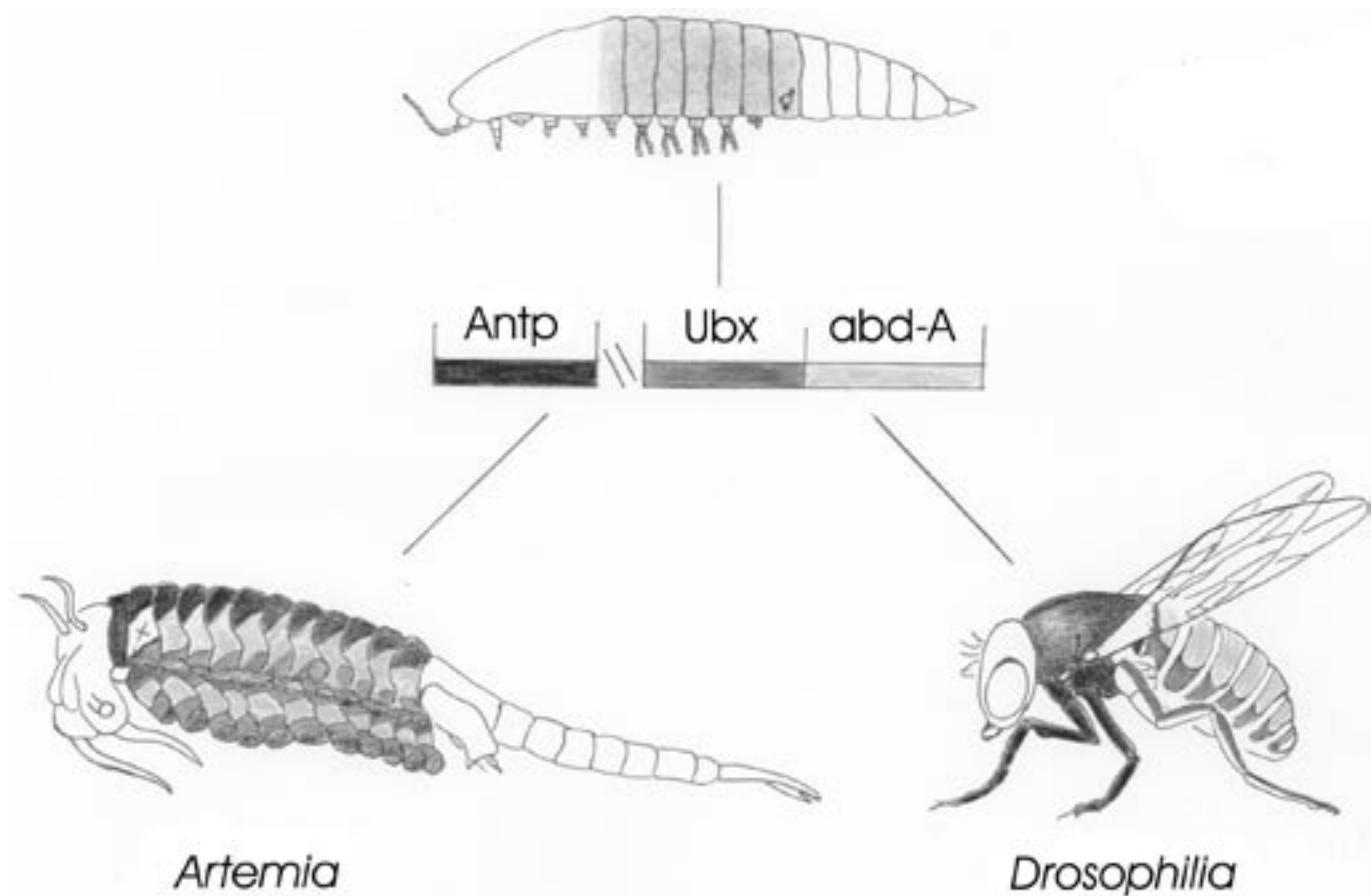


Figure 2. Body plans of *Artemia* and *Drosophila* showing conservation of abd-P, Antp, and Ubx genes.

This theory is the recent adaptation of Goldschmidt's "hopeful monsters," invoking small mutations in Hox genes to produce the profound effects needed for macroevolution to occur (Batten, 2002).

Walter Gehring's research group initially started working with this homeobox "cluster," seeking to find the individual genes' functions and the mechanism by which these functions were carried out. Little by little, regulating functionality of the Hox genes became apparent. As Gould (2002) remarked: "Presumably, Hox genes 'read' positional information to set the location of differentiating structures, thereby triggering the cascade of downstream [sic] architects, but not building the varied structures themselves" (p. 1099). This fit the mold, set forth by Jacob and Monod, for how a regulatory gene should operate.

By genetically altering Hox genes, the researchers were able to create mutations within the developing organisms. Some of the more radical mutations that were achieved involved the substitution of an appendage or an exterior organ at another location on the insect's body. An example of this is the alteration of the gene *Antennapedia* (first performed in 1987), which enabled scientists to grow a jointed

leg in place of an antenna (Barinaga, 1995). They also were able to control the characteristics of body segmentation, allowing them to make two identical thoracic regions. In a series of three separate mutations, known as *bithorax*, *postbithorax* and *anterobithorax*, a four-winged variety of *Drosophila* resulted. In this mutation, the second set of full-sized wings replaced the halteres (balancing appendages), which normally are located in the third thoracic region behind the wings (Wells, 2000). Much of Gehring's later work focused on the genes involved in the organization of the eye. Gehring made headlines when his group published their work on the newly discovered gene, "eyeless." By altering this particular gene, the group produced eyes in various other tissues such as wings, legs, and antennae (Barinaga, 1995).

In more recent experiments, scientists expanded their research to include the crustacean *Artemia* (brine shrimp). William McGinnis, Nadine McGinnis, and Matthew Ronshaugen, all of the University of California, San Diego, have been conducting research on the Hox gene, *Ultrabithorax* (Ubx), which has been found in both *Artemia* and *Drosophila*. The team, whose findings were published in

Nature, has found that the Ubx gene is associated with limb development (see Ronshaugen, McGinnis, and McGinnis, 2002). By manipulating and transplanting the Hox gene from *Artemia* into *Drosophila*, they have been able to affect the development of the *Drosophila* subjects. The replacement of this gene affected the growth of the fly's legs. This was one of the first experiments to cross the Hox genes of separate organisms to see their correlating effects (Luskin, 2002).

According to Amanda Onion, "Past research has shown that Hox genes act as master switches that turn on and off other genes during embryonic development" (Onion, 2002). Matthew Ronshaugen, a graduate student working in McGinnis' laboratory, commented that "[t]his kind of gene is one that turns on and off lots of other genes in order to make complex structures" (as quoted in McDonald, 2002). Much of the prevailing thought concerning the premise of the Hox gene has been that it is a "master switch." However, this view also has engendered some controversy. As Nelson (2000) commented: "These genes are not master switches for making wings or legs, but they specify position in the fly's body." In an article, "Where Do Toes Come From," in *Time* magazine, J. Madeleine Nash wrote:

Researchers are finding evidence that the Hox genes and the non-Hox homeobox genes are not independent agents but members of vast genetic networks that connect hundreds, perhaps thousands, of other genes. Change one component, and myriad others will change as well—and not necessarily for the better (Nash, 1995, vol. 146).

Master Genes—or Just Part of the Overall Machinery?

While convenience stores do not carry Hox genes, this does not stop evolutionists from portraying them as a common "one-stop-shop" solution for changing one species into another. Hox genes have been fashioned as self-reliant, relatively simple entities that can cause major mutations. Thus, these "master genes" are used to explain the vast differences in species we see today. The scientific literature on homeobox genes spans the spectrum from reporting experimental results, to pure speculation. Much of this speculation can be attributed to the fact that although most vertebrates and arthropods "have strikingly different body architectures, many of the regulatory genes they use to establish their body plan are conserved" (Kmita-Cunisse, et al., 1998, p. 3030). That is, the "same" homeobox genes are believed to be responsible for very different attributes in vastly different species. However, scientists have drawn conclusions regarding a common origin—with little regard for the empirical evidence. These inferences have led to

a belief that animals experience a developmental cascade common to all animals—using these "conserved genes." However, these genes are not simply passive providers of encoded instructions responsible for development.

The cellular environment in which they reside is infinitely complex. In describing eukaryotic cells, Rose stated that the "ribosomal machinery itself consists of a giant assemblage of sub-units together containing more than 80 different proteins, and RNA sequences containing more than 6,700 nucleotide bases. Without it, without the complex biochemical environment the cell provides, 'gene'...simply can't function" (1997, p. 128). In this complex cellular environment, segments of DNA interact with proteins, metabolites, nutrients, and other segments of DNA. Thus Hox genes are "reactive complexes that are in constant and dynamic interaction with their carriers" (Plotkin, 1994, p. 39). In reality these "master control genes" are reliant on a vast network of cellular machinery in order to operate properly.

Gehring (1998) claimed that homeobox genes are the first active genes that lead to a particular outcome. He asserted that these "master genes" activate a series of other genes, leading eventually, in the case of the gene *Antennapedia* for example, to leg morphogenesis. However, this claim breaks down on several different points. *First, homeobox genes are not the first active genes in the embryo.* As Robert (2001) pointed out, mesoderm [the middle layer of cells of an embryo, from which the skeletal, reproductive, muscular, vascular, connective, etc. tissues develop] is genetically induced at the cleavage stage, long before homeobox genes are activated. Additionally, a large number of interacting agents [e.g., antennal disc only form in regions of the body not expressing *Hom-C* (homeotic), and agents responsible for specifying antennae in the larval imaginal disc are *extradenticle* (*exd*) and *homothorax* (*hth*).] and processes must be in place for *Antennapedia* to function at all, for *Antennapedia* does not arise out of thin air and then operate in a precursorless void.

William Bateson, who coined the term "homeosis" in 1894, "felt that he could further strengthen Darwin's case by exhaustively compiling the discontinuous variations that occur naturally within a species" (Lewis, 1994, p. 341). As such, evolutionists were quick to point out that homeobox genes are responsible (at least in part) for the evolutionary origin of body plans (Lewis, 1994; Raff, 1996; Gellon and McGinnis, 1998). Many evolutionists have taken this a step farther and have suggested that Hox genes are the agents responsible for saltation (saltation is the origin of a new species or a higher taxon in essentially a single evolutionary step that in some especially former theories is held to be due to a major mutation or to unknown causes).

Paleoanthropologist Jeffery Schwartz contends that the role of homeobox genes in individual development better explains the origin of new species. He even has suggested that in the production of structures such as the feet, brains, and “completely useful and fully formed eyes,...all that is necessary is that homeobox genes are either turned on or they are not” (Schwartz, 1999, pp. 362,368–369).

Alex Rosenberg, the co-director of the Duke University Center for the Philosophy of Biology, influenced by Gehring’s work (Gehring, et al., 1995), as well as that of Lewis Wolpert (1994), contends that genes can “compute” the eye from nucleic acids and proteins alone. According to Rosenberg (1997), there is no need to explain the eye from a structural point of view, because upper-level structures are themselves computable from DNA. Rosenberg contends that the only thing that remains is to fill in the downstream blanks at the genetic level, and we will have a satisfactory explanation for eye morphogenesis. However, Schwartz and Rosenberg are grossly mistaken. As Robert (2001) noted:

The development of an organism is not fully prescribed in its inherited zygotic or maternal DNA. Rather, development is hierarchical, characterized by the emergence of structures and processes not entirely predictable from lower-level (e.g., genetic) properties of the embryo. For instance, how cells behave collectively during morphogenesis cannot be predicted by examining the behaviour of individual cells prior to cell division, differentiation, or condensation, let alone by examining gene sequences (Hall, 2000, p. 177; see also Hall, 1999). *The very presence of the downstream targets of homeobox genes is due to the synergy of genetic, epigenetic, and environmental factors—not to genetic predetermination* (p. 293, emphasis added).

Even though scientists are able to detect a gene that is necessary for a given developmental event to occur (i.e., wing production), it is a grievous mistake to think that this is all there is to forming that end-product—i.e., that the causal pathway ends (or begins) there. As Nijhout (1990) correctly pointed out: “The causal pathway is endless and involves not only genetic, but manifold structural, chemical, and physicochemical events, a defect in any of which can derail the normal process” (p. 442). Thus, Hox genes cannot serve as so-called “master genes”—because the Hox genes themselves are controlled by external elements. Nijhout (1990) went on to comment: “In a system in which every component, and past history, all have come together at the right time and in the right proportions, it is difficult to assign control to any one variable, even though one may have a disproportionate effect” (p. 442). Are we to believe that all of these components evolved together at precisely

the same time so that they could signal development of a leg?

So what of the evolutionists’ claim that homeobox genes are “master genes” that can lead to a different species? While a mis-expressed Hox gene can lead to different phenotypic expressions of certain traits, such traits can occur only if the appropriate downstream targets are present at the new site. Akam (1998) noted: “When it comes to the downstream targets of the Hox genes, context is everything, in particular, which other transcription factors are present in the same cell will be a key factor determining the outcome of Hox gene action” (p. R678). That is, Hox genes are reliant on other postcursors (other genes that already are present) including in some cases, other Hox genes.

Mutations and Raw Material— Escape Route, or Dead End?

Hox genes are now the escape route of choice for researchers when they are asked how species evolve into another species. Evolutionary theory holds that mutations in Hox genes produce large-scale changes providing the needed macroevolutionary jumps. For instance, a press release from the University of California, San Diego, said in part:

Biologists at the University of California, San Diego have uncovered the first genetic evidence that explains how large-scale alterations to body plans were accomplished during the early evolution of animals.... The achievement is a landmark in evolutionary biology, not only because it shows how new animal body plans could arise from a simple genetic mutation, but because it effectively answers a major criticism creationists had long leveled against evolution—the absence of a genetic mechanism that could permit animals to introduce radical new body designs (McDonald, 2002).

According to proponents of this ideology, such as physical anthropologist Jeffrey Schwartz, “[n]ew species would need not be the result of gradual changes [microevolution—BM/BT/BH] that accumulate over many generations as suggested by conventional evolutionary theory. Instead, new species could appear suddenly, as they do in fossil records” (as quoted in Spice, 1999). He went on to elaborate about the specifics of how this might occur: “Mutations could spread silently through a population over many generations, until animals suddenly begin producing mutated offspring. That would be the birth of a species” (as quoted in Spice, 1999). Schwartz (1999) further argued: “When particular genes are turned on for certain lengths of time and in certain regions, a worm may emerge. If the same or other genes are expressed for different lengths of time and in different regions, a more complex organism may

develop” (p. 342). And yet, there is no evidence for such a (false!) claim. Worms do not produce lizards or frogs, no matter how many experimental permutations there may be in which Hox genes are involved. While we can use species-X Hox genes to induce variations in positioning in species-Y specific structures, this is still an extremely long way from Xs birthing Ys based on manipulations of the Hox gene. *Scientific American* editor, John Rennie, erroneously concluded:

On the contrary, biology has catalogued many traits produced by point mutations (changes at precise positions in an organism’s DNA)—bacterial resistance to antibiotics, for example. Mutations that arise in the homeobox (*Hox*) family of development-regulating genes in animals can also have complex effects. *Hox* genes direct where legs, wings, antennae and body segments should grow. In fruit flies, for instance, the mutation called *Antennapedia* causes legs to sprout where antennae should grow. These abnormal limbs are not functional, but their existence demonstrates that genetic mistakes can produce complex structures, which natural selection can then test for possible uses (Rennie, 2002, p. 82).

In trying to go from single-celled “primitive” organisms to *Homo sapiens*, evolutionists commonly focus on mutations as the catalyst for transforming one species into another. As George Gaylord Simpson and William Beck noted: “Mutations are the ultimate raw materials for evolution” (Simpson and Beck, 1965, p. 430). Evolutionist Luigi Cavalli-Sforza, head of the international human genome diversity project, remarked in his book, *Genes, Peoples, and Languages*:

Evolution also results from the accumulation of new information. *In the case of a biological mutation, new information is provided by an error of genetic transmission* (i.e., a change in the DNA during its transmission from parent to child). *Genetic mutations are spontaneous, chance changes, which are rarely beneficial, and more often have no effect, or a deleterious one.* Natural selection makes it possible to accept the good ones and eliminate the bad ones (Cavalli-Sforza, 2000, p. 176, emphasis added).

Cavalli-Sforza is correct on one of his points, and incorrect on another. It is true that genetic mutations “more often have no effect.” Neutral mutations, as they are known, are of little use to evolutionists (see Hitching, 1982, pp. 62–63), as such mutations are dependent on still further mutations in order to be fully expressed and “useful” (in an evolutionary sense). But Cavalli-Sforza was *incorrect* when he stated, “new information is provided by an error of genetic transmission.” It most certainly is not! As Sarfati (2002) commented:

The issue is not *new traits*, but new genetic information.

In no known case is antibiotic resistance the result of new information. There are several ways where an information loss can confer resistance. We have pointed out in various ways how new traits, even helpful, adaptive traits, can arise through loss of genetic information (which is to be expected from mutations).

Mutations do *not* result in *new* information! Hayward (1985) correctly noted:

...mutations do not appear to bring progressive changes. Genes seem to be built so as to allow changes to occur within certain narrow limits, and to prevent those limits from being crossed. To oversimplify a little: mutations very easily produce new varieties within a species, and might occasionally produce a new (though similar) species, but—despite enormous efforts by experimenters and breeders—*mutations seem unable to produce entirely new forms of life* (p. 55, emphasis added).

In the end, after mutations have occurred, no macro-evolution has taken place. *None!* Let us not lose sight of the forest for the trees. Producing a four-winged fly, or adding a pair of legs to its head, is a far cry from explaining how plants, animals, and bacteria all descended from a nonliving source. Additionally, we need to keep in mind that the second pair of wings is nonfunctional, and provides more of a hindrance, rather than any benefit.

Hox genes themselves do not produce the information that results in such complex structures as legs, wings, antennae, or body segments (to use Mr. Rennie’s examples). Hox genes do not act in a “biological vacuum.” They rely on many other genes and proteins as valuable pieces of the overall puzzle. For instance, a light switch is great for turning on a light—but only if you have the necessary wires and bulb “downstream” from that switch. Without those, the switch is nothing more than, well, a switch. Keep in mind there is a well-balanced feedback mechanism in place inside every living cell. If more proteins are needed, genes are “turned on” so that those proteins can be produced. When genes mutate, this delicate balance of proteins is affected adversely, causing the production of either too much or too little of these much-needed proteins.

In trying to go from amoeba to fish to reptile to land dwellers, evolutionists clamor about mutations being the catalyst for transforming one species into another. But the question really is: How often do *good* mutations occur? Hermann J. Muller, Nobel laureate in genetics, said: “Accordingly, the great majority of mutations, certainly well over 99%, are harmful in some way, as is to be expected of the effects of accidental occurrences” (Muller, 1950, p. 35). Evolutionist Theodosius Dobzhansky of the Rockefeller University admitted that favorable mutations amount to less than 1% of all mutations that occur (as quoted in David-

heiser, 1969, p. 209). Dobzhansky (1995) even remarked: “Most mutants which arise in any organism are more or less disadvantageous to their possessors...” (p. 105). Twenty-one years later, in addressing the rarity of these “good” mutations, Japanese geneticist, Motoo Kimura, commented: “Considering their great importance in evolution, it is perhaps surprising that well-established cases are so scarce” (Kimura, 1976, p. 260). And twenty-five years after that, Harvard’s eminent taxonomist, Ernst Mayr, remarked that “...the occurrence of new beneficial mutations is rather rare” (Mayr, 2001, p. 98).

We are told that “nature” has “selected” certain beneficial mutations and incorporated them into various organisms, eventually causing those organisms to change from one kind to another. If “mutations are the ultimate raw materials for evolution,” and therefore provide the mechanism for evolution, there are some very serious problems indeed. Considering their rarity and randomness, the good mutations that evolution requires must be rather exceptional. Pierre-Paul Grassé, the pre-eminent French evolutionist, recognized the error to which so many scientists succumb when interpreting mutations, and commented:

Some contemporary biologists, as soon as they observe a mutation, talk about evolution. They are implicitly supporting the following syllogism: mutations are the only evolutionary variations, all living beings undergo mutations, therefore all living things evolve. This logical scheme, is, however, unacceptable: first, because its major premise is neither obvious nor general; second, because its conclusion does not agree with the facts. *No matter how numerous they may be, mutations do not produce any kind of evolution* (Grassé, 1977, p. 103).

However, in order not to rely solely on one evolutionist’s admonitions, we add to Grassé’s voice the voice of the late American evolutionist, Stephen Jay Gould. In a speech, “Is a New and General Theory of Evolution Emerging?,” presented at Hobart College on February 14, 1980, Dr. Gould

went on record as stating: “A mutation doesn’t produce major new raw material. You don’t make a new species by mutating the species.... That’s a common idea people have; that evolution is due to random mutations. A mutation is not the cause of evolutionary change” (as quoted in Sunderland, 1984, p. 106, emp. added). This brings to bear an excellent point concerning mutations and their supposed ability for macroevolution. Macroevolution, by definition, is the “evolution above the species level; the evolution of higher taxa and the production of evolutionary novelties, such as new structures” (Mayr, 2001, p. 287). Yet, according to Gould, mutation does not make new species. Is mutation a process for macroevolution? Again, according to the definition, macroevolution must “produce evolutionary novelties, such as new structures.” However, Gould said that mutations do not make new raw material. Is mutation a process for macroevolution? Not according to Dr. Gould.

In their book, *Acquiring Genomes: A Theory of the*

Origins of Species, evolutionists Lynn Margulis and Dorion Sagan boldly stated: “Many ways to induce mutations are known but none lead to new organisms. Mutation accumulation does not lead to new species or even to new organs or new tissues” (Margulis and Sagan, 2002, p. 11). They went on later to conclude: “New mutations generate variations in members of the same species but the accumulation of mutations has never been shown—in laboratory organisms or in the field—to lead to crossing of the species barrier” (p. 72). Creationist David A. DeWitt, professor at Liberty University, also has emphasized the point that, despite their introduction of mutations, “the fact that scientists can significantly alter the body plan does not prove macro-evolution nor does it



Figure 3. Image of fly with ectopic eye (used with permission).

refute creation. Successful macro-evolution requires the addition of *new* information and *new* genes that produce *new* proteins that are found in *new* organs and systems” (DeWitt, 2002). *These quotes, from both evolutionists and creationists, have emphasized a crucial point: scientists have not produced anything “new” via mutations.* How, then, can evolutionists claim that Hox genes provide the answers to

speciation, when the evidence demonstrates that *new* organisms are not formed? Dewitt (2002) went on to note:

For example, a single mutation that might prevent legs from forming is much different from a mutation that produces legs in the first place. Making a leg would require a large number of different genes present simultaneously. Moreover, where do the wings come from? Just because an organism loses a few legs doesn't convert a shrimp-like creature into a fly. Since crustaceans don't have wings, where does the information come from to make wings in flies? Having the wings themselves is not even enough. Researchers in another study have found that the subcellular location of metabolic enzymes is important for the functional muscle contraction required for flight. Indeed, the metabolic enzymes must be in very close proximity with the cytoskeletal proteins that are involved in muscle contraction. If the enzymes are not in the exact location in which they are needed within the cell, the flies cannot fly. This study bears out the fact that "the presence of active enzymes in the cell is not sufficient for muscle function; colocalization of the enzymes is required." It also "...requires a highly organized cellular system."

The experiments discussed earlier, although rather impressive in what they have accomplished, have not interjected the addition of new information, genes, or organs. The transplanted genes, whether in the shrimp/fly or the mouse/fly experiments, did not introduce new structures. For example, the ectopic eyes that grew in the uncommon tissues of *Drosophila* were the ordinary compound eyes of a fly, as opposed to the deformable lens of vertebrate eyes. The scientists did not introduce anything new; rather, they rearranged and duplicated the pre-existing structures. *The Hox gene is only an instruction provider and a structure-placement gene; the actual formation of the eye was left up to the "2500 genes from Drosophila...required to assemble an eye"* (Gould, 2002, p. 1124; see also Keller, 2000, p. 96, emp. added).

Further, the eyes were, as Gould proclaimed, not even "wired up," and thus were non-functioning organs that apparently were useless to the fly. Keller (2000) questioned the explanation of the experiment involving these "master control genes," and their morphogenesis of the eye, when she commented:

[T]here is a sense in which this claim is obviously contradicted by the very experiment that has been taken to corroborate it. If the mouse counterpart to *eyeless* (Pax-6) were truly a 'master control gene,' ought we not to expect that it would induce the formation of a mouse eye and not a *Drosophila* eye? Might one not interpret the fact that the mouse gene is used by the fly to form its own kind of eye as corroborating a claim of a rather different sort—namely,

that *eyeless* plays a key role in the formation of an eye, the precise nature of which is determined by the context in which the gene finds itself? (p. 97).

Likewise, in the experiments involving limb growth, which worked with either *Antennapedia* or *Ubx*, the same holds true. No new structure was added to the organism. In the case of *Antennapedia*, some rearrangement occurred, while in the case of *Ubx*, there was growth impediment. In the instance of *Antennapedia*, the leg that replaced an antenna was non-functioning and, as such, hardly could be called a "good" mutation. As was the case in the four-winged fly, which did exhibit an additional set of wings, but the wings were of no benefit to the organism. What the scientists formed via mutations were not new and better-equipped organisms, but were organisms encumbered by their misplaced and underdeveloped organs—i.e., laboratory monsters. Are scientists ready to argue that these "unfit" creatures uphold their survival-of-the-fittest theory?

Conservation or Common Designer?

The data obtained thus far clearly have shown that homeobox genes have been found in a variety of specimens, covering many different phyla. However, Morange (2001) cautioned: "We should avoid jumping to conclusions: using the same genes in development does not necessarily indicate the presence of a homology" (p. 99). The similarity of genes and gene development does not require common descent. The late British biologist, Gavin de Beer, remarked: "Characters controlled by identical genes are not necessarily homologous," and conversely, "homologous structures need not be controlled by identical genes" (as quoted in Wells, 2000, p. 73). Both of these statements—which, in the case of an evolutionist, are clearly confessions—obviously restrict the interdependence between genes, structures, and their homology. An example of de Beer's common gene, yet uncommon structural development, is the gene *Distal-less*. This developmental gene is involved in limb formation in the mouse, spiny worm, butterfly, sea urchin, and velvet worm. Each of these creatures is in a different phylum, and each uses the gene to form vastly different structures. In each case, the *Distal-less* gene forms a unique product, with a unique body position, and a unique number of gene expressions—all of which clearly show the separation in the supposed commonality of descent.

Is common ancestry indicated by the fact that both plants and animals contain homeobox genes? Or, could the fact that both possess Hox genes be evidence of a common Designer? The Hox genes are viewed as a remnant from the past. As the earlier definition noted, they are "highly conserved," which means, according to evolutionists, that

Hox genes have been passed down through the phylogeny with little change. Evolutionists allege that a common ancestral descent is proved through the similarity of the genes and physical structures between organisms. Yet, it makes logical sense that these similarities would be present—if life had been designed. Take, for instance, the lung; used by air-breathing organisms, it shows great similarities in many different kinds of creatures. However, this does not demand common descent, but rather shows design intended for survival. Another example is the structures of locomotion, which reveal many similarities, but are complex units that perform the function of transportation. Further, it is logical that if cellular life were designed, many of the same components (i.e., nucleus, ribosomes, DNA, etc.) would be found in all life forms. The idea of the conserved gene has fallen under scrutiny as scientists find differences in homeobox genes of various animals.

Additionally, data suggest that these genes may not be as “highly conserved” as once thought. Galant and Carroll (2002) reported finding a transcriptional repression domain in the carboxy-terminal region of the *Drosophila Ultrabithorax* (Ubx) protein. They found this domain among similar proteins in other insects, but found that it was absent from the Ubx in other arthropods and onychophorans (wormlike carnivorous animals, having characteristics of both arthropods and annelid worms—e.g., the velvet worm). They went on to speculate (Galant and Carroll, 2001):

The differences between DUBx and OUBx could be due either to the aggregate divergence of sequences along the length of the proteins, or to the presence of one or more discrete functional motifs that arose in the insects or were lost in the onychophorans, some time after the separation of their lineages from a common ancestor more than 520 million years (Myr) ago (p. 910).

The lines connecting such groups to the evolutionary tree of life frequently are found crossing over one another as evolutionists continue to try to harmonize the fossil record with these types of genetic data—all the while keeping in mind that they must be able to account for the loss (or addition) of various Hox genes in different animal species.

Conclusion

Paleoanthropologist Jeffery Schwartz once noted:

It is mind-boggling to entertain the possibility that, for all intents and purposes, the difference between a fruit fly and a human might have as much (or even more) to do with turning on and off of *homeobox* genes that both animals share (as quoted in Spice, 1999)

With the single stroke of a pen, Schwartz reduced the image of man down to that of a fruit fly. We agree with at

least the first part of Schwartz’s quote: “It is mind-boggling to entertain” such a possibility, and worse yet—ludicrous. Since 1983, when the homeobox genes were discovered, the scientific world has earnestly sought out their role and function. Numerous experiments continue to be conducted in an effort to manipulate and control the development of a variety of species. Scientists are producing good data in a quest to understand Hox genes. However, it must be stated that it is *not* the scientific data of Hox gene research that are being disputed. What *is* in dispute, though, is the *interpretation*. As in all areas of science, the *motivation* for observations does not affect the validity of correctly gathered data, but most assuredly taints the *explanation*. Despite what the evolutionists are trumpeting, the mutations induced through Hox genes are not introducing *new information*—which is a requirement for macroevolution. As evidenced by their experiments, the mutated creatures are simply deformed, and as Jonathan Wells put it, “In affect, all they’ve produced is a crippled shrimp” (as quoted in Onion, 2002). Evolutionists also have pointed to the similarity of genes and physical structure as “proof” of common ancestry. However, it has been shown that the similarity of Hox genes does not demand similarity in physical structure; neither does similarity in physical structure require similar genes. As geneticists and biologists continue to probe the physiological elements that define life, there is an abiding sense of awe toward the complexity found. From the studies of heredity and genetics, to the discovery of the double-helix structure of DNA, each new breakthrough has proven life’s incredible complexity. Though the Hox gene is a regulatory gene that can direct thousands of other genes, it is still only part of an intricate network. Regulatory genes themselves are directing, being directed by, and interacting with, countless other genes. Simply put, the Hox genes are another example of a design masterpiece.

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Photographic Essay

Lichens at VACRC: Lichen Surfaces under the Electron Microscope (A Van Andel Creation Research Center Report)

by Mark H. Armitage and George F. Howe*

Introduction

Christ told His disciples and a large crowd of other people that God maintains an exact, numerical tally of the hairs on every human head (Luke 12:7). He also asserted that God has each individual sparrow under surveillance (Luke 12:7). The Creator's cognizance, care, and control thus cover all life forms at all times. Far from forgetting His handiwork after the one, novel week of origins, God has perpetuated a continuous, ongoing involvement with all of His creation—animate and inanimate (e.g. Colossians 1:17).

The Creator's concern encompasses plants as well as animals; Christ noted that God governs the glorious colors of wild flowers in the field (Matthew 6:28–32). It would then be no stretch of the Scripture to say that His providence and design extend down to the details of the microscopic anatomy of lichens.

We present a brief commentary on certain aspects of lichen surface structure, facts that fit with the concept that supernatural activity rather than random processes prevailed in the origin of lichens. The Creator's otherwise "*imperceptible power*" (Romans 1:20—Concordant Version) can become readily *perceptible* from the study of His created beings, including lichens.

Materials and Methods

Armitage's scanning electron microphotographs (SEMs) show the upper surface of several lichen species that grow on the Hickey Basalt rocks at the Van Andel Creation Research Center (VACRC), Chino Valley, AZ. Background information about these lichens and about lichens in

general is contained in our previous papers (Howe and Armitage, 2002; 2003). In a subsequent paper we intend to discuss aspects of creation design inside the lichens, as seen in transmission electron microphotographs (TEMs) and brightfield microphotographs of lichen thin sections.

We processed the lichens for scanning electron microscopy by fixation in cold, 2%, buffered glutaraldehyde for 24 hours. Specimens were then post-fixed in osmium tetroxide because this compound helps plant materials to become more conductive and ultimately more visible. Another reason for using osmium tetroxide is that we processed these lichens for SEM work together with the lichens that will be studied in our next paper using TEM—TEM specimens do require osmium tetroxide fixation. We washed the lichens next in a buffer, and subsequently dehydrated them through a graded series of acetone solutions (i.e. 20%, 35%, etc., up to 100% acetone). Next, they were sputter coated with palladium at 30 milliamperes for 2 minutes. These are standard techniques described in Hunter (1993). The lichens were then photographed with an ISI-60 or with a Hitachi S-2400 electron microscope.

Results and Discussion

The Lichen in Cross Section

At the top of their thallus (lichen body), many lichens have a layer that resembles an epidermis of flowering plants, a layer that Fink (1935, pp. 6–7) called a "dermis." The surface of this uppermost lichen layer is visible at various magnifications in our SEMs. The dermis of lichens have been photographed extensively by Hale (1976), who demonstrated that their surface characteristics are constant enough to be of value in their classification and identification—lichen "taxonomy." Figures 2-15 are surface microphotographs (SEMs) of several VACRC lichen species at various magnifications.

Figure 1 is a cross-sectional view of the lichen *Xanthoparmelia* sp. Although lichen internal structure is simple and non-vascular, it bears a striking resemblance to the com-

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plex arrangement of true tissues found in layers within flowering plant leaves. This layered condition of lichens is what leads to their being designated as “stratified” (Brodo et al., 2001, p. 13). In this report, we are discussing the exposed surface of the lichen upper cortex (Figure 1 — “UC”).

The cortex undergoes replacement continually from below because aging cells from the layers beneath are pushed slowly upward (Fink, 1935, p. 7). The outer cortex may thus contain a few algal cells that are being eliminated from the algal layer, but the bulk of the cortex, and of the entire lichen, is fungus tissue.

The cortex serves as a skin to the lichen, preventing excessive evaporation and providing a measure of protection (Brodo et al., 2001, p. 13).

On the outer cortex of various lichen species one can find such diverse features as tiny hairs (composed of fungal hyphae), crystals of lichen acids, and even pores that expedite gas exchange (Moore-Landecker, 1972, p. 380; Jahns, 1973, pp. 174–175.) Each of these surface phenomena has a functional counterpart on the surface (epidermal) layer of flowering plants—leaf hairs, secretory glands with their crystals, and guard-cells that regulate stomate pores. Such parallelisms of form and function between lichens, on the one hand, and tissue-forming plants on the other, support the creation origins model. Convergences like these, each arising by chance from such greatly different forms that are said to have separate evolutionary histories, would be highly unlikely, in terms of naturalistic evolution.

Small bulges visible on the surface at higher magnification (Figures 3, 4, and 7) correspond to the outer surfaces of the many interwoven, fungus filaments that together form the cortex. Concerning this pattern of minor bulges and creases, Hale (1976, p. 9) wrote that they are “. . . for the most part a faithful replica of shape and orientation of underlying hyphae.”

Underneath the outer cortical surface are fungal cells, whose hyphae are cemented together or “conglutinated”, providing rigidity to the thallus. We will write more about these and other internal features of lichens in another paper.

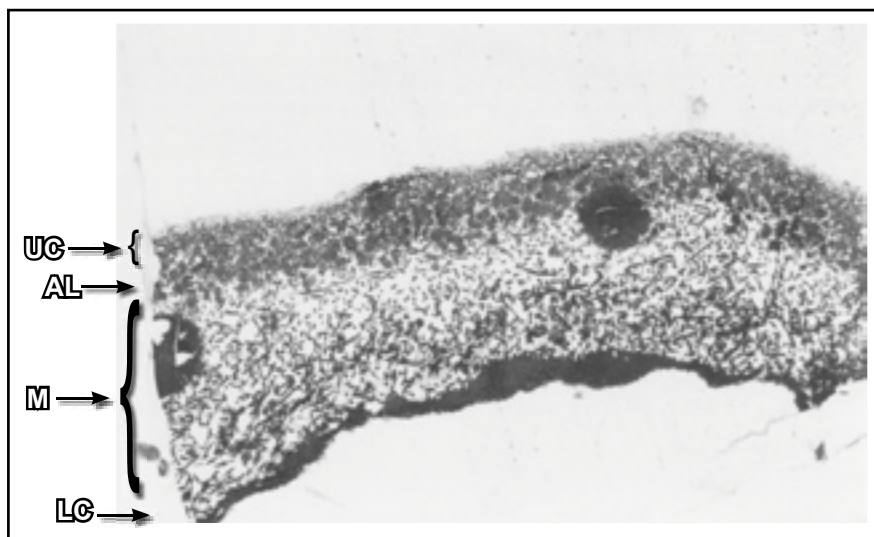


Figure 1. The various “tissues” of the lichen *Xanthoparmelia sp.* are seen here in cross section, using brightfield optics. The symbols are: AL = algal layer, LC = lower cortex, M = medulla, UC = upper cortex. As a foliose or “leaf-like” lichen, *Xanthoparmelia sp.* has a lower cortex. This is an important feature for protection underneath because foliose lichens curve up and away from the rock at many points, exposing their lower surface. The other three lichens we have photographed have the crustose morphology in which the medulla adheres directly to the underlying rock surface. Generally, such crustose lichens have no lower cortex. The absence of a lower cortex in the crustose lichens (where such a lower cortex would be of little or no “value”) is one of those little scientific supports for believing that behind even the lowly lichens there is intelligent design.

Areoles

Deep cracks called “fissures” subdivide various crustose lichen species into several-sided patches known as “areoles” (Brodo et al., 2001, p. 17.) Such cracks between areoles are visible in our photographs of *Pleopsidium chlorophana* (a species that was previously known as *Acarospora chlorophana*)—see Figures 2, 3, 5, and 7. Lichens that possess areoles, like this one, are said to be “areolate.”

The fissures that divide the thallus into areoles also allow gases to circulate into the lichen layers beneath. This fits with the origins hypothesis of a planned creation because photosynthesis, which requires carbon dioxide gas, occurs in the algal cells, deep inside the thallus. By means of photosynthesis, the algae supply the nutrition for the entire lichen.

Lichen fissures may also become important as lines of separation, along which the areole may break away. Loose areoles can then be transported and they may grow independently, forming a new thallus by vegetative reproduction. Hale (1979, p. 9) reported that areoles and all other thallus fragments containing both fungus and alga, can “. . . act as vegetative propagules and when dislodged apparently

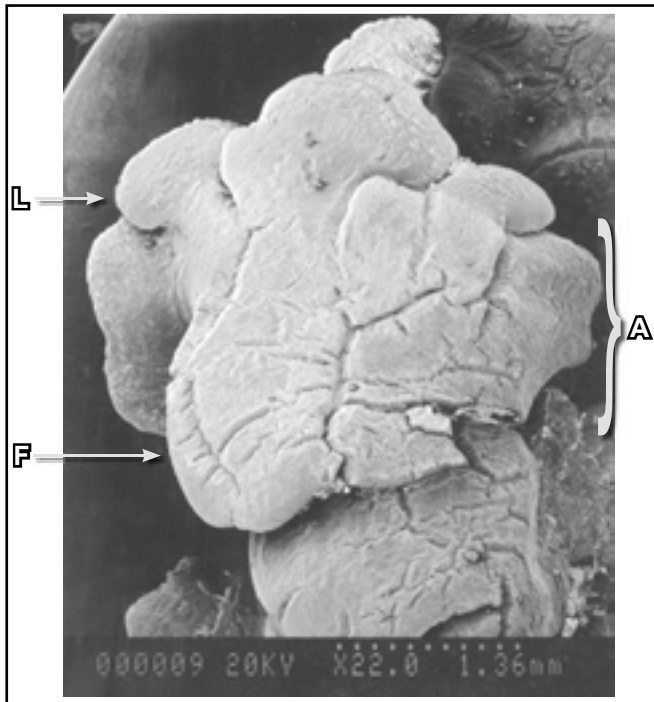


Figure 2. SEM micrograph of fissures, lobules, and areoles on the upper cortex surface of the lichen *Pleopsidium chlorophana*. The surface of this crustose lichen consists of multi-sided, irregularly shaped patches called areoles (A). Each areole is bounded by deep fissures (F) that extend down into the body of the lichen, allowing for interior aeration. A fissure can be seen beyond the arrow tip. The rounded structures at the edge of the thallus are lobules (L). The magnification on Figure 3 is 130 power (“X130”) and the distance between the first and the last of the ten dots is 231 micrometers (“231 μm ”). Similar magnification and micrometer markings are present on most of the figures that follow.

resume growth to form a new thallus.” [A “vegetative propagule” is some portion of the plant that can grow to form a complete new plant without any sexual involvement.] Hale also noted on p. 9, that “. . . lichens are eminently successful colonizers in nature.” We conclude that this highly successful vegetative reproduction in lichens supports their origin by design. To imagine that chance mutations and natural selection produced such results is “wishful thinking.”

Pores: Possibly Two Kinds

On the surface of one *P. chlorophana* lichen, we found and photographed some pores with raised edges (Figures 4 and 5). We also observed larger, sunken cavities—pit-like chambers that extend downward into the thallus (Figure 6). In these large pits it is possible to look directly into the lichen

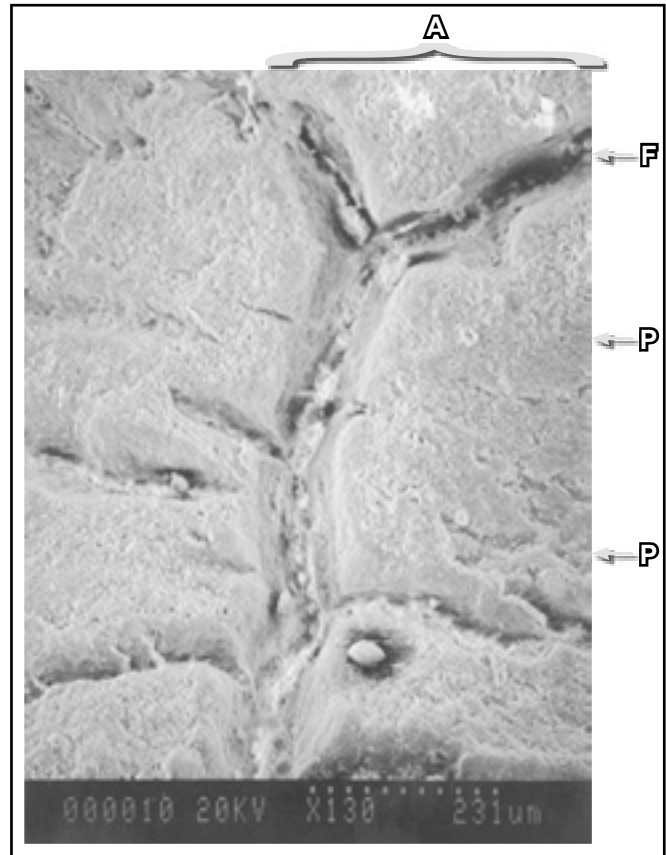


Figure 3. SEM micrograph of lichen fissures, areoles, and pores. This is an enlarged view of the center area of the same *P. chlorophana* specimen photographed in Figure 2. Fissures (F) and areoles (A) can be seen. Also visible are crater-like pores (P) to the left of each arrow. The width of these small pores is about 20 μm . (Magnification 130x)

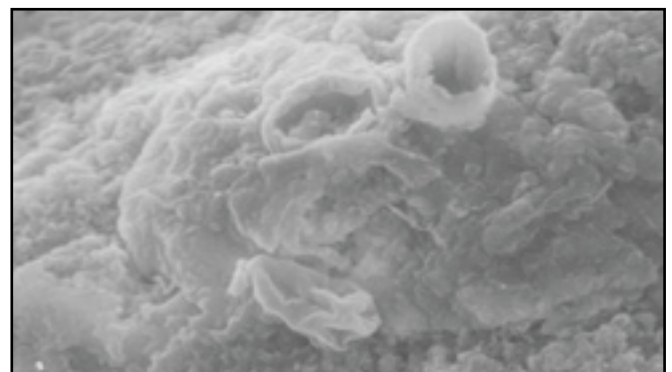


Figure 4. SEM micrograph of small bordered pores. Lip-like edges surround very small pores on the surface of the *P. chlorophana* lichen. At the time Figures 4, 5, and 6 were taken, our camera was not recording size or magnification. We are certain, however, that Figures 4 and 5 are at very high magnification. The pores here probably correspond to the small pores seen in Figure 3.



Figure 5. SEM micrograph of a small crater-like pore with objects visible inside it—*P. chlorophana* lichen, surface view. Note the slightly raised margin. Possible identity of these small bordered pores is discussed in the text. Magnification data not available.

thallus at many loosely-arranged cells that are about the size and shape of algal cells; they have an average diameter of 20 micrometers (μm). Compare the cell-like objects of Figures 6, 8, and 9 with lichen algae from a torn portion of the algal layer of this same lichen—Figure 10. The relationship of the larger cavities to the areoles of *P. chlorophana* is obvious in Figure 7. The opening of the large chamber has a wide diameter and a narrower one (Figure 8) which are respectively 225 μm and 110 μm , making them considerably larger than the pits with borders (Figures 4 and 5).

Lichen Surface Pores and Gas Exchange

Whatever these two types of pores are, they each provide contact between the outside air and the algal layer beneath the cortex. Purvis (2000, p. 18) observed that lichen surfaces

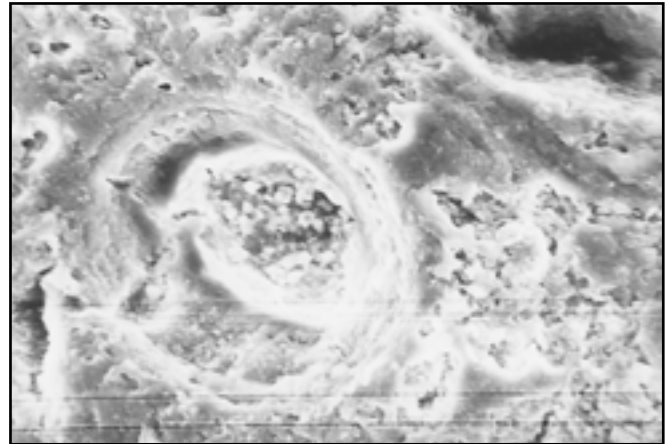


Figure 6. SEM micrograph of a view down into one of the larger pores on upper surface of *P. chlorophana* lichen (magnification data not available). Objects inside have cell-like shapes, perhaps algal cells—see Figure 10.

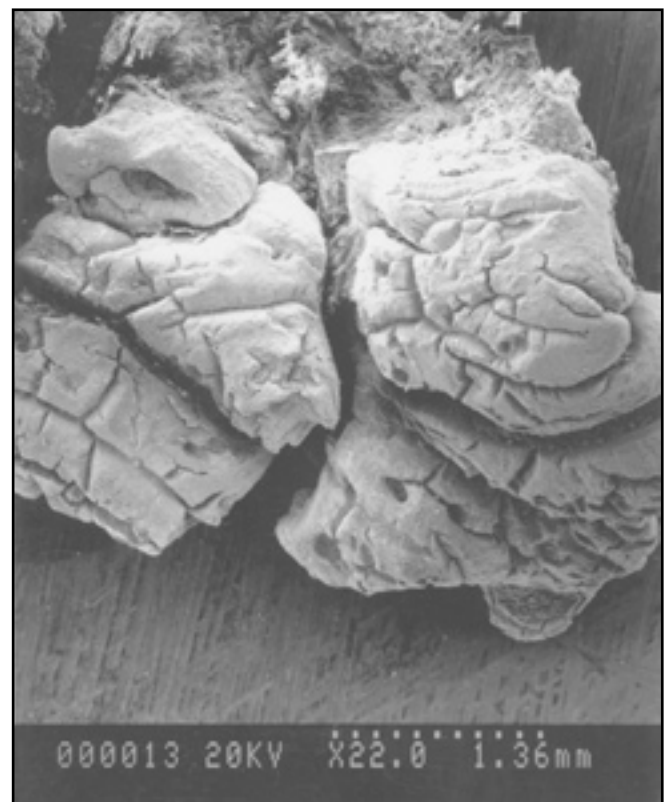


Figure 7. SEM micrograph of pits located among the areoles of another *P. chlorophana* specimen—low magnification. The pits appear as dark, oval-shaped dots. (Magnification 22x)

regularly have pores as well as cracks, “. . .to allow gases to enter and leave the thallus.” Whether it was intended or not, Purvis’ remark implies teleology. If that was his intent, we would agree. Hale (1976, p. 6 and 1973, p. 4) also

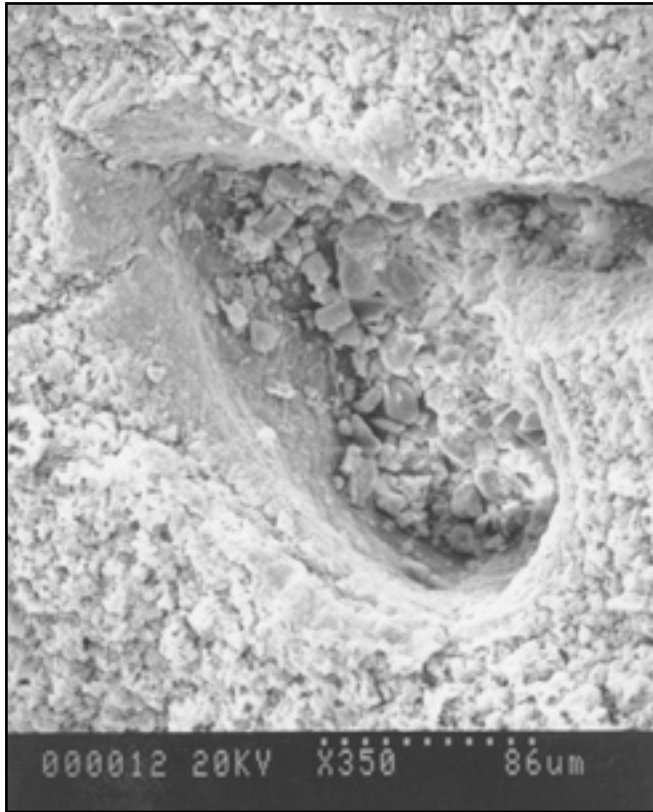


Figure 8. SEM micrograph of one of the crater-like cavities from Figure 7. The contents look like algal cells, as seen in Figure 10. The cells inside have about the same size range as lichen algae cells—from about 25 μm and smaller.

implied purpose when he wrote that lichen pores exist “. . .for gas exchange.” It is difficult not to conclude that there is a high degree of functionality in each aspect of lichen anatomy—mute but perceptible testimony supporting the belief that this is the Creator’s handiwork.

Hale (1976, p. 8) described this gas exchange function by stating that in some lichens the pores provide passage into the deeper layers. Unlike the stomate pores of vascular plants, however, lichen pores are permanently open, although Fink (1935, p. 12) described the pores of one lichen species that “. . .resemble stomates in that they can be closed.” Hale (1973, p. 15) showed pores that are about 25 μm in diameter—about the same width as our small, bordered holes, Figures 3 and 4.

Soredia and Soralia

The lichen literature offers several possible options for the small (bordered) and larger (unbordered) pits. Some of these pores looked like soralia openings, with soredia inside. Soralia (soralium, singular) are the variously shaped apertures in which soredia are borne. Jahns (1973, pp. 46–47)

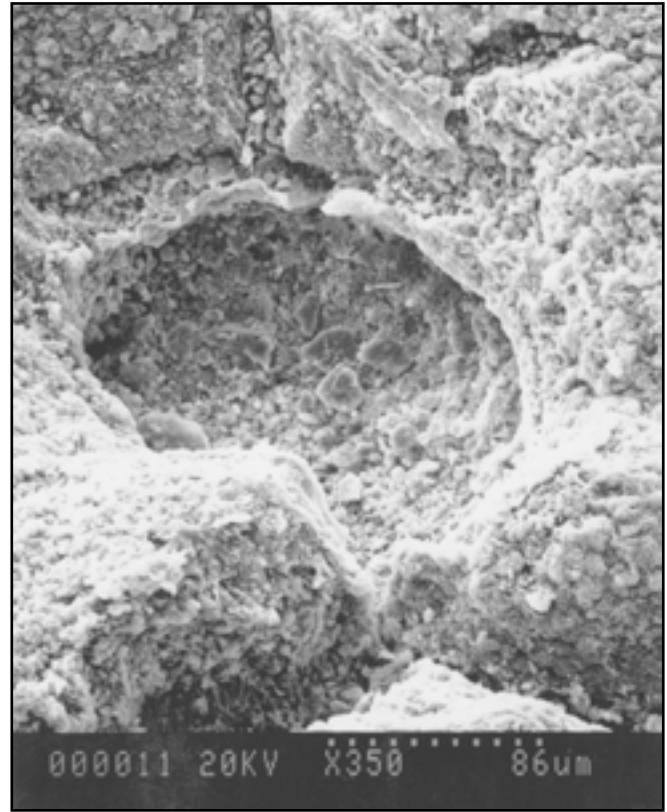


Figure 9. SEM micrograph of one of the sunken pits in the surface of a *P. chlorophana* lichen. Note resemblance between objects inside this pit and algal cells—Figure 10.

lists seven types of soralia, based on shape. Certain lichens have “orbicular” soralia, looking like the larger, cup-like, non-pored cavities on our *P. chlorophana* specimens—Figures 6, 8, and 9.

A soredium is an asexual, reproductive unit that consists of one or more algal cells with some of that lichen’s fungal hyphae loosely clinging to the algae (Webster, 1980, p. 368). They are produced in the medulla and algal layers (Budel and Scheidegger, 1996, p. 62). Growing outward and upward, the mass of soredial mycelium and algal cell(s) roll into a ball-like shape (Bessey, 1971, p. 219). Numerous soredia erupt from within the lichen, spilling forth from openings. In some lichens the soredia are so numerous that they cover the entire surface of the thallus (Hale, 1967, pp. 19–20). The soredia vary in size, most ranging between 20 and 50 μm , which is the size of the small objects in the larger *P. chlorophana* cavities—Figures 6, 8, and 9. In many species, soredia emerge from variously shaped slits or openings, while in others they are produced directly from the surface of the lichen.

Like so many lichen features, soredia cannot be produced by the fungus itself or by the alga grown alone. They

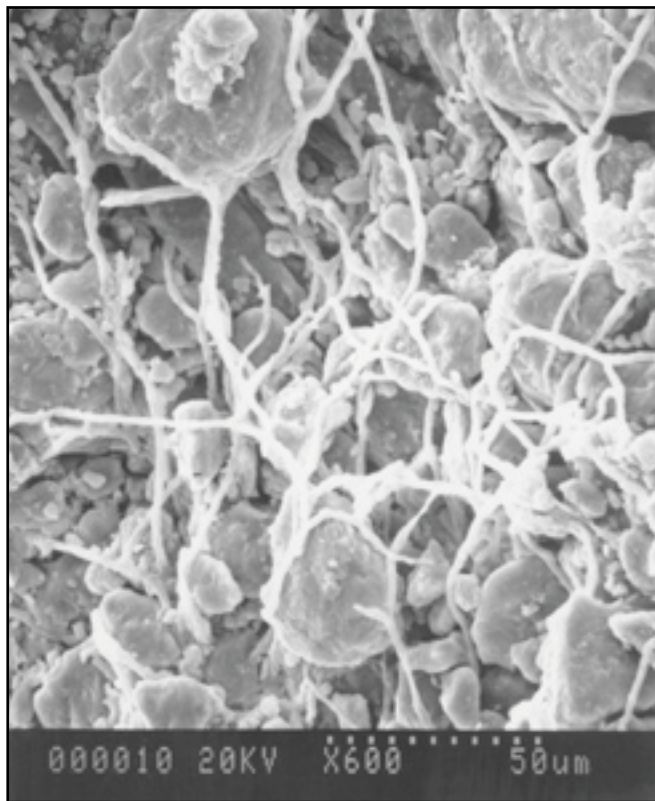


Figure 10. SEM micrograph of the algal layer of a *P. chlorophana* lichen showing fungus filaments attached. At one location in this torn specimen we were able to directly photograph its algal layer. Note the close claspings of algae by fungal filaments. Variation in algal cell diameters is from about 5 μm to over 30 μm . (Magnification 60x)

appear only when the fungus and alga of that lichen grow together (Hale, 1967, p. 18). The genes of the fungus and alga may have been “co-designed” to yield soredia and their surrounding soralia only when the two partners are together in close proximity—another feature that does not find ready explanation in the macroevolutionary origins model.

The soredia are loosened from the soralia and are then “. . . scattered by hygroscopical movements of the cortical tissue” (Budel and Scheidegger, 1996, p. 63). Transport of soredia occurs by wind, water, gravity, and insects (Jahns, 1973, p. 48.) Each soredium is an asexual reproductive body, capable of starting a new thallus (Bessey, 1971, p. 219).

A lichenologist brought information from Budel and Scheidegger (1996) to our attention—information maintaining that *P. chlorophana* individuals have never been observed to produce soredia. In light of this, it seems unlikely that the little algal objects are soredia. On close analysis, the soredia-like objects in our photomicrographs do not appear to have fungal hyphae attached to them, as do the typical soredia. The possibility that this species of lichen may in fact



Figure 11. SEM micrograph of the surface of the reddish, crustose lichen *Calloplaca* sp. We think the bowl-shaped depressions seen at this low magnification are apothecia (AP)—one type of ascocarp). (Magnification 40x)

have soralia with soredia, however, should be examined. Perhaps they have been previously overlooked.

Are The Pores Pycnidia?

The lichenologist who studied our photographs made two suggestions concerning the possible identity of the pit-like cavities on *P. chlorophana*: (1) perhaps they are the openings of pycnidia, or (2) maybe they are the walls and remnants of apothecia. Pycnidia and apothecia are features involved with the sexual reproduction of lichen fungi. Pycnidia are sunken, vase-shaped chambers in which pycniospores are produced—small cells that can grow asexually to produce a new fungus or may serve as male gametes by uniting with a female structure (Ahmadjian, 1967, p. 56. In our 2002 and 2003 papers we regrettably misspelled Ahmadjian’s name). Pycnidia are well illustrated in the lichen literature—see Hale, 1975, p. 9, for example. Perhaps the small, bordered holes seen in Figures 4 and 5 are the openings of pycnidia.

Ascocarps, Apothecia, and Asci?

After the pycniospore and the female cell unite, the resulting bi-nucleate cell divides many times—yielding a spore-producing mass called an ascocarp. An apothecium is a type of ascocarp having a vase- or cup-like shape. The

apothecium has an opening at its top, through which the ascospores emerge. Produced in sacs called asci (ascus, singular), the ascospores are capable of germinating to form a fungus mycelium. We think the broad, bowl-shaped areas seen on the surface of the *Calloplaca sp.* lichen in our Figures 11 and 12 are apothecia of a very open type.

Ascocarps have been discussed and those of *Xanthoparmelia sp.* have been illustrated (Howe and Armitage, 2002, pp. 83 and 86). Ahmadjian's drawings (1967, p. 66) show that ascocarps are generally larger than soralia and they have a different appearance inside. In fact apothecia of the *Xanthoparmelia* lichen are easily visible to the unaided eye. Hale (1979, p. 32) has affirmed that the apothecia of the *P. chlorophana* lichen, seen in our photographs here, are visible as *pores in the areolae*.

If the larger openings in our photographs are apothecia, then one would expect to see asci inside them. As mentioned earlier, the contents appear instead to be algal cells, not asci. But perhaps after ascospore production, the apothecia of *P. chlorophana* become cavities whereby the algae are in direct contact with the atmosphere.

It will require more research to determine if the various orifices on the surface of *P. chlorophana* are the openings of apothecia, pycnidia, or both. We intend to explore these and other options further.

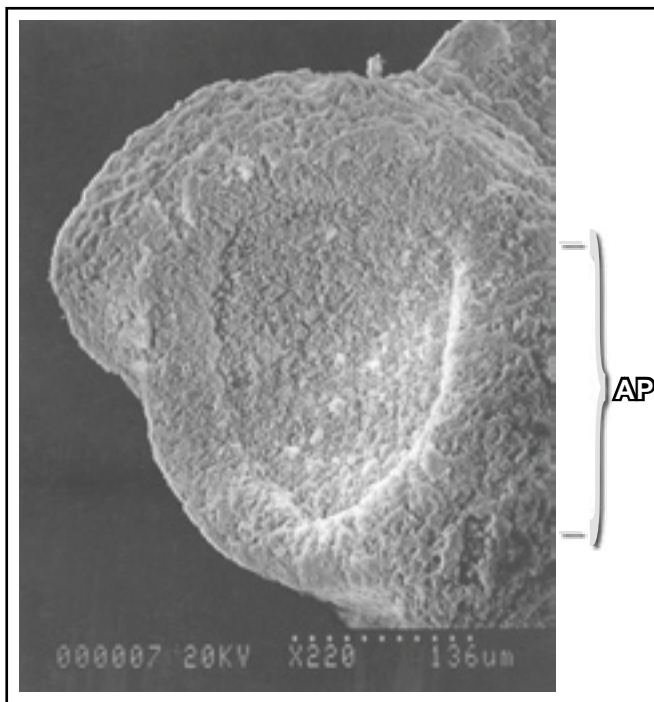


Figure 12. SEM micrograph of the object at the upper right, Figure 11, at higher magnification—possibly an apothecium (AP) in which asci and ascospores are formed. (Magnification 220x)

Lobules

A lobe is a rounded or strap-shaped division of a lichen thallus (Hale 1979, pp. 243–244) and a lobule is a subdivision of a lobe. Lichens that produce numerous marginal lobules are said to be “lobulate.” Lobules have been shown to be regenerative. Hale (1967, p. 22) called them “effective vegetative propagules,” the growth of which is actually stimulated by tearing or wounding. A lobule separated from the parent lichen serves to produce a new plant asexually. The internal structure of a lobule is comparable to that of the main lichen in that lobules possess a cortex, a medulla, etc. The rounded, lobe-like objects at the edge of our *P. chlorophana* specimen (Figure 2) and likewise the lobular projections all over the *Candelilaria* lichen (Figure 13) are lobules.

Isidia

Surface photographs of *Xanthoparmelia sp.* showed outgrowths called isidia (isidium, singular)—see Figures 14 and 15. Hale (1979, p. 39) noted that isidia are common on *Xanthoparmelia sp.*: “There are a number of isidiate *Xanthoparmelias* in the southwestern United States. . .”

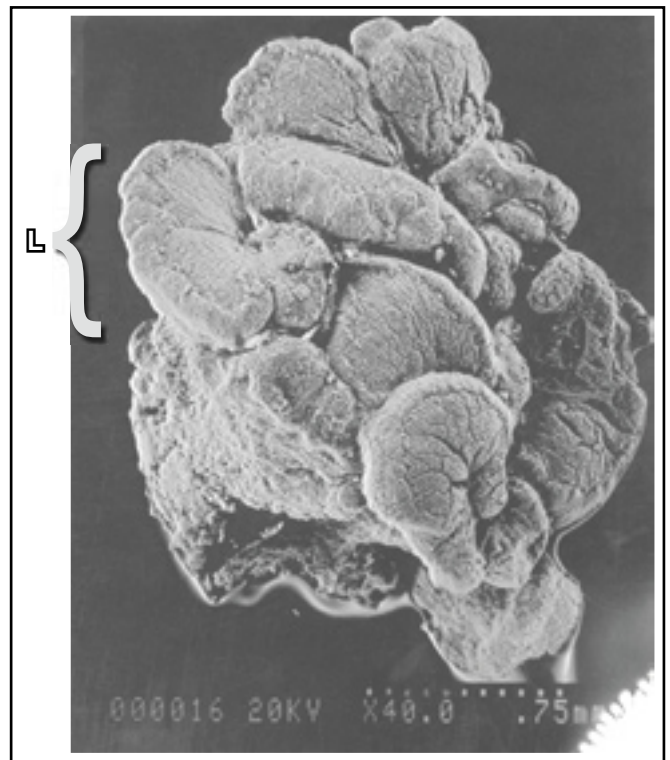


Figure 13. SEM micrograph of lichen lobules (L), clearly evident on the surface of the yellow-orange lichen, *Candelilaria sp.* Each lobule has the structure of a lichen in miniature, capable of yielding a new thallus asexually if it breaks away from the parent plant. (Magnification 40x)

Isidia arise from the surface of the upper cortex, whereas soredia develop from deeper tissues and erupt outwards. Soredia do not have the tissue organization of the parent lichen (cortex, medulla, algal layer, *etc.*) but isidia do, and isidia are therefore said to be “corticate.” The degree of tissue-like organization within isidia varies with different lichen genera.

Isidia can eventually break away from the lichen, leaving a scar on the thallus. An isidium may then regenerate, forming another lichen. Thus, isidia serve primarily as vegetative propagules—and the list of different lichen asexual reproductive structures grows longer!

Isidia can be of different shapes: coralloid, spherical, or columnar. Like those in Budel and Scheidegger (1996, p. 53), the isidia in our photographs (Figures 14 and 15) lie somewhere between being spherical and columnar in shape. Ours are 80 to 120 μm wide and up to 190 μm tall (Figure 15). Published size figures for isidia are between 10 and 300 μm wide and between 50 and 3000 μm tall. The smaller figures here are probably from very immature isidia.

Asexual Reproduction in Lichens

The different asexual reproductive bodies that we have already discussed are distributed by wind, water, and even gravity: areoles, lobules, soredia, isidia, and even picnospores. Speaking of these features and others, Purvis (2000, p. 18) wrote: “There is a wide range of structures and surface features, which help the lichen grow and reproduce.” There is a great potential for asexual reproduction in lichens, which Brodo et al. (2001, p. 30) addressed: “In fact any fragment of lichen containing both the fungal and algal components can, theoretically, form a new lichen. . .”

The list of asexual reproductive bodies produced by lichens includes many others that we are not discussing in this paper: spinules, blastidia, schizidia, *etc.* Brodo et al. (2001, p. 63) listed 20 different reproductive units in all, most of them asexual in character! Hale (1979, p. 9) summed it up: “Soredia, isidia, and thallus fragments can all act as vegetative propagules and when dislodged apparently resume growth to form a new thallus. . .lichens are eminently successful colonizers in nature.” Is such success-

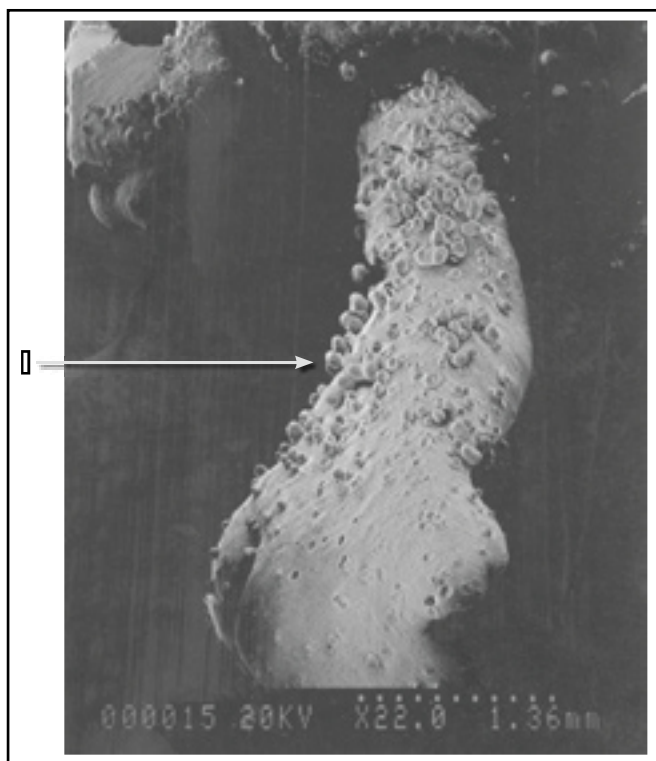


Figure 14. SEM micrograph shown dozens of isidia (I) of various sizes, borne on the surface of the grayish-green lichen, *Xanthoparmelia* sp. Isidia have an internal structure similar to that of the parent plant, so they too are miniature lichens—aseexual reproductive bodies. (Magnification 22x)

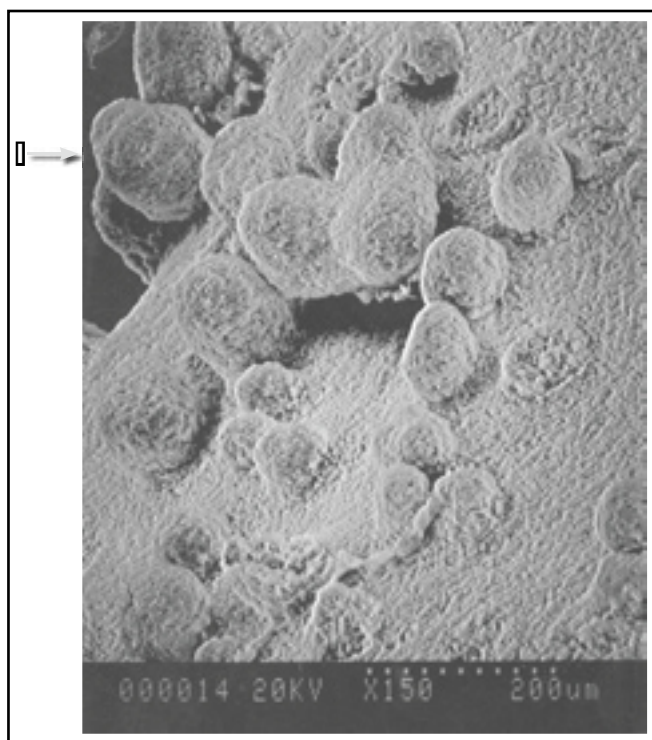


Figure 15. SEM micrograph showing several isidia (I) from the center of Figure 14 at higher magnification. In *Xanthoparmelia* sp., and in many other lichen species, isidia vegetative propagules, which may produce new lichen plants when they become detached. (Magnification 150x)

ful versatility in reproduction indicative of design or chance in lichen origins? We see design.

Which Mode of Lichen Reproduction Is Most Important: Sexual or Asexual?

Quite aside from *how* the many lichen vegetative reproductive bodies came into existence, a different and more scientific question arises: what role does fungus sexual reproduction play in lichen life histories at the present time? Three facts need to be taken into account in answering (Ahmadjian, 2002). (1) There are no known free-living strains of *Trebouxia sp.*, the alga found most commonly in lichen species. But if *Trebouxia* cells are not widely distributed outside of lichens, (2) it does not appear likely that germinating fungus ascospores would stand much of a chance of hooking up with their favorite alga! Actually, (3) the very act of a lichen fungus sporeling joining with a free-living alga to produce a new lichen has never been observed in nature.

Some workers maintain that the *principal* means of lichen dispersal are the asexual options, and others go so far as to say that asexual reproduction is the lichen's *only* reproductive option. But years ago, Ahmadjian (1967, p. 65) wrote that a very puzzling situation would exist if the *asexual* reproductive structures were the only means by which lichens multiply in nature. It would mean that all the ascospores produced by all lichen fungi are without function. Unlikely as such a deduction seemed to him in 1967, Ahmadjian appears recently to have adopted that conclusion. He calls the following idea a *pervasive myth* (2002, p. 1): "... that the most common photobiont of lichens, *Trebouxia*, occurs free-living (outside the lichen) and thus is available to sporelings of mycobionts who use them to reconstitute the lichen." He speaks almost wistfully about the myriads of ascospores, and we sympathize with him: "... the fate of the sporelings is not clear." He further noted that it is "... hard to imagine that there is not a function for so many spores" (Ahmadjian, 2002, p. 2).

Indeed, it would actually amaze both creationists and evolutionists if it turns out that all these fungus spores, released by lichens in such great numbers, play no function in lichen reproduction at all! Evolutionists would face explaining how it is that such "useless" features as pycnidia, ascocarps, asci, and ascospores would have persisted in full-blown form through hundreds of millions of years—time during which these structures would have been a detriment to survival, not an advantage. Creationists likewise would need to explain how it is that truly functionless features would be present in God's little lichens. It will take more work on lichen reproduction in nature to settle this question for both groups.

Origins Speculations

Lichen Literature and Evolution

Technical lichen documents have been useful in our study. In some cases they represent whole lifetimes spent diligently analyzing this little corner of creation. Evolution, on the other hand, has contributed little or nothing to lichenology. In fact, evolutionary ideas often run counter to the data, so that evolution theory becomes a "rationalization after the fact" rather than a predictive, scientific tool. For example, if macroevolution (defined as "common descent") were valid, one would expect to find numerous instances in which lichen species are in various stages of producing new taxa. Such is not the case. We see instead a stasis that fits with the special creation of "kinds," each rich in genetic potential, but possessing fixed boundaries beyond which variation does not occur. If we are asked to believe that evolution is "too slow a process for humans to observe," that would be tantamount to saying that evolution is not part of science.

If evolution were *scientific*, then technical literature would be terribly deficient in the absence of neo-Darwinian discussions. To the contrary, most lichen treatises make little reference to macroevolution, for the lack of which they are none the worse off. Comments about natural selection in these books often amount to little more than a passing nod, here or there. A highly useful monograph on lichens could be written without one reference to evolution.

This shows that the scientifically based macroevolution theory, like scientific creation, is a *philosophy* of origins. Evolution has no special claim to scientific superiority among competing origins models. Evolution ought to be treated in research and teaching as a philosophical construct, which lies outside the domain of science. If macroevolution were a pure science, it would then be able to pass "muster" by showing the usual hallmarks of experimental science—a requirement at which it fails spectacularly.

In their writings, evolution-minded scientists often fail to distinguish between their presuppositional origins beliefs and empirical science; little off-hand comments betray this failure. Here are five examples of flawed logic from the papers of various lichenologists.

(1) "Some desert and Antarctic lichens have adapted to their environments by the formation of thick, compact upper cortical layers. . ." It remains to be proved that these lichens adapted themselves to such extreme conditions. Perhaps they were equipped with those capabilities beforehand, by design. (2) Of another lichen, a worker writes that it "... somehow has adapted to life near large cities and towns." Whether or not this was evolutionary adaptation, as he assumes, is unknown. Maybe this survival capability was a pre-adaptation originally programmed into the genes

of that lichen by the Creator. (3) One evolutionist has said that lichens living where there is not much water “. . . have adapted to this lack of liquid water by being able to absorb water vapor very quickly.” The question of how they got this amazing feature has obviously been “begged.” (4) A more glaring illustration of a logical fallacy called *petitio principii* (begging the question) lurks in the following quotation: “The existence of different kinds of algae and fungi in the symbiosis implies that lichens have arisen on a number of separate occasions during evolution.” The word “implies” is far too strong, because not one lichen has ever been observed to have “arisen” by evolution. To say that we are rather sure lichens have arisen by evolution on *several* occasions is to “beg” the question that needs to be proved. (5) Speaking about fungi, another scientist wrote “Evolution in this group. . . has been extremely diverse, resulting in a wide range of body types, reproductive mechanisms, and associations.” His unsupported assumptions are again obvious, since it has not been shown that evolution had anything to do with producing the wide diversity among fungi.

These will be sufficient to illustrate the underlying tone of illogic found in evolutionary writings and the way these statements really add nothing to the science discussed in the manuscript. All of this would have been quite proper, however, had the writers made it known in their reports that they possess a presuppositional bias for macroevolution, which is an unprovable origins model.

Over-design and Extreme Situations

Lichens show an outstanding tolerance to environmental extremes, a tolerance that far exceeds the demands of their various environments. Lichens are so resistant to low temperatures that some were still able to carry out respiration after being subjected to -183°C for 18 hours (Ahmadjian, 1967, p. 111). At the other extreme, one lichen species was able to respire at temperatures close to 100°C . Concerning their uncanny ability to survive in conditions of low moisture, Ahmadjian had this to say:

Lichens also can withstand dry periods for considerable lengths of time, *far longer than what they normally encounter in their natural habitats*. Even the least resistant lichens can withstand up to sixteen weeks of constant drying either under dry air conditions or over a dehydrating agent such as phosphorus pentoxide. More resistant forms survive for over one year without detectable signs of damage. (Ahmadjian, 1967, p. 111) [Italics are ours]

Such a proclivity of living systems to go “over and beyond” the demands of nature can be called “over-design.” Over-design fits with a belief in creation. Evolution by natural selection of gene mutations could not yield systems that would go beyond the basic prerequisites for mere existence

and survival. It has not even been shown that evolution can yield resistance to moderate periods of drought in various *known* environments. To further ask that it generate the equipment necessary in lichens to endure drought for over a year is unfounded.

The same criticism applies to the belief that evolution was the source for resistance to low temperatures. It is unlikely that ancestors of lichens experienced temperatures as low as -183°C . It cannot be demonstrated that natural selection would be able to develop survival apparatus against such extremely low temperatures, temperatures that probably never even existed in the environment of the evolving organism. Such extreme capabilities on the part of lichens, however, support the kind of fail-safe engineering posited in the creation origins model.

We would be remiss if we did not mention a fascinating event reported by Purvis (2000, p. 18) in which lichens endured a strange and unusual challenge. Their potential for survival in the face of bizarre conditions is highlighted in that certain lichens remained alive and continued to grow after having been gold-sputtered for SEM examination!

To ask that evolution develop one or two means of asexual reproduction taxes one's scientific imagination to the breaking point. To suggest further that evolution somehow yielded 20 different kinds of lichen propagules would be the height of unfounded assumption. But such fail-safe planning, such over-design, fits nicely with the belief that the divine designer carried out origins.

Conclusion

Over-design is the type of engineering that only intelligent designers (like humans or deity) can build into their products. The surface features observable in lichens growing at VACRC, the functions they fulfill, and the versatility in lichen reproductive physiology support the special creation model as the key component in lichen origins.

Acknowledgments

We extol the One who produced lichens, making them in such a way that by simply studying them, one can learn much about His intelligence and provision! We alone are responsible for the contents of this photographic essay, but we gratefully acknowledge the help of the following people in supplying input and/or technical assistance in various ways: an anonymous lichenologist, John Meyer, Peg Westphalen, Emmett Williams, Cindy Blandon, Stephen B. Austin, Jerry Bergman, Lane Lester, Eugene Chaffin, and Kevin Anderson. We also thank those who have contributed to the CRS Research Fund and the VanAndel Creation

Research Center Fund, interest from which has helped to support various phases of this research.

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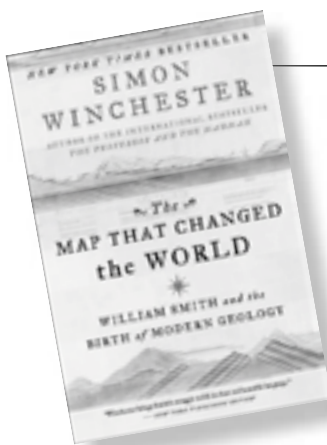
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Book Review

The Map that Changed the World

by Simon Winchester

Harper Collins Publishers, New York, 2001, 330 pages, \$14.00.

This book is a biography of William Smith (1769–1839), the “Father of English Geology.” Smith studied rock strata while

supervising canal construction. He

noticed that similar fossils often were found in particular layers at far different locations, thus discovering the “principle of faunal succession.” With this knowledge Smith constructed geological maps which showed various bedrock strata. One particular geological map, giving the book title, encompassed all of England and Wales. It required thousands of miles of travel while Smith made geological surveys. This map of England and Wales, 6x8 feet in size, took 15 years to complete.

Smith did not have an easy life. He was orphaned at an early age and raised by an uncle. His geology expertise was long ignored because of a lower class heritage. The wife he chose was mentally ill. Poor investments and plagiarism of his maps landed Smith for awhile in a London debtors’ prison. In his final years, Smith’s achievements were finally recognized and he was awarded the 1831 Wollaston Medal.

The book is a disappointment from the creation viewpoint. There is no mention of any interaction between William Smith and Charles Darwin (1809–1882). This is surely an oversight since their lives overlapped by 30 years and they lived in the same vicinity. A more serious problem, author Winchester grossly misunderstands the creation position. He writes, “any intelligent understanding of fossils [assaults] divinity’s most firmly held notions, like the Creation and the Flood” (p. 111). To the contrary, fossils are excellent evidence for the global Flood. Winchester also describes creation as “thousands of years of fettered and blinkered prejudice” (p. 286). William Smith himself was an agnostic.

Smith’s early maps are of historical value in recording *Flood* strata. The paperback book edition contains only a small, poor-quality illustration of his major map. A hard-back edition includes a larger fold out copy of the map. Special thanks to Mart DeYoung for providing the book for review.

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Notes from the Panorama of Science

Geology beyond Plate Tectonics

In the year 1980, I circulated to geologically-minded friends a short polemical article with the title: "Free the crust from mantle serfdom" (Fowler, 1977). It was a splendid catalyst for discussion, because it contrasted the plutonic, mantle heat-driven model of geodynamics with a tectonic, athermal, surface-driven alternative. My interest in this debate was stimulated by the implications for historical geology. The plutonic paradigm locks geologists into timescales measured in millions of years, whereas the active-crust paradigm permits both catastrophism on short timescales as well as actualistic processes over millennia.

The plutonic approach has matured into the contemporary theory of plate tectonics and the athermal alternative is today a minority view championed by Don Anderson of the University of California. An excellent overview (Anderson, 2003) of the contrasting positions is available as a preprint via www.mantleplumes.org. Anderson refers to the active-crust paradigm as the "General Theory of Plate Tectonics" or "Plate Theory" and the conventional plutonic approach is referred to as the "Special Theory of Plate Tectonics." This terminology appears to be chosen to emphasise the common ground shared by advocates of the two theories, but it could be said that this nomenclature understates the differences.

Anderson considers that plate tectonic theory, as practiced by most geologists today, has reached an impasse. Some features of the Earth are well explained by the theory, but there are other major problems in explaining continental deformation, continental breakup, large igneous provinces and island chains. Numerous concepts have been invented by geologists to address these anomalies, and Anderson sees them as adding unnecessary complexities to basic plate tectonic theory. A recurring theme in the paper is that by applying Occam's Razor, these extraneous concepts may be stripped away. Anderson ranks them (notably the mantle plume hypothesis) alongside the concepts of "ether, geocentric, phlogiston, caloric, impetus, permanence and immutability" (Anderson, 2003, p. 4) which are described as having "held back the natural and physical sciences for millennia." (p. 4).

Mantle convection has gripped the imagination of geologists ever since Arthur Holmes included it in his classic textbook: *Principles of Physical Geology* (Holmes, 1944).

The concept of a convection cell goes back to 1900 when Henri Bénard "heated whale oil in a shallow pan and noted a system of hexagonal convection cells." (p. 6) This was analysed mathematically by Lord Rayleigh and the theory was regarded as robust. "Rayleigh-Bénard convection has been taken as the classic example of thermal convection and the hexagonal 'honeycomb' planform has been considered to be typical of convective patterns at the onset of thermal convection." (p. 6).

However, as Anderson has often pointed out in the past, the Earth's plates do not fit the model at all well.

Computer simulations of mantle convection have been unable to reproduce plate tectonics. Furthermore, it is now known that surface tension effects are responsible for the honeycomb structures, and the phenomenon has been renamed. Bénard-Marangoni convection "is organised by the surface tension on top, which serves as a template." (p. 6)

Anderson then draws attention to the work of Ilya Prigogine, who "has shown that open systems, which are far from self-equilibrium, have a tendency to self-organise." (p. 6) This leads to an active-crust scenario, in which other crustal plates drive their own movements (powered by gravity) and where the plates organise flow in the mantle.

Many other important issues are discussed by Anderson, notably whether the mantle is homogeneous (well mixed) or heterogeneous, whether the crustal plates are fixed and rigid, and whether mantle plumes exist:

The first thing to realise about hotspots is that they are not hot. It is important to realise that they are not, strictly speaking, spots either (p. 17).

The conclusion includes this concise overview of the two positions:

The general theory of plate tectonics, discussed here, drops most of the assumptions, adjectives and limitations of the special theory and makes it evident that plate tectonics is a much more powerful concept than generally believed. The general theory is put forward as a topdown, stress and plate controlled, largely tectonic and athermal alternative to the bottoms-up deep thermal plume hypothesis. Lithospheric architecture and stress, not concentrated hot jets, localize volcanism. Melting anomalies are due, in part, to fertility variations. The perceived limitations

of the plate tectonic theory, which are thought to require special mechanisms to drive and break-up the plates and create volcanic chains, are semantic, not real, limitations (p. 19).

Those who challenge the reigning paradigm have to stand aside from “the comfortable path of conventional wisdom” (p. 2). Anderson is very aware that questioning the plutonic approach is revolutionary. “The history of science is replete with examples of scientific revolutions and paradigm shifts. The earth sciences have had their share. Plate tectonics is one, and we are currently living through another” (p. 2).

Is this controversy of interest to Diluvialists? Most certainly it is. Evidences of catastrophism are not hard to find in the geological record, and geologists are more than ever willing to consider catastrophist scenarios. Yet the overall timescale is never rethought, partly because of radiometric dating, and partly because of a “plutonic” mindset. When geology is driven by heat released from the mantle, or by heat from the sun, overall timescales have to be small and whatever catastrophism is recognised punctuates a uniformitarian background. This is not the Diluvialist paradigm.

Tyler (1990) has proposed a tectonically controlled rock cycle as an alternative to the “Rock Cycle” that introduces successive generations of students to Earth science. He argued that tectonic control provides a different mindset for approaching geological data and that it has the potential for harmoniously bringing catastrophism into the portfolio of recognised geological processes. Insofar as the General Theory of Plate Tectonics is a surface-driven, tectonic alternative to plutonism, it provides a useful complementary framework for studying and understanding contemporary geological activity.

Some convergence with Anderson’s approach is shown also by a radical and insightful analysis of volcanism produced by Cañón-Tapia and Walker (2004). They refer to the dominant paradigm of plate tectonics as “trying to force a preconceived explanation of volcanism in the light of only three tectonic settings” (p. 180). The reality is, say these authors, that observations do “not fit the predictions” and that there is a “conceptual gap left between plate tectonics and most (if not all) of the characteristics of volcanic activity at a global scale” (p.163).

Classic plate tectonic theory has three tectonic settings for volcanism, all defined by reference to the Earth’s tectonic plates. These are as follows:

- Rift volcanism (two neighbouring plates move away from each other)
- Subduction volcanism (converging plates lead to one plate descending below the other)

- Hot Spot volcanism (mantle plumes generate activity that may be far from plate margins)

These tectonic settings do have some explanatory power. There is a predominance of volcanism at plate margins and the geochemistry of the magmas can be modelled by reference to the three settings.

Nevertheless, there are significant problems with explaining the global patterns of volcanism from the perspective of plate tectonics theory. Examples include:

- There are a significant number of volcanic centres that do not fit easily into any of the three tectonic settings listed above;
- the occurrence of monogenetic and polygenetic volcanism regardless of tectonic scenario. (Monogenetic volcanism involves magma that has essentially the same composition throughout the sequence of eruptions, whereas polygenetic volcanism involves significant changes in magma composition with time); and
- the distribution of volcanic centres along plate margins tends to be point-like and there are significant gaps in volcanic activity.

Instead of seeing these examples as ‘exceptions’ and ‘anomalies’ to plate tectonic theory that require individualised explanations, Cañón-Tapia and Walker say that “all of these hard-to-explain volcanic features... seem to be the result of common rules controlling volcanism at a global scale; rules that are not included explicitly on the paradigm of plate tectonics” (p. 164).

In order to provide an alternative conceptual model of volcanism, the authors advocate the concept of “Volcanic Systems.” The term is not new, but neither has it been formally defined and treated independently from the framework of plate tectonics. This is the task the authors undertake (in a qualitative way) in their review paper.

A significant shift in thinking has taken place concerning magma chambers. Earlier models of volcanism postulated sizeable pools of magma below volcanoes and ocean ridges—but geophysical research has failed to confirm their existence. The emerging models have “vertically distended mush columns” (p. 166) produced by partial melting.

What can cause the partial melting? There are three ways to melt a rock: heating, decreasing the pressure of hot rocks, and changing the chemical composition. Heating becomes important, for example, when there is an injection of hot basaltic magmas into continental crust, where the rocks can melt to form granitic magmas. Decreasing the pressure is the focus of interest in this review paper. Changing the chemical composition can become important with the injection of water or mineralising fluids.

The rates of volcanic processes are described as oc-

curring “at a much faster rate than that characteristic of tectonic processes” (p. 167). Plate tectonics operates on timescales of thousands and millions of years, whereas volcanic processes are measured in hours, months and years. The authors say that “it is reasonable to assume that the time required to melt mantle rocks will not be much greater than the characteristic times observed for crystal dissolution, or the achievement of textural equilibrium, once the [pressure/temperature] conditions for melting have been reached” (p. 167). Crystal dissolution rates are measured in hours to months, and textural equilibrium is thought to be achieved in just a few years. Over these timescales, inferred plate tectonic motions are almost negligible. “Therefore, there seems to be a contradiction in the fact that a basically stationary mantle ... is directly responsible for processes that occur at much faster rates like melting or volcanic activity on the surface” (p. 167).

The key process linking activity at depth and the surface is rock-fracturing. “The birth of a volcanic system can be defined as the moment when hydraulic fracturing allows a significant amount of magma to be transported out of the source region” (p. 167). The authors note that there are a variety of alternatives to conventional plate tectonic mechanisms, and all of them are compatible with the definition of a volcanic system.

The authors then go on to delineate their “volcanic systems” model and to identify different modes of behaviour over time. In their discussion section, they return to the three features of volcanism that are not readily explained by plate tectonics but which are in their proposed model. They see plate tectonics as the framework within which volcanism takes place, but also that new theoretical work is needed “to fill the gap left between the characteristic time-scales of either phenomena” (p. 180).

The authors conclude: “it is considered that “Volcanic

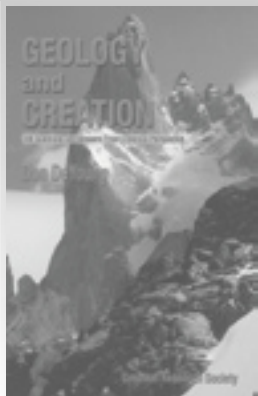
Systems” is the blueprint that should be used to guide future “fresh insights” required to understand in a quantitative sense the global aspects of volcanism, and their relation with plate tectonics” (p. 180). For those of us who are not persuaded to adopt the long timescales of plate tectonics, this is a very positive contribution to knowledge. Our interest in developing an alternative framework of geological activity is one that will find much common ground with the “Volcanic Systems” approach. Catastrophism, of course, extends the range of processes available for interpreting the past, especially when considering features like the Earth’s large igneous provinces.

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Letters to the Editor

Helium Diffusion in Zircons

The excellent research article in the June 2004, *CRSQ*, “Helium Diffusion Age of 6,000 Years Supports Accelerated Nuclear Decay,” stated that Helium diffusivity was measured for zircons relative to vacuum. One assumes this was done to ease the problem of detection and measurement of the tiny amount of He in the very small crystals; but no specific justification was provided for this aspect of the procedure. Gas pressure was a concept not much discussed in the article, just relative concentrations.

My company has engaged in the color enhancement of gem crystals for a number of years, employing irradiation, heat, chemicals, and atmospheres of different character and pressures. Color depends on impurities of certain elements (and other subtle factors) that we are usually attempting to diffuse as far as possible *into* the crystal lattice. In a few cases, one may wish to leach certain elements *out of* the lattice by varying chemical concentrations or reducing pressure in the ambient environment.

We believe that high pressure is helpful for diffusing atoms into crystals, and reduced pressure/vacuum helpful in extracting certain elements. Oxidizing, reducing or neutral atmospheres variously promote diffusion and color formation, depending on the elements and type of crystal. The exact shape of the ramp-up/down heating/cooling cycle may affect the solution or precipitation of mineral impurities in gems, such as titania in sapphire.

Chemical affinity plays a large part in rate and depth of diffusion. Diffusion rates can be tremendously enhanced by the presence of the most unlikely elements, e.g.: the rate of gold diffusion in quartz in the presence of sulfur, although gold neither combines chemically with sulfur, nor wets silica. Thus, the idea of cleaning the zircon crystals before testing would have seemed sound, if a way could have been found to do it without the damage actually experienced.

The case of inert He and highly refractory, pure zircon would seem simple enough. In the instant, however, the U-Pb decay series contains several highly reactive elements, esp. U and Pb. As every assayer knows, Pb has tremendous affinity for any silicates, like zircon. Zircons often contain rather high percentages of U—up to 10%. Such crystals may be quite cloudy from the multitude of fission tracks. The crystals pictured in the article seem transparent. One would guess their U content to be much less than 10%. They also

appear to have the usual solid and gas inclusions, possibly also, liquid inclusions; although, liquids cannot be determined from the published photos. Whether distortion of the crystal lattice by U and Pb makes any significant difference in diffusion rates is something the experimenters should answer, if possible. The authors mention that Pb itself has very low diffusivity up to 313°C. At higher temperatures, one suspects that any Pb would be highly mobile, since lead oxide is a nearly universal solvent. But, the real question is to what extent fission tracks, inclusions, or Pb atoms in the lattice would enhance or inhibit the diffusion of He at the lower temperatures.

The great merit of the RATE experiment is the use of the actual, relevant, natural zircon crystals to determine the He diffusion rates as they may actually have occurred. One hopes it will be possible in the future to see chemical analyses of these crystals, along with comparison of diffusion rates in zircons, natural or synthetic, containing little or no U and Pb, to see how diffusion curves vary with chemical analysis.

One might have considered the whole problem from a different, perhaps conceptually simpler, perspective. The process of diffusion might be likened to the passage of a gas or fluid through a filter of certain porosity and thickness, and/or the process of osmosis through a membrane. In either case, pressure/vacuum applied to one side will greatly influence the rate of flow, and also the final equilibrium condition. Dr. Humphreys, et. al., teach that *because* of chemical and interface potentials the measurement of zircon diffusivities in vacuum is “generous to the uniformitarian model.” They also point out that relative solubilities of He in zircon and biotite enhance outflow. How much more, then, would the outflow be enhanced *vis-à-vis* vacuum, which might be thought of as having “infinite solubility.” In that case, the measurement is slightly less generous to the uniformitarian model than stated.

Could the diffusion process be modeled as though the radiogenic insertion of He created a condition of “high gas pressure” within the crystals, gradually relieved by outward diffusion and escape? Assuming an initial period of rapid U decay, the diffusion rate would have been higher once most of the decay were completed, and would slow as pressure were relieved. What combination of temperature and pres-

sure would be necessary to “reload” the zircons with He? How much He can be forced back into the crystals? Would the diffusion experiment yield the same result the second time around? One would like to gain a greater understanding of the possibilities of moving He in and out of zircon, and the range over which such diffusion/solubilities were reversible by varying temperatures and pressures, and for a range of chemical analyses of Pb and U content.

Rocks at depth are thought of as being under considerable hydrostatic pressure. Would not this pressure slow the rate of diffusion out of the crystals? Or, is it that only the partial pressure of He within and without the crystal is relevant, along the lines of answers given in the article about the concentration of He in the surrounding mica? Could an “internal partial He pressure” be defined as the

equilibrium outside partial He pressure, $\pm$ interface resistance, which would prevent flow? The source condition of these zircons at, e.g., 2,900m, seems a lot different than the vacuum under which they were tested!

Finally, have the authors consulted with Dr. David L. Bergman about the work of Common Sense Science group on the Helicon Model of Elementary Particles? Dr. Bergman was kind enough to forward me a paper on the subject of radioactive decay, which seems to answer the possibility of faster decay at the beginning of creation, without special pleading.

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Humphreys Replies to Drake

I appreciate the thoughtfulness George Drake shows in his comments on our article [Humphreys *et al.*, 2004]. The quick answer to his comments is that experts in diffusion have dealt with all of those topics throughout the last century and have thoroughly discussed them in the literature (and subsidiary references) we cited in the article.

In particular, noble gas diffusion in and from minerals has become a well-developed science over the last few decades, not only because of (U-Th)/He chronometry, but also because of the wide interest in potassium-argon dating. One of the world's foremost experts [his name is in one of our earlier articles] on helium diffusion in minerals performed our experiments, and he is quite aware of the possible pitfalls in such measurements. Most of Mr. Drake's comments have to do with the effects of pressure, so I will deal with them first.

Large differences in gas pressure could play a role in the diffusion rates, if they had existed *in situ*. The solubility numbers we cited [Humphreys *et al.*, 2004, p. 13] suggest that it would require many bars of pressure differential to make a significant difference in the concentration or outflow of helium we observed in the zircons. Yet according to the helium concentration we measured, the partial pressure of helium in our zircons was on the order of 100 microbars, which is insignificant compared to several bars. The relative pressure difference between the zircons and the biotites was even less than that, making that factor even less significant.

Experimenters and theorists developed the techniques for measuring diffusivities in minerals on the assumption of a vacuum outside the mineral [Fechtig and Kalbitzer, 1966; Farley *et al.*, 1999]. So, even though the partial pressure

of helium within the mineral is small, they have already accounted for it.

Hydrostatic pressure due to depth does make some difference in the diffusivities of more compressible materials. For example, increasing the pressure on polycrystalline lead by one kilobar reduces its (self) diffusivity by about 20% [Mrowec, 1980]. However, lead is quite soft, while zircon is a very hard mineral. So it is doubtful that the less than one kilobar of hydrostatic pressure our zircons experienced *in situ* would make a significant difference. That is probably why geoscientists studying helium diffusion in zircons have not put possible pressure effects high on their list of research priorities.

Moving on to other effects, as Mr. Drake points out, chemical affinities related to helium are likely to be almost non-existent. Nevertheless, we examined that possibility in our article [Humphreys *et al.*, 2004, Appendix] and showed that it is indeed irrelevant. But even if there had been significant chemical effects at the zircon surface, then cleaning the crystals would have moved them one step further from the real environment *in situ*. Thus our diffusion measurements are closer to reality than if we had used chemically clean zircons. Detailed chemical, radioisotopic, thermal, and geological analyses of the same zircons, borehole, and formation are available in the literature [Brookins *et al.*, 1977; Zartman, 1979; Kolstad and McGetchin, 1978; Laughlin and Eddy, 1977].

The effect of lead, uranium, impurities, and radiation damage, can indeed affect the low-temperature “defect” part of the diffusivity data, as we pointed out at the top of page 8 in our article, and in more detail in an earlier article we referenced [Humphreys *et al.*, 2003, sections 3 and 4]. As

Mr. Drake says, that is why we studied the same zircons from the same borehole—to eliminate that variable completely. Our own quantitative analysis of radioisotopes, including U and Pb, in these zircons is in an earlier article we referenced [Humphreys et al., 2003, Appendix A, p. 191]

I had not heard of Dr. Bergman's work on nuclear decay acceleration, but I plan to contact him. However, we need a mechanism that could work not only during early Creation Week, but also during the Genesis Flood.

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Lead and Helium Diffusion

The feature on helium diffusion age in the June 2004 issue of *CRSQ* (41:1–16) may be classified as one of the most significant items in creationist literature. Biblical creationists owe special appreciation to each of the individuals who contributed to its publication, and to the research on which it is based.

We should expect knowledge concerning the operation of the physical universe (science) to be compatible with inspired historical testimony (Biblical specifications); although a limitation of available data and misunderstanding of specifications may hinder perception of this compatibility. A helium diffusion age of 6000 $\pm$ 2000 years is remarkably compatible with the approximate 5400 year specification of the Septuagint version of Genesis for time between the present and the geological reformation of the crustal features of planet Earth associated with the Flood. Such compatibility strongly undergirds confidence in all the historical specifications in Genesis (Creation Week, and subsequent extent of time, e.g.).

The helium diffusion age treatment provides “scientific proof,” since it depends entirely on observations and presumed unchanging operation of physical laws (God’s

normal operation of the physical universe). But contrary to the implication of the last sentence on page 10 of the *CRSQ* feature, lead diffusion data does not support the “young helium diffusion age.” Since there would be negligible diffusion of lead in zircon crystals over 6000 years, harmonization of the uranium-lead data with a young age model requires postulation of intervention by God in the creation of the lead/uranium ratios at essentially present values, or in radioisotope decay rates since primordial creation that were orders-of-magnitude greater than presently observed. Either of these presumptions does not provide scientific support for a young age model; they are only a speculative consequence.

If the creation account of Genesis 1:1–2:4a is interpreted strictly according to the definitions of key terms in 1:6–10, rather than according to expanded meanings of those terms that developed after Moses wrote, it is a record of: the initial placement of organic life on planet Earth, the making of the surface of the planet suitable for the support of organic life, and human experience between Creation Week and the migration of Hebrews from Palestine to Egypt. Helium diffusion age of mineral formations associated with the

Flood provide scientific support for the young age modeling required by the 5th and 11th chapters of Genesis.

A detailed treatment of these considerations from a Biblical perspective may be found on Web page www.grisda.org.

Humphreys Replies to Brown

I am very pleased by Dr. Brown's kind words about our article [Humphreys et al. 2004]. Because he is a pioneer in creationist geoscience research, his approval has a special significance to me, as I am sure it does to the other three authors.

I am not sure we made ourselves clear on the implications of the lead diffusion data, so I will try again here. Based on approximate lead retention data from Gentry [1982], we roughly estimated a maximum of 10% for the lead losses from the hottest of our zircons. Using lead diffusivity data provided by Magomedov [1970], the *maximum* lead diffusion age would be roughly 300 Myr. Because that maximum excludes the 1.5 Gyr U-Pb age and includes the 6,000 year helium diffusion age, we were counting it as some support for the latter.

However, Andrew Snelling recently made me aware of new data on lead diffusion in zircons [Cherniak and Watson, 2000] that have blurred our lead diffusion age. The new data give much lower diffusivities for lead in zircon than Magomedov's data. This makes it likely that Magomedov's higher numbers were due to the high radiation damage in his zircons. That is, he may have measured the lead-in-zircon "defect" parameters [Humphreys et al., 2003, section 3; Humphreys et al., 2004, p. 8], not the intrinsic parameters as we had thought. That means we would have to similarly measure the "defect" parameters for lead in our particular zircons in order to properly estimate a lead diffusion age.

This development does not affect our helium diffusion age at all, but it does set aside lead diffusion as a minor sup-

port for our argument until more data comes in. Because lead diffusion is so slow, it would very likely not give as accurate an age as the helium data, so the value of doing lead diffusion measurements on our zircons would not be great.

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FACT Dig Montana July 2004

Otis Kline's Glendive Fossil Camp in Montana was a great success. This is a creationist dinosaur dig opportunity that is open to the public. I was there in early July to direct the excavation of fossils for a wonderful group of Christians. All the time Otis and I have spent crawling over the badlands of the Hell Creek formation dinosaur beds there has really

paid off. Otis had covered all the bases. The meals were excellent. And the shelter he built at the dig site is really a welcome break from the hot weather, and it made a good place to bring in fossils we had collected to study and work on them.

Otis and I had located a dozen dig sites on the FACT

property, and he has found several more lately. This first session included work on a triceratops at the first Otis Kline's Glendive Fossil Camp in Montana was a great success. The initial group uncovered the two brow horns of the triceratops and one almost complete illium, its left hip bone, and parts of the huge creature's skull. With it we found the shoulder blade of a hadrosaur, a duckbilled dinosaur.

As always, we are very interested in how the bones are laying and what else is buried with them, and there was a lot of good news for creationism in that regard. On our T-rex site a few miles away, we found petrified figs, crocodile teeth, water turtles, fish bones, closed clams and a log jam of trees mixed in with 18 broken T-rex teeth. There were also a half dozen velociraptor teeth and numerous fish teeth, but very few leaves. At the triceratops site there were many plants mixed in with the clay layers above and in with the bones. Our Australian geologist, paleontologist and botanist, Mr. John MacKay, amazed us by identifying one beautiful plant specimen after another. It was so interesting that some of the group chose to work exclusively on that material with him.

John confirmed what I had been saying for the last few years, that the Hell Creek formation sediments flowed southeasterly. He uncovered layers of plants well above our layer as well as at least 12 feet below it. In almost every case, the twigs and plants were orientated southeast. He also pointed out that, due to the fact that we found plant material stuck to the surface of the bone, our triceratops' illium (about 3-feet long) was probably from an animal that already become a skeleton rather than being buried alive. We, of course, left that in place.

The first-time diggers were enthralled to see so many figs preserved in the clay along with sequoia cones and needles. These were found with leaves of the willow tree and huge, giant horsetail reeds, which today are about the size of a soda straw, but when the Flood of Noah buried these triceratops bones were three to four inches in diameter. There's more. There was amber in the clay, like over in Wyoming, which signifies that the trees were buried quickly, preserving the sap still oozing from their freshly broken trunks.

The best evidence for those of us who believe in creation is that the trees we found do not grow together—they need very different environments—plus the fact that in most cases the bones of these huge land animals are buried with water creatures and plants from different places, which all strongly suggest a terrific, wide-ranging catastrophe and rapid burial. Not only that, but I can testify that the same phenomenon is typical over several surrounding states.

All in all, the Glendive dig was a great time and great fellowship with great folks. Best of all, God's word was verified by actually seeing evidence for it with one's own eyes and holding it in one's own hands. Plans are already in the works for the 2005 Fossil Camp.

Do not miss this excellent opportunity. Contact Otis Kline now about being part of a group next year at the fact@midrivers.com, or by calling him at 406-377-1141. You can also learn more about it at my website: www.mtblanco.com.

Joe Taylor
Mt. Blanco Fossil Museum

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One of the most spectacular floods in prehistoric times, besides the Genesis Flood, was the great Lake Missoula flood, which left its mark in the Channeled Scabland of the Pacific Northwest in the United States. However, the evidence was the subject of intense controversy for 40 years before being accepted. In this book, Michael Oard discusses not only the abundant evidence, which at the time was considered to be "too biblical," but also the circumstances surrounding the controversy.

A chapter is dedicated to other ice age floods, and evidence of the Genesis Flood is presented, consisting generally of new information from the field of geomorphology. Another chapter is devoted to a defense of the short time scale of Scripture.

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

Submitted manuscripts should have the following organizational format:

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

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

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

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

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

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

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

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

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

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

———. 1971b. *Origin of Eukaryotic Cells*. Yale University Press, New Haven, CT.

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

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

7. Tables. All tables cited in the text should be individually placed in numerical order following the reference section, and not embedded in the text. Each table should have a header statement that serves as a title for that table (see a current issue of the *Quarterly* for specific examples). Use tabs, rather than multiple spaces, in aligning columns within a table. Tables should be composed with 14-point type to

insure proper appearance in the columns of the *CRSQ*.

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

Special Sections

Letters to the Editor:

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

Editor's Forum:

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

Book Reviews:

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

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Creation Research Society

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

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

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

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

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

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

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

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

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