Creation Research Society Quarterly

Haec credimus:

21st

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

Year

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COVER ILLUSTRATION

Layias or tidy tips in the foreground, lichens on the rocks at the Creation Research Society Grand Canyon Experiment Station land, Paulden, Arizona. Photo by John Meyer.

PLACEMENT SERVICE

Do you know of academic vacancies to which Creationists might be directed? The Creation Research Society would like to be in a position to be able to inform Creation scientists of such vacancies. If you know of such positions, will you please inform Dr. John W. Klotz, 5 Seminary Terrace North, St. Louis, Missouri 63105, describing the position and the academic requirements and training required, and giving any other information which might be available?

Graduate students who are interested in placement may write to Dr. Klotz for information about any available positions which are known to the C.R.S.

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INSTRUCTIONS TO AUTHORS

Prospective authors will find instructions for preparing papers on page four of this Quarterly.

DEDICATION TO HENRY MADISON MORRIS

This issue of the *Creation Research Society Quarterly* is dedicated to Dr. Henry M. Morris who was elected a Fellow of the Society in April, 1983. Dr. Morris has served effectively the cause of creationism and, particularly, our Society. He was President of the Society from 1967-1973 and has written numerous technical articles for the Quarterly as well as a chapter in the thermodynamics monograph.

Recently Dr. Morris had to resign from the Board of Directors of the Society to devote more time to the Institute for Creation Research (which he founded) and has been Director since 1970. He was instrumental in the founding of Christian Heritage College where he was Vice President of Academic Affairs from 1970-1978 and President from 1978-1980.

Henry Morris was born October 6, 1918 in Dallas, Texas to Ida (Hunter) and Henry Madison Morris. His mother often typed manuscripts for her son and enjoyed participating in his writing ministry. He married Mary Louise Beach on January 24, 1940 and they have six children; Henry Madison III, Kathleen Louise, John David, Andrew Hunter, Mary Ruth, and Rebecca Jean. Presently the number of grandchildren stands at 12.

Dr. Morris graduated with distinction from Rice University in 1939 with a Bachelor of Science in Civil Engineering. He was awarded Master of Science and Doctor of Philosophy degrees in 1948 and 1950, respectively, from the University of Minnesota. His major was hydraulics and minors were geology and mathematics.

A recognized authority in hydraulics he has authored a textbook, *Applied Hydraulics in Engineering* (1963) and a more comprehensive modern revised edition of the same book with J. M. Wiggert in 1972. Other writings in hydraulics include a research bulletin, *Hydraulics of Energy Dissipation* and, an earlier study, *Hydraulics of Flow in Culverts* with C. L. Larson. Dr. Morris is a Fellow of the American Association for the Advancement of Science and the American Society of Civil Engineers. Memberships in professional societies include American Geophysical Union, Geological Society of America, American Association of Petroleum Geologists, Geochemical Society, and the Society of Economic Paleontologists and Mineralogists. He is a registered professional engineer in Texas.

While serving as Professor of Hydraulic Engineering and Chairman of the Department of Civil Engineering at Virginia Polytechnic Institute (1957-1970) he was quite active professionally and served as Secretary-Editor, Civil Engineering Division, American Society for Engineering Education (1960-1961). He was a member of the Research Awards Committee of the American Society of Civil Engineers (1969-1971) and of the Ad Hoc Accreditation Visitation Committee, Engineers Council for Professional Development (1968-1973).

While at V.P.I., he authored, with John C. Whitcomb, *The Genesis Flood,* probably the book for which he is most well-known. This book is certainly a classic in the field of creationist Flood geology. It has probably been quoted and "cursed" more than any of his

other writings. *The Genesis Flood* is definitely one of the cornerstones of the modern creationist movement. Dr. Morris hoped that future creationist geologists and hydraulic engineers would study and revise many of his concepts. He wanted this treatise to be the nucleating force for many future creationists' scientific studies. In issue after issue of the Quarterly are found many authors referring to this monumental work, either in defense, revision, or expansion of specific points. His dream has been realized.

During his academic life Dr. Morris has directed 12 M.S. and four Ph.D. projects. He was a participant in the 1960 National Science Foundation (NSF) Conference on Fluid Mechanics, 1963 NSF Conference on Water Resources and the 1967 IBM Seminar on Computers' Languages. He was on the NSF Panels for Evaluation of Undergraduate Research in 1965, 1966, and 1976. He has been elected into the following honor societies due to his intellectual and research attainments: Phi Beta Kappa, Sigmi Xi, Tau Beta Pi, and Chi Epsilon.

Not only does Dr. Morris excel in scientific endeavors, he is a student of the Bible. He has been a member of the Gideons since 1942 and acted as President of the Louisiana Gideons from 1954-1956. This organization places Bibles in hotels, hospitals, and doctors' offices and gives testaments to nurses, school children, and servicemen. Henry Morris prepared the "Helps" in Gideon hotel and hospital Bibles as well as the Gideon Scripture Memory Course. Many of his

writings are replete with Scripture references. Books such as *The Bible Has the Answer* (with M. E. Clark) and *Sampling the Psalms* involve Biblical exegesis. But as important as his written works, he has based his life and actions on the Word of God.

Bob Jones University recognized the spiritual and professional achievements of Dr. Morris by awarding him an honorary LL.D. in 1966. His biography and attainments can be found in several Who's Who: —in the World, —in America, —in Science, and —in Engineering and several other prestigious listings.

His professional career has spanned over 40 years as he has worked for the International Boundary and Water Commission El Paso and the St. Anthony Falls Hydraulic Laboratory, University of Minnesota. He has taught at Rice University, University of Southwestern Louisiana, Southern Illinois University, Virginia Polytechnic Institute and Christian Heritage College.

His prolific writings number over 250 books and articles. The author's favorite is *The Twilight of Evolution*, which Dr. Morris claims he wrote with the notes left over from *The Genesis Flood*. In addition he has spoken in 400 churches, 180 colleges, 160 educational gatherings and participated in over 36 creation-evolution debates.

You might think that Dr. Morris has spent his life behind books and lecture podiums, but his interest in people is a strong point in his character. He founded the College Baptist Church in Blacksburg, Virginia where this author accepted the Lord Jesus Christ as his personal Savior. Dr. Morris is willing to counsel individuals when help is needed. Much of his work is aimed at helping people escape the traps of humanism and this has been part of his motivation.

His Sunday School lessons on the Bible and science, later developed into the quarterly, *Science, Scripture and Salvation*, were the most intellectually stimulating lecture series the author ever attended. Because of Dr. Morris' influence, I became a Christian and entered the creation-evolution battle. At his insistance I joined the Creation Research Society. I can testify that Dr. Morris loves and takes time with people.

He is the most well-known and respected creationist of our time. Henry Morris deserves every honor that can be bestowed on him. He has worked tirelessly for the Creator. May God grant Dr. Henry M. Morris many more years of fruitful ministry for the cause.

Emmett L. Williams, Editor

QUOTE

There is no recorded experiment in the history of science that contradicts the second law or its corollaries as stated in this paper. No such statement can be made about the known laws of mechanics.

Hatspoulous, G. N. and E. P. Gyftopoulos. 1970. Deductive quantum thermodynamics in A critical review of thermodynamics, Stuart, E. B., B. Gal-Or, and A. J. Brainard, Editors. Mono Book Corp., Baltimore, p. 78.

EDITORIAL COMMENTS

A regular feature in the Quarterly will be an editor's column to introduce various articles and discuss pertinent issues dealing with the creation model of science. If you have any constructive comments, may I suggest that you submit a letter to the editor. A free flow of technical ideas is essential when dealing with scientific models.

Hopefully this is a well-rounded Quarterly with offerings in physics, biology, geology, as well as philosophical and historical selections. Perhaps you will find many that will interest you. There will no longer be an Annual issue. As an author, I remember that if you did not have your manuscript accepted for the Annual, anything else was second rate. Instead, I will try to present issues throughout the year of approximately the same length and value.

For prospective authors, instructions are given below.

1. Manuscripts shall be typed and double spaced.
2. An original plus two copies shall be submitted to the editor of the Quarterly.
3. All submitted articles will be reviewed by at least two technical referees. The editor may or may not follow the advice of these advisors. Also, the prospective author may defend his position against referee opinion.
4. The editor reserves the right to improve the style of the submitted article. If the revisions of the editor and referees are extensive, the changes will be sent to the author. If the changes are not suitable to the prospective author, he may withdraw his request for publication.
5. Due to the expense involved, manuscripts will not be returned to authors.
6. All references (bibliography) must be presented in the style shown in the Quarterly. If a prospective author is not familiar with the CRS format, the editor will furnish an example reference page.
7. All figures and drawings must be prepared professionally. No sloppy hand drawings or freehand lettering will be accepted. The editor reserves the right to approve submitted figures. Unacceptable illustrations will result in rejection of the manuscript for publication.
8. Any manuscript containing more than 30 pages is discouraged. If a topic cannot be covered to the author's satisfaction in this length of pages, the author *must* divide his material into separate papers that can be serialized in the Quarterly.

Prospective authors, please give careful attention to the proper referencing system in the Quarterly. Note how the author's name is written (last name first). Please write the title of all books and papers.

The Quarterly is a journal of original writings. Only under unusual circumstances will I reprint previously published manuscripts. Never submit an article to two or three journals, including ours, hoping all of them will publish your work. I consider this practice unethical.

This issue is dedicated to Dr. Henry M. Morris, one of the brilliant creationists of our time. His work on the creation model of science is known throughout the world and it is a pleasure to honor him.

A new series of invited papers for the Quarterly begins in this issue. The purpose of these is to acquaint our new members with past CRS literature on particular topics. They will serve as "refresher courses" giving valuable references for serious students. The first invited article is on environmentalism by John Klotz in which he outlines what he considers to be a proper creationist attitude toward nature. Subsequent articles written by Dr. Tom Barnes and Dr. Walter Lammerts will appear in this series.

The front cover is a photograph of some flora found on the land of the CRS Grand Canyon Experiment Station. Dr. George Howe discusses the actual physical site as well as some possible research. He would greatly appreciate your comments and suggestions. What ideas do you have for research? This land was purchased with interest from the Laboratory Project Fund. A report on the Grasslands Experiment Station will appear in the September Quarterly.

Is light capable of moving from distant stars to all parts of the universe in less than 16 years? Dr. Russell Akridge does not think it can and disagrees with the Moon-Spencer model of the universe from which such a prediction comes. The editor welcomes comments on this subject. Will anyone defend the Moon-Spencer model?

Glenn Morton provides strong evidence that the sedimentary strata were deposited as a result of a worldwide catastrophe. He catalogues similarities in strata systems throughout the world. As I mentioned in the dedication, Dr. Morris hoped creationist geologists would continue the work started in *The Genesis Flood*. No scientific model is ever complete due to the nature of science. In his papers that have appeared in the Quarterly, Morton offers suggestions on improving Flood geology.

In this article Morton mentions uniformitarian calculations concerning the evaporation of seawater. Rapid formation of geological features have been discussed in previous issues of the Quarterly and readers may be interested in the pro and con of creationist reasoning.

1. Nevins, Stuart E. 1972. Is the Capitan Limestone a fossil reef? *Creation Research Society Quarterly*, 8:231-248.
2. Wonderly, Daniel E. 1974. Critique of "Is the Capitan Limestone a fossil reef?" by Stuart Nevins. *Creation Research Society Quarterly*, 10:237-241.
3. Nevins, Stuart E. 1974. Reply to critique by Daniel Wonderly. *Creation Research Society Quarterly*, 10:241-244.

Norbert Smith's article deals with an important aspect of the creation model, i.e. the survival of organisms during the Flood. The introductory study sponsored by the Research Committee is replete with interesting details. Dr. Smith presents compelling evidence that there could not have been complete mixing of salt and fresh water if certain types of organisms were to survive.

Some interesting historical, philosophical, and scientific perspectives are presented by Randall Hedtke. His use of supranatural processes when discussing macroevolution are quite germane to the creation-evolution debate. The first time this editor heard that macroevolution required supranatural processes to succeed was from Dr. John Moore. I refer you to one of his articles dealing with the subject.

Moore, John N. 1982. An estimate of the current status of evolutionary thinking. *Creation Research Society Quarterly*, 18:189-197.

It makes interesting reading to compare the Hedtke article with the book review of *Challenge and Response*.

Bill Rusch takes another swing at the Darwin's last hours legend. I must admit that I sympathize with Rusch's position. Good sense would dictate that Darwin would have written of his recanting of evolutionary views if such were true rather than entrusting them to "word-of-mouth."

Finally, may I congratulate Harold Armstrong on his many years of service as editor. His faithful work is appreciated by all readers of the Quarterly. Hopefully, he will have time to contribute more articles to the Quarterly now.

Emmett L. Williams

NEWS ITEM

Dr. John N. Moore, a member of the Board of Directors of the Society, has founded the Origins Educational Service to meet the need of "how to teach" origins without controversy. Dr. Moore employs the two-model approach in discussing and comparing evolution and creation. His experience includes 36 years of teaching at Michigan State University where he developed a course in origins.

Lectures and workshops can be presented to interested groups on methods of teaching origins that will eliminate interference by the American Civil Liberties Union. Dr. Moore recently has authored a book entitled *How To Teach Origins (Without ACLU Interference)*, which will be reviewed in a future Quarterly. For further information, please contact Origins Educational Service, 1158 Marigold Avenue, East Lansing, MI 48823, or call (517) 332-1867.

INVITED PAPER

A CREATIONIST ENVIRONMENTAL ETHIC

JOHN W. KLOTZ*

Received 13 September 1983, revised 17 November 1983

A consistent creationist is an environmentalist. All of nature belongs to God since He is the Creator. Man is a steward of the natural world and he should be a good one. Many instances are cited where man has foolishly upset the balance of nature, not understanding the consequences of his acts.

Introduction

The September 1981 *Audubon Magazine* featured an article entitled "Fundamentals" by Peter Steinhart.[1] The essay was an attack on the Biblical account of creation and creationists. Since the thrust of the *Audubon Magazine* is toward environmental problems, Steinhart made an valiant effort to connect creationism with the exploitation of the environment. He said, "Many fundamentalists believe it is man's duty to develop and exploit nature, citing the Biblical injunction to subdue the earth and have dominion over all living things. Former Interior Secretary James Watt, for example, told the North American Wild Life and Natural Resources Conference 'America's resources were put here for the enjoyment and use of people, now and in the future, and should not be denied to the people by elitist groups'."[2]

Steinhart quoted the author of this article as disagreeing with the alleged creationist position of exploitation of the environment. The November 1981 *Audubon Magazine* carried a letter of mine to the editor in which I stated that Steinhart's 'Essay' does a disservice to the cause of environmentalism. You see, it is *because* of my religious background that I am a conservationist, environmentalist, or Auduboner. My understanding of Scripture and my science agree. Since I believe that God made all things that I see, it belongs to Him and not to me. His command to Adam was to till the garden and *care* for it, Genesis 2:15. God's concern extends to birds and animals, for He provides them with food, Psalm 147:9. Not a sparrow falls to the ground without His knowledge and concern, Matthew 10:29. The eyes of all—plants, animals and man—wait on Him and He gives them their meat in due season, Psalm 145:15, 16. Because I take seriously what He tells me, I must act as a responsible steward of what He has made and what He owns. I cannot exploit nature because it does not belong to me. Most creationists, I am convinced, will agree with my position. Steinhart is wrong in condemning creationism as it opposes evolution from a scientific point of view, and he is as wrong as Lynn White, Jr., was in suggesting that creationists advocate exploitation. Quite the contrary is true, if creationists are really consistent.[3]

Steinhart goes on in his article to state that many Christians who take the Bible at face value hint that the duty of stewardship is only a temporary one; he suggests that because they look for the second coming of our Lord they are motivated in exploitation rather than in conservation. He further states that "perhaps the most important contribution the theory of evolution has made to mankind is the idea that man must take responsibility for life. . . . Evolution tells us that there are limits to the nature we want to manipulate and urges us to form ethical systems aimed at regulating the manipulation. If we are suffering from a crisis of values today, it is largely because we are faced with the need to develop ethics that will fit the biological realities of life. If we do not change those values we are doomed to live, not just the holocaust, but the unspeakable afterwards . . . our environmental policies now rest on evolutionary assumptions . . . the ethic that brings millions to wild life conservationists assumes a kinship between man and animal and a responsibility to the ages . . . to take man out of nature, to draw an end to time, or to call off the biological revolution would be to subvert our ecological outlook."[4]

A Caricature of Creationism

It should be quite clear that Steinhart's discussion is a caricature and misrepresentation of the creationist position. What is needed is not the evolutionary ethic but a return to the environmental ethic of the Scriptures. The problem is not with the Scriptural principles but rather with the problem of their not being followed. It is the evolutionist with his philosophy of survival of the fittest and the struggle for existence which suggests exploitation, not the creationist position.[5]

The world that God created was a good world, Genesis 1:31. The world that He established was perfectly balanced. It was not red in tooth and claw. Only with the coming of sin into the world was there

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suffering and death. Even today the world which God created is basically a good world. For that reason, creationists hesitate to change it with the object of improving it. We ought to recognize that our intelligence is a very limited thing. We must confess with the psalmist, Psalm 73:21, "I was so foolish and ignorant; I was like a beast before you." We ought to recognize that, compared to God, we have at best the intelligence of a chicken. The changes we might make in our environment are about as wise as changes that a chicken might make in its environment. And all too often when we seek to improve, like a chicken, we "lay an egg."

Time after time we have examples of how man in his desire to improve on the natural world has upset the balance of nature. Such was the case when Thomas Austin imported 24 European rabbits into Australia in 1859. The rabbits had no natural enemies and multiplied beyond all expectation. Soon they were eating the grass on which the sheep fed. Attempts to remedy the situation by building a rabbit-proof fence across the continent in Queensland were unsuccessful. A system of bounties was equally unsuccessful because people took advantage of the income that bounties provided. They were careful not to wipe out all the rabbits so that they would have a source of income year after year.[6]

The Aswan dam is another example of man's stupidity. It was assumed that the dam would generate a substantial amount of electricity and add to the gross national product in Egypt. However, there have been a number of effects which have bordered on the catastrophic. The nitrates and phosphates which the Nile River once brought down regularly into the Mediterranean are no longer there. As a result, there has been a marked decline in the Mediterranean sardine take. Another effect has been the rapid spread through the Egyptian population of infestation with parasitic blood flukes whose intermediate hosts are snails. The snails spread through the irrigation canals which have been extended in order to utilize the water which the dam makes available. Also artificial fertilizers must be used now.[7]

Sometimes the balance of nature has been upset accidentally. An example of this was the importation of the gypsy moth into the United States in 1886. It was hoped that by using this moth a native silk industry could be established. The hazards of an exotic organism were recognized and care was taken to prevent the escape of the gypsy moths. However, the moth escaped accidentally and has proved to be a serious pest today.[8]

The state of Florida continues to be involved in an intensive control program to destroy a fist-sized snail which apparently was brought in from Hawaii by a child as a gift for his grandmother. The snail is doing a great deal of damage and is difficult to control because it has no natural enemies.[9]

A weed that can grow almost five meters tall and cause severe rash and blisters in humans is now established in at least 12 counties in the central and western parts of New York state. The Russian "giant hogweed" originally introduced into this country as a curiosity and an ornamental plant, is propagating in the wild, where it poses a health hazard. It causes a painful skin reaction which results from contact with the plant in the presence of moisture and exposure to sunlight. The skin irritation occurs within 24 to 48 hours after contact with the plant and is followed by swelling and blistering. The plant is perennial, native to the mountainous Caucasus region between the Black and Caspian Seas.[10]

God the Creator-Owner

Creationists believe that God is the creator of all things and therefore He is the owner of all. It is not only in the Book of Genesis that we learn this, but this claim is made throughout Scripture as, for example, in Psalm 24:1. It is an axiom that I own what I have made. If I have made something and someone else appropriates it he is guilty of stealing, and I have recourse to the law to get it back and to punish him. According to the Bible, God is the creator. Everything in the universe belongs to Him. We have no claim on it at all.

The picture that Scripture draws of our relationship to the environment and to everything in the universe is that of a steward. We are to care for the world that God created, Genesis 2:15. We cannot make any claims for ourselves. It is God's, and He will hold us responsible if we exploit what really does not belong to us.

Moreover, we have a responsibility of stewardship for future generations. We certainly can use the resources that God has given us; that is clear from the Scriptures. However, they are not to be abused, not to be permanently diminished and not to be exploited.

In this connection it is interesting to examine the Jewish property laws so far as they applied to land. There was no such thing as private real property among the Jews. The property was owned by the tribe who held it in trust for the Lord Himself from whom the tribe had received it. The only private property was held by Caleb as a reward for his faithfulness at the beginning of the Exodus, Joshua 14:6-15.

Accordingly, under the theocracy no property could be sold, Leviticus 25:23. At most it could be leased until the time of jubilee and then it returned to the family who was custodian and steward of that particular part of the tribal inheritance, Leviticus 25:28.

Whether there should be private ownership of land is a political question and a moot question so far as the question of stewardship is concerned. In the western world we have opted for private ownership and are no worse off as far as soil erosion is concerned than societies which have placed ownership of the land in the same category as ownership of other elements of "the commons," air and water. The idea of private property is not the logical consequent of Christianity as Robbins claims.[11]

The Tragedy of the Commons

One of the concepts that has been developed to make clear what is involved in the exploitation of air, water, and soil is the concept of the tragedy of the commons. According to Hardin who developed this concept, the air, the water, and the soil which must be used by all of us is like the medieval European commons. In Europe people lived in walled villages

for protection. Their land, however, was outside the village wall, and they traveled to their land each day to care for the growing crops. Sometimes the land was at a distance from the individual's home. It was too far to drive his cattle each day, so provision was made either in the village or just outside of it for a commons on which all citizens of the village could graze their animals. So long as the number of cattle was limited, there was no problem because the commons regenerated. However, it was very easy for an individual to reason that if he sneaked onto the commons an extra sheep or an extra cow he would have all the profit from the animal whereas the damage to the commons would be shared by all members of the community.[12]

This is certainly a helpful picture in understanding the problems that arise when we exploit the air, the water, and the soil. The exploiter often profits at the expense of the entire community. What is most significant is that from the creationist standpoint he is violating God's directive to care for what He has given us.

It is also interesting to note that God cares for all, not just for man, Psalm 145:15ff. Specifically He cares for the birds, Deut. 22:6f. The Psalmist tells us that He cares for both man and beast, Psalm 36:6. In Exodus 23:11 we are told that the fields were to be permitted to lie fallow every seven years to provide food not only for the poor but also for the wild animals. In the New Testament our Savior tells us that not a sparrow falls to the ground without God's permission. It is clear that our God has a concern not only for man but for all creatures.

The Fall Into Sin

Today we suffer from two problems, both of which are the result of the fall into sin. First of all man tends to exploit. He takes advantage of the commons. He utilizes what God has created for all people for his own personal benefit. We are all selfish and exploiters at heart, and it does not do to point a finger at others. To quote Pogo, "We have met the enemy and he is us."

But we also face a problem because of the limitations of our minds. We do not have the wisdom that God has, and some of our environmental problems are due, not to selfishness, but to man's lack of wisdom. Sometimes we simply do not know how to use well the gifts that God has given us. Such was the case with DDT. Here was a discovery which God permitted us to make that had tremendous potential for good. It was an effective insecticide and might well have been used to reduce substantially the number of deaths on a world-wide scale from malaria, the disease which has been the major killer in historical times.

To use it against the mosquitos which spread malaria would have required selective application of the insecticide. But DDT was a new toy. It was effective not only against mosquitos but against other insects. Some of these insects, it is true, created problems which warranted careful control. Others were chiefly nuisances. However, this new tool made it possible for us to attack a wide-range of insects, and we used DDT indiscriminately.[13]

For example, large quantities of DDT were used in a vain attempt to wipe out the beetle that transmitted the Dutch elm disease. The problem was due to the introduction of the pest insect accidentally. However, as a result of our efforts large quantities of DDT reached the soil and eventually were found in the tissues of most organisms, including man. Moreover, DDT attacked not only the harmful insects but insects that were useful, such as honeybees, as well.

Man simply did not have the intelligence to use wisely this gift which God permitted him to discover.

Needed — A Return to the Biblical Ethic

A return to the Biblical ethic and to an acceptance of Biblical principles is needed. We must recognize and practice stewardship. God is the Creator and Owner; because it is His gift to us we have no claim on what He has placed in the environment for us. He does not forbid our use of it; He has put it there for our benefit and enjoyment. However, we are not to exploit it selfishly but we are to care for it so that we can pass it on to future generations.

We also need to recognize our limitations. We need to realize that man is likely at best to muddle through many of the environmental problems. Men and women of the 20th century are an arrogant lot. We look down our noses at the people of past generations. We do indeed stand tall, but we stand tall only because we stand on the shoulders of those who have gone before us. Moreover, many of them enjoyed the same amenities that we enjoy. We are surprised by the monuments of the ancient world, by the pyramids of Egypt, by Stonehenge and by the Mayan temples in Guatemala and the Yucatan. We simply find it impossible to believe that ignorant savages could have built these. Yet many of these represent engineering feats which we could not achieve today. We need to be more humble when we seek to evaluate the past. Our attempts to improve on God's creation may well end in disaster, for we are not more intelligent than those who have gone before us.

The consistent creationist is an environmentalist because he recognizes God as his Creator and the Creator of everything. He realizes, too, that he is but a steward with stewardship responsibilities. It is the consistent evolutionist who destroys in the name of survival of the fittest. The creationist seeks to preserve the good world over which God has made him steward.

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4. Steinhart, *Op. Cit.*, p. 14.
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11. Robbins, John W., 1972. Ecology: the abolition of man *Creation Research Society Quarterly* 8:280-287.
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13. Klotz, 1971. *Op. cit.*, pp. 141-148.

A TRIP TO THE GRAND CANYON EXPERIMENT STATION

GEORGE F. HOWE*

Received 9 September 1983, revised 12 January 1984

An exploratory investigation of the Creation Research Society Grand Canyon Experiment Station and surrounding area is discussed. Possible future projects are offered and a catalogue of some local plants and animals is given.

Introduction

Dr. John Meyer and I began a trip May 10, 1983 to explore the research potential at the Grand Canyon Experiment Station (GCES). Our goal was to attend to the land survey and study the site and surrounding area for future work. We had undertaken similar ventures in the past and some of them have led to the production of research papers.[1]

Leaving the Santa Clarita Valley of California, we crossed the Mohave desert from Palmdale to Needles. Against a backdrop of dark, hilly lava beds dotted with glistening teddybear cacti and ungainly Joshua trees we discussed possible research that could be done at GCES.

Research Potential

We encourage readers to comment on the appropriateness, feasibility, or creationist perspectives for any of these proposals and to suggest alternative ideas that are not listed.

1. Lichens Growth. Like Rutherford Platt, many botanists assume that these little mutualistic tapestries of fungus and algae grow so slowly (only a few millimeters per year) that some of the larger lichen masses must be very old.

> Growth rate is erratic, and any estimate of the age of a lichen is guesswork. The plants have no annual increment of growth, they are seemingly independent of the passage of seasons, they live in their own time dimension. It may take fifty years for a flat lichen to grow an inch across. . . . The timelessness of lichens is revealed in their luxuriance on granite where the face of the stone has been undisturbed by other plants or by man for centuries, as in the Arctic or on mountaintops.[2]

The lava outcrops on our acreage are splashed with lichens of green, orange, and other colors (front cover). Experiments on lichen growth could be easily initiated by cleaning rock areas and observing the rate at which the lichens are restored.

2. Analyze the Growth of Juniper. Even though there are no junipers on the site, there are scattered junipers thriving on a ridge a few yards to the east and others about one-half mile west (see Figure 1). Some questions readily presented about the junipers could be investigated. What factors govern their growth here and elsewhere in Arizona? Could their distribution offer an explanation of the dispersal of life after the Flood? Some southwestern farmers destroy juniper forests to foster pasture development. Is this a wise practice? If so, how can the growth of juniper best be suppressed? Did farmers of the past destroy juniper to develop pasture?

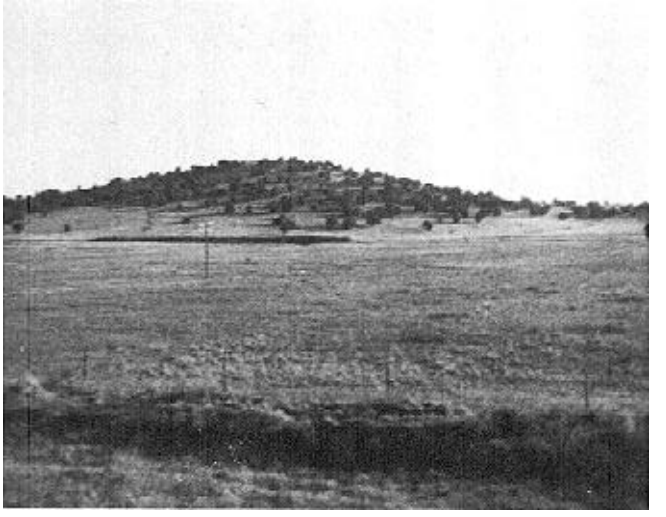

Figure 1. Tall shadows are cast by junipers in the evening sunlight, looking southwest from Highway 89 near the GCES.

3. Search for New Crops. American agriculture is based precariously on the production of a few main plant and animal cash crops. This practice leads to unexpected overproduction with attendant economic catastrophe for numerous growers. Do we as creationists believe that the Creator has placed valuable materials in many other plants? Could we help broaden the farming base by introducing alternative crops geared to the agriculture of the southwest?

The jojoba bean, a source of a very useful oil, and the winged bean *(Psophocarpus tetragonolobus),* a plant that is almost totally edible, are two possible desert crops. While these two may not survive the rigors of the 4400 foot climate at the station, others may be developed.

As a new crop is developed, so must a market arise simultaneously. This challenging proposal involves several facets. There are massive federal agencies grappling with the same issue but perhaps we as creationists have a David's stone that others might neglect—a well-founded belief that the Creator has produced many plants and animals for man's direct use and benefit. It may be that this search would be outside the generally acknowledged objectives of CRS.

4. Limits of Plant "Kinds." Through experiments in hybridization, determine limits of plant "kinds."

*George F. Howe, Ph.D., is Chairman of CRS Research Committee and Director of The Grand Canyon Experiment Station. His address is 24635 Apple Street, Newhall, CA 91321.

How far will crosses between similar species occur and show fertility for offspring? Chino Valley offers the land, water and a milder climate necessary to investigate this. There is a significantly longer growing season here than in the vicinity of Flagstaff, Arizona.

5. Catalogue Chromosome Data. For species in certain key Arizona genera we could perform our own chromosome counts. A CRS worker might easily undertake the collection and "fixing" of flowers. This "fixing" is a rapid chemical killing of tissue in such manner that cells and tissues are prevented from undergoing major structural changes. He could assimilate existing data on chromosomal counts as well, and begin orienting them in creation perspective to determine real boundaries of Genesis "kinds." Dr. John N. Moore started this work several years ago.[3]

6. Restore Native Grass Cover. Vegetation maps of Arizona show that these 2.5 CRS acres originally supported native shortgrass prairies. Small quadrats within our station, now covered by weeds, could be restored to native grassland. This could be coupled with a study of climatic trends that developed after the Flood to establish the original grassland cover.

7. Studies Using the Surrounding Areas. The GCES may become a base of study for the many sites of scientific interest within a 200 mile radius of Chino Valley. The south rim of the Grand Canyon is 110 miles from the site. Appendix A contains a partial list of some other important areas accessible in a few hours from the GCES. Once the lab has been erected and a researcher secured, creation studies can be undertaken at these outstanding natural landmarks.

John Meyer suggested, for example, that GCES could be used as a base for field experiments involving breeding studies and evaluation of genetic relationships between Kaibab and Albert squirrels, using the isolated ponderosa pine forests a few dozen miles to the west as "natural-cages." In other studies the many facets of plant and animal distribution brought about by the Grand Canyon and the Colorado River in northern and western Arizona could be investigated.

8. Reinvestigate Hakatai Shales for Pollen Content. In 1966 Clifford Burdick[4] reported finding fossil angiosperm and gymnosperm pollen in Precambrian Hakatai Shale strata at the Grand Canyon. Recently, using a slightly different technique than Burdick's, Arthur Chadwick reported his failure to replicate Burdick's results.[5] Perhaps CRS should study pollen grains present in Hakatai and other strata.

Figure 2. The Sonoran desert is seen here in late bloom, on a side trip near Alamo Rd. which leads southeastward away from Interstate 40 near Yucca, Arizona. In the foreground at the far left globemallow is seen with brittle bush at the center. Yucca stands in the far right background and creosote bush in center background. GCES is close to several fine desert regions that research in these unique ecosystems could be undertaken.

Trip Observations

From Yucca, Arizona we left I-40 to go southwest by way of Alamo Road which was level but dusty. We had an undisturbed view of the Sonoran desert in late bloom (Figure 2) and groves of sahuaro cacti that carpeted the nearby hills and buttes. We counted at least 30 turkey vultures hovering on rising air columns while following this bypath. These lofty fliers manifest red heads and white rear wing surfaces as they serenely search for carrion. John tallied more than 15 lark buntings which are flashy black birds. They unfurl white wing bars, like the mocking-bird, when they dart from shrub to shrub.

As we continued southwestward on route 93 we passed through broad canyons with high qualitv sahuaro scenery. But the plant which is by far most prevalent throughout the entire southwest, from the hills near Palmdale to El Paso (and even farther east) is the creosote bush. This short, spreading shrub has small, sticky, two-forked leaves. Its yellow flowers appear in April or May (Figure 3) and its fuzzy fruits resemble spiders (Figure 4).

Figure 3. Flower center and two-parted leaves of the creosote bush. These shrubs cover vast sections of the southwestern United States.

Turning northward on route 97 toward Bagdad, Arizona we learned that Bagdad is the site of a large copper mining pit. We were unable to explore that as the road to the pit was closed to the public. Near Bagdad we chose a side road which twisted and turned

Figure 4. The fuzzy fruits and two-pronged tiny leaves of creosote bush. This plant contains an anti-oxidant which some workers feel could be developed as a cancer treatment.

upward through dense stands of tough scrub oak and small sugar bush trees similar to Southern California chaparral territory. One high valley was dotted with junipers and pinyon pine trees alternating with steep pastures where herds of long-horned cattle grazed. Dazzling white blossoms of blazing star, rusty stalks of dried curled dock, and the bright yellow blooms of goldenbush lined the edge of this lonely one-lane mountain thoroughfare.

From Bagdad we followed route 96 downward until we crossed the Santa Maria River, through Kirkland, Arizona until we entered the Prescott National Forest. There we encountered scrub oak chaparral with juniper and finally ponderosa pine were observed at higher altitudes.

Prescott

At the corner of Iron Springs Road and Skyline, we stopped in a fragrant yellow pine forest to watch birds and identify plants (Figure 5). John saw chipping sparrows and western bluebirds and I was able to locate three different species of oak growing together; emory, Arizona white, and scrub. Although the first two have oblong, leathery leaves, they can be distinguished as the former has olive drab foliage with smooth undersurfaces while the leaves of the latter have an overall bluish color with tiny, starlike, brown hairs on the lower surfaces. The Arizona white oak is not one of the true white oaks. It is a "live" oak. But one real white oak, gambel oak, is found in the Prescott area. Continuing into Prescott we saw shrubs as mountain mahogany, mountain lilac and manzanita in a type of mixed chaparral, a pine and juniper community (Figure 6).

We contacted the Forest Supervisor Office of the Prescott National Forest (See Appendix B for the address of establishments in Prescott). From a display in the office we learned there are 14,000 cattle and

Figure 5. A forest of ponderosa or "yellow" pine stands near the corner of Iron Springs Road and Skyline. Some of these pine forests could serve as natural "cages" for the study of tassel eared squirrels. Three different species of oak also thrive in this region, west of Prescott.

Figure 6. Traveling further east toward Prescott, one finds a patchwork of chaparral, pine, and juniper forests which make for some high quality scenery.

28,000 sheep in the vicinity of Prescott as well as pronghorn antelope, deer, turkeys, mountain lions and small game. A Multiple Use Sustained Yield Act was passed in 1960 assuring availablity of recreation, forage, water, timber and wildlife from the forest. The USDA Forest Service manages the timber and the conversion of chaparral range into productive grassland. Forest Service personnel assured us that research projects may be conducted in the forest if properly planned with them.

Colleges in Prescott

A state supported junior college, Yavapai College, serves about 6000 students with 800 of these full-time students in Prescott. At the Learning Resources Center (Figure 7) in the Stadler Building we found a collection of books and journals that will be of assistance in future research efforts. An "Arizona Index" includes an extensive list of literature on the natural history of Arizona. Appendix C lists some items found in their library.

Figure 7. Pyramidal poplar trees line the walk near the Stadler Building, Learning Resources Center where the library of Yavapai College is located. Materials in this library should be of significant help as GCES research projects develop.

Embry Riddle Aeronautical University is a four year institution centering on air science and related fields. The enrollment is about 1000.

Prescott College has a two to four year curriculum specializing in outdoor leadership and "wilderness challenge." This college is six years old and has about 100 students.

Prescott has a city library and several museums of historical and anthropological interest.[6] City buses in downtown Prescott are replicas of old fashioned trollies. Located only 22 miles south of the GCES, this town offers numerous cultural and educational advantages for research workers.

Chino Valley, Paulden and the GCES

Leaving Prescott we saw Fort Whipple Veteran's Hospital which was named after Fort Whipple Military Post, established around 1864 when Arizona became a US territory with Prescott as its capital. Continuing on route 89 we passed beautiful Watson Lake and a picturesque rock formation known as Granite Dells (Figure 8). Scrub oaks, pinyon pines, and junipers grow near these magnificent boulders.

Some miles above Granite Dells one enters the Chino Valley area which has horse ranches, cattle farms, and quarries. In addition to many homes, trailer parks, and alfalfa fields, greater Chino Valley contains clusters of offices, banks, shops and churches. Chino Valley boasts its own police force and a forest ranger station.

Figure 8. Watson Lake and the Granite Dells rock formation are located about 2 miles north of Prescott on Highway 89. Good examples of all stages in the spherical weathering of Precambrian granite can be found at this location.

The GCES is about six miles north of the town of Chino Valley on route 89. Just beyond the Harper Realty Company our land is the second 2.5 acre lot north of that structure (Figures 9 and 10). One mile south is an historical marker indicating the site of Del Rio Springs which was the original camp for the offices of the territorial government from January through May of 1864. This was later moved to Prescott.

We spent periods at the plot watching birds, collecting plants and discussing a land survey. Appendix D is a preliminary list of the plants here and at nearby localities. Approximately one-third or less of our land

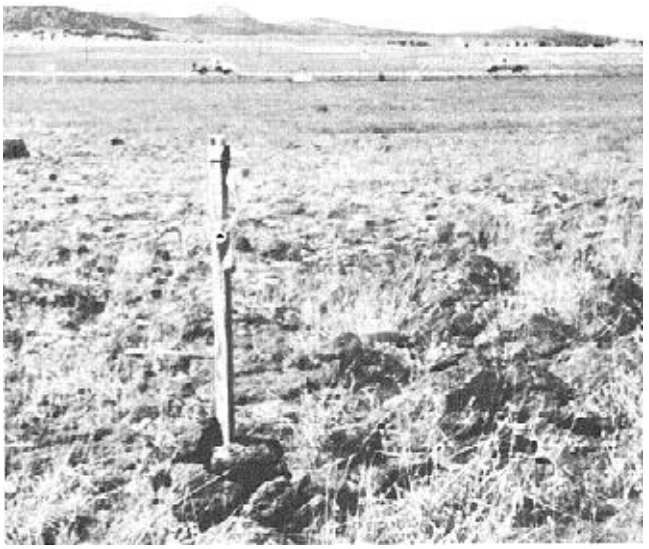

Figure 9. This realtor's stake is seen near the southeast corner of our GCES land, looking west. Less than 1/3 of our land has lava rocks dotted with lichens (foreground) while the major share appears to be tillable soil.

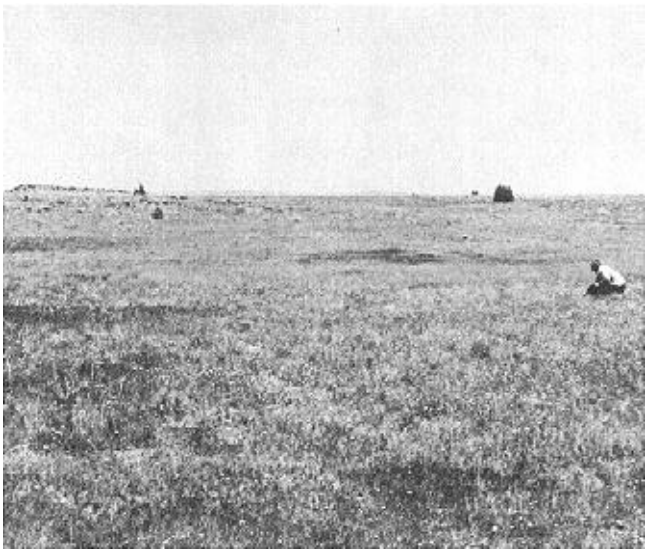

Figure 10. Direct view of the GCES land, looking northeast, with author studying herbs and grasses. The San Francisco Mountain peaks near Flagstaff are faintly visible in the background. It was in these mountains that William Hart Merriam performed his classical studies on temperature as a factor in determining the altitudinal and latitudinal distribution of plants. Photo by John Meyer.

has lava rock dotted with lichens. The remainder of the ground appears to be tillable and is presently covered with grasses and other herbs such as the yellow mariposa lilies (Figure 11), pink globe mallows, and white tidy tips. There is also a small grass that grows in tubular clusters looking like elongated ridges of moss (Figure 12). I was unable to identify this grass and would appreciate suggestions.

Among the many birds seen here, the horned larks and sweet singing meadowlarks prevailed. John Meyer has prepared a list of birds encountered at specific locations for Appendix E.

While on site we discussed digging a well, constructing fencing and the ultimate plans for a laboratory. Water is available on the site since neighbors directly south hit water at 85 feet and went below 100 feet for their well in June of 1983. CRS is committed to develop the station but only as interest money from the Laboratory Project Fund will permit. When completed, the mailing address will be Paulden, Arizona which is a small settlement a few miles north.

Figure 11. Mariposa lily is a small but striking plant. Spots and other markings on petals serve as cues and nectar guides to visiting insects whose spectrum of vision is somewhat different than our own. Photo by John Meyer.

Figure 12. Note the bunchy tubular mound of grass (indicated by arrow) growing in a crescent shape near the ball-point pen. This grass was common on the CRS land.

Figure 13. The paintbrush is seen here and there in Chino Valley. Photo by John Meyer.

Adjacent Areas

Ten miles north is Prescott National Forest. Here we enjoyed rolling landscapes of fragrant juniper, oak, pinyon pine, and cowania forests interspersed with grasslands.

We stopped at Hell Canyon which lies exactly on the 35th parallel and was the site of a famous route traveled by Indians, missionaries, and trappers. An historical marker told us between 1857 and 1859 Lt. E. F. Beale and his well-known camel corps made exploration here for a road.

One mile south along a forest road we saw a roadrunner trotting jauntily between the holly-grape shrubs. At intervals bright paint brush blossoms blurted out a red contrast to the sandy soil (Figure 13). Exploring roads west of route 89 directly north of GCES we saw nine pronghorn antelopes. These crisply marked, graceful animals demonstrate that there is opportunity for game and wildlife studies. Appendix F contains a list of mammals observed in this vicinity.

There are Indian ruins in several localities as evidenced by those about one-half mile across route 89 and directly southwest of GCES (Figure 14). From the top of this large mound, facing northeast is an excellent view of GCES (Figure 15).

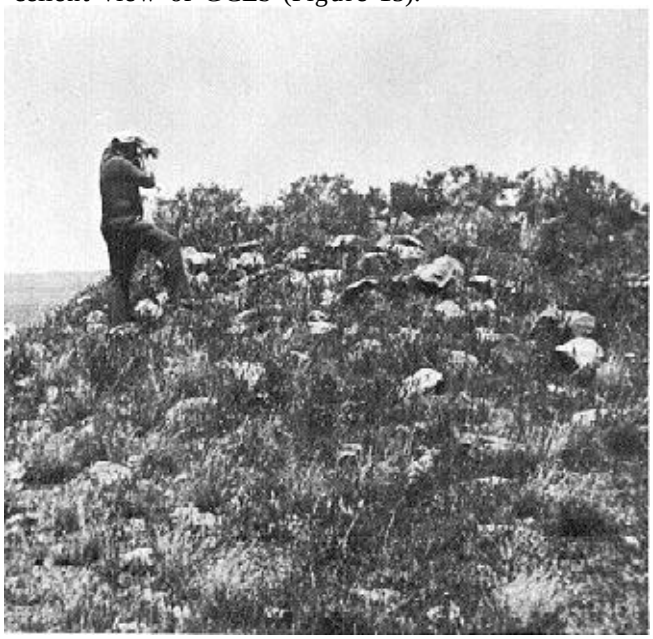

Figure 14. John Meyer photographing rocks atop the mound of Indian ruins southwest of the GCES. Although special permission and various regulations surround such inquiry, Chino Valley would be a choice area for studying Indian anthropology.

We learned that a group of local people near Gunsight is establishing its own astronomical observatory and gathering data each evening on stars and planet. John Meyer writes that:

> The clarity of the atmosphere and the usual freedom from cloud cover suggest interesting possibilities for studies using groud-based optical astronomy in analyzing origins. Perhaps the astronomy oriented CRS members can suggest appropriate low-budget projects using relatively small telescopes.[7]

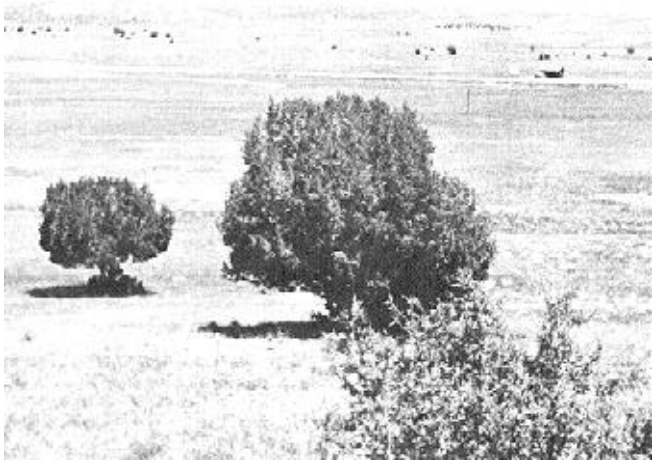

Figure 15. Looking northeastward from the top of the Indian mound there is a clear view of the Harper Realty Building and the GCES land across Highway 89. Pronghorn antelope range these rolling lands and illustrate the fact that research on wildlife could be easily enacted — in consultation with proper authorities, of course.

Figure 16. Sunset at Sullivan Lake. The cottonwood seen in the foreground is a common sight in riparian habitats throughout the southwest. Clear skies and 4400 foot altitudes make this area a choice location for astronomical activities.

Sullivan Lake, about one mile north of GCES (Figure 16), offers opportunity for work in aquatic biology. The lake and adjacent land is owned by the city of Prescott. It was established early in the 1900's as a

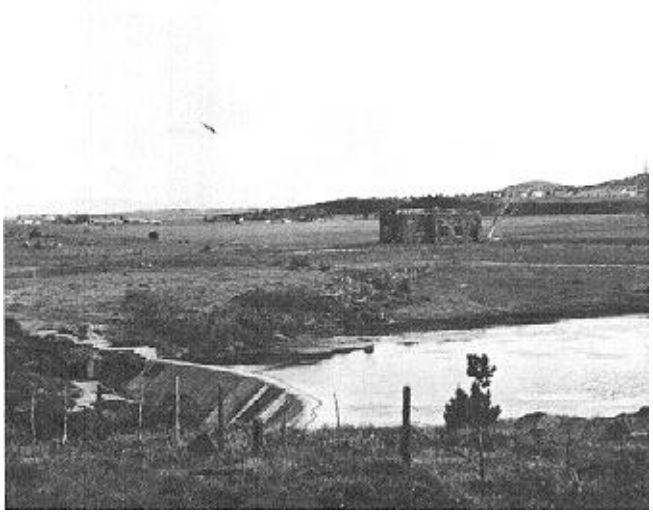

Figure 17. Dam is seen at the left, and in the center an abandoned swimming lodge which once served the city of Prescott. Photo by John Meyer.

swimming area for residents of Prescott. The one large building seen in Figure 17 was a lodge while the smaller stone structures dotting the basin were bath houses in the late 1920's and early 1930's. This lake was obviously filled in to a large extent since there is but a vestige of water left above the dam and the bath houses are now many feet inland from the borders of the present lake. Beyond the dam to the east is a steep gorge and a railroad which is parallel to an access road (Figure 18). The abrupt canyon below Sullivan Lake:

> . . . marks the beginning of the head-waters of the Verde River. At Sullivan Lake several normally dry washes coalesce, providing drainage for a basin of well over 5000 square miles including the southwest slopes of the Coconino Plateau well north of Seligman.[8]

Figure 18. This gorge and canyon eastward below Sullivan Lake mark the beginning of the head-waters of the Verde River. This lake and gorge serve as the drainage basin for a large portion of northern Arizona.

Both Sullivan Lake and the GCES land have an elevation of about 4400 feet. Temperature data are recorded in Appendix G. We found the early mornings in May rather nippy. Although the growing season near Paulden is generous compared to Flagstaff, Arizona it will never rival Orange County, California for raising plants.

Other Helpful Agencies

The secretary for the Yavapai County Agricultural Agent explained the procedures for securing soil tests. She also related some agricultural features of the Prescott region and a unique ordinance, established by early ranchers and still in force, prohibiting the production of pigs.

The staff of the Soil Conservation Service gave us numerous soil books. In the soil survey for the western part of Yavapai County,[9] it appears that the CRS plot contains an Abra gravelly, sandy loam. Concerning these soil areas the county soil manual states:

> Slopes range from 0 to 30 percent. Elevation ranges from 4000 to 5,500 feet. The vegetation is dominantly grass on the plains and pinyon pine and juniper on the alluvial fans. Annual precipitation is 11 to 16 inches. The average annual temperature is 50° to 57°, and the frost-free period is 145 to 180 days. . . . These soils are used mainly for range, wildlife habitat, and watershed catchment areas. Small areas in the Chino Valley are used for irrigated crops and homesites.[10]

At the Soil Conservation office I saw a display of several native grasses and suggest that CRS might initiate a program of study on reintroduction of these original species. California biologists have recently become interested in the stipa needle grass, naming it the "State Grass" since it once evidently covered large sections of the central valley and foothills.

Looking Ahead

Following our visit to the site John Meyer and I discussed some steps which seem to lie ahead in the development of GCES.

1. Fence the land.
2. Drill a well.
3. Provide a highway access.
4. Hire a part-time person to undertake summer studies as was done at the CRS Grassland Experiment Station in Weatherford, Oklahoma.
5. Build a lab and hire a full-time researcher.

We are convinced that the door for a highly productive program at Paulden, Arizona stands wide open. With your help, we will enter it.

Acknowledgements

I wish to thank Dr. John Meyer for his help in planning this venture and then accompanying me. Some of the photographs and appendices are credited to Dr. Meyer. I appreciate the hours of travel and corre-

spondence by Dr. Emmett Williams in leading us to this choice site. We appreciate the valuable advice of Dr. Walter Lammerts and for accompanying Dr. Williams and me on two trips to select the site.

The minor expenses incurred during this trip for gasoline mileage and photography were covered by interest income from the CRS Laboratory Project Fund. I extend special appreciation to the many donors to that fund who have made this purchase of land possible. Such gifts "keep on giving" because only the interest is used to purchase land or develop the station while the fund stands intact. Your continuing contributions may be mailed to:

CRS Laboratory Project
5093 Williamsport Drive
Norcross, Georgia 30071

APPENDICES

Appendix A

Important points for possible research within one morning's drive (approximately 200 mile radius) of The GCES. Some of these are merely listed while others include a phone number and/or mailing address:

1. Arizona Sonora Museum. (602) 883-1380. Rt. 9, Box 900, Tucson, AZ 85743.
2. Arizona State University. (602) 965-9011. Tempe, AZ 85743.
3. Boyce Thompson Southwestern Arboretum. (602) 689-2811. P.O. Box AB, Superior, AZ 85273. These people publish a journal entitled "Desert Plants" which contains many articles pertinent to Arizona research projects.
4. Desert Botanical Garden of Arizona. (602) 941-1217. 1201 N. Galvin Pkwy., Phoenix, AZ 85008.
5. Grand Canyon Caverns. Located on old Route 66. (602) 422-3223.
6. Grand Canyon National Park Service Library. (602) 638-2411. P.O. Box 129, Grand Canyon, AZ 86023. Also at Grand Canyon is a museum of natural history.
7. Havasu Lake National Wildlife Refuge.
8. Imperial National Wildlife Refuge.
9. Joshua Forest Parkway.
10. Kofa National Wildlife Refuge.
11. Lowell Observatory. Located in Flagstaff along with several other major observatories.
12. Meteor Crater. Located between Flagstaff and Winslow.
13. Mogollon Rim country with its steep escarpments.
14. Northern Arizona Museum. (602) 774-5211. Flagstaff, AZ. Note, they publish "Plateau" magazine which frequently contains articles of origins significance.
15. Northern Arizona University. (60) 523-9011. Box 6022, Flagstaff, AZ 86011.
16. Oak Creek Canyon.
17. Organ Pipe Cactus National Monument. (602) 256-2983.
18. Painted Desert. (602) 524-6228.
19. Petrified Forest National Park. (602) 524-6228.
20. Sierra Ancha Experimental Forest. (602) 524-6228.
21. San Francisco Peaks towering 12,670 feet above sea level just north of Flagstaff.
22. Sunset Crater National Monument. A large volcanic cone northeast of Flagstaff.
23. Sycamore Canyon Wilderness Area. 47,000 acres covering parts of the Coconino, Kaibab, and Prescott National Forests.
24. University of Arizona. (602) 621-2211. Tucson, AZ.
25. Yavapai Museum (½ mile east of Visitor Center, Grand Canyon south rim).

Appendix B

Offices and other establishments in Prescott and Chino Valley, AZ, that may be of help in matters pertaining to research at the GCES:

1. Chino Valley Ranger Station, P.O. Box 485, Chino Valley, AZ 86323. (602) 636-2302.
2. Prescott College, 220 Grove Ave., Prescott, AZ 86301. (602) 778-2090.
3. Prescott Chamber of Commerce, 117 West Goodwin, Prescott, AZ 86301. (602) 445-2000.
4. U. S. Department of Agriculture Forest Service, Forest Supervisor, Prescott National Forest, 344 S. Cortez, Prescott, AZ 86301. (602) 445-1762.
5. U. S. Department of Agriculture Soil Conservation Service. 1555 Iron Springs Road, Prescott, AZ 86301. (602) 445-7990.
6. Yavapai College, 1100 E. Sheldon, Prescott, AZ 86301. (602) 445-7300.
7. Yavapai County Agricultural Agent, Yavapai County Annex #2, Room 5, 500 S. Marins, Prescott, AZ 86301. (602) 445-5690.

Appendix C

A few examples of the resource materials available in the library at Stadler Building Learning Resources Center, Yavapai College.

1. A large set of materials entitled Arizona Natural History QE85.43.
2. Arizona General Soil Map. Produced by the USDA Soil Conservation Service and the University of Arizona Agricultural Experiment Station.
3. Arizona Natural Vegetation Map. This gives considerable detail regarding the distribution of general plant types such as grassland, chaparral, pine forests, etc. It is evidently available through the U. S. Forest Service.
4. Geology of Yavapai Co: a bibliography. Feb. 1982. 56 sheets. QE105.A654.
5. Journal of The Arizona-Nevada Academy of Science. Membership Secretary, Rm. A-3114, Physical Science Center, Arizona State University, Tempe, AZ 85287. Three issues are printed each year. Vol. 1, #2, contains an article (pp. 60-67) by Rittastings dealing with the change in vegetation and stream flow in Arizona during the last 100 years. The author attributes loss of grassland to overgrazing but admits that climate change may have been the "gun," the "trigger" of which was pulled by overgrazing.
6. Prescott National Forest Map. Available through Prescott National Forest Headquarters in Prescott. Prescott National Forest lies both to the east and to the west of the GCES with a narrow strip of privately owned land in between.
7. Smith, W. L. 1974. Established natural areas in Arizona. Arizona Academy of Science, Planning Division—Office of Economic Planning and Development.
8. Soil Survey of Yavapai County, Arizona—see reference 9 of this present paper. This volume contains extensive coverage of soil types, vegetation, wildlife associations, and climatological data as well as complete aerial photographs of the area.
9. U. S. Geological Survey Map. The Paulden vicinity map covers the immediate area of GCES. Both the Paulden vicinity map and the USGS index maps for the state are available from the U.S.G.S., Denver Distribution Section, Federal Center, Building 41, Denver, Colorado 80225.
10. Visitor's guide to Yavapai County. 1977. Outdoor Arizona. 49:13-52. December.

Appendix D — Plant life.

Plant life at the GCES and land nearby such as the Indian ruins and neighboring lots:

bladderpod. *Lesquerella intermedia.*
brome grass. *Bromus sp.*
daisy fleabane. *Erigeron divergens.*
gilia, golden. *Linanthus aureus.*
grass growing in small tubular mats.

globemallow, gooseberry. *Sphaeralcea grossulariaefolia.*
globemallow, small leaved. *S. parvifolia.*
lily, mariposa. *Calochortus nuttallii.*
lupine, *Lupinus sp.*
prickly pear. *Opuntia sp.*
snakeweed. *Gutierrezia microcephala.*
tidy tips, white. *Layia glandulosa.*
vervain. *Verbena bipinnatifida.*

Plants noted at and near Sullivan Lake:
cottonwood. *Populus fremontii.*
paintbrush. *Castilleja sp.*
phlox. *Phlox longifolia.*

Plants noted west of Highway 89, near Gunsight.
bladderpod. *Lesquerella intermedia.*
deer-vetch. *Lotus mearnsii* (with some features of *L. wrightii*)
locoweed. *Astragalus sp.*
phlox. *Phlox longifolia.*
tidy tips, white. *Layia glandulosa.*

Plants noted near Hell Canyon and in the Prescott National Forest 10 miles north of G.C.E.S.
currant. *Ribes sp.*
desert rose. *Cowania mexicana.*
evening primrose. *Oenothera caespitosa.*
four o'clock. *Mirabilis.*
holly grape. *Berberis fremontii.*
juniper. *Juniperus monosperma.*
mullein. *Verbascum thapsus.*
manzanita. *Arctostaphylos sp.*
oak, scrub. *Quercus turbinella.*
pinyon pine. *Pinus edulis.*
prickly pear cactus. *Opuntia sp.*
yucca. *Yucca sp.*

Plants noted in the lower section of Prescott National Forest, near Ironwood Springs Rd. and Skyline.
box elder. *Acer negundo.*
juniper. *Juniperus monosperma.*
locoweed. *Astragalus sp.*
mountain mahogany. *Cercocarups (montanus?).*
oak, Arizona white. *Quercus arizonica.*
oak, emory. *Q. emoryi.*
oak, scrub. *Q. turbinella.*
pine, western yellow or ponderosa. *Pinus ponderosa.*

Plants noted in the desert along Alamo Rd.
creosote bush. *Larrea tridentata.*
sahuaro cactus. *Carnegia gigantea.*
wild rhubarb. *Rumex hymenosepalus.*

Appendix E — Bird life.

Prepared by John R. Meyer.

Birds noted directly at the GCES and nearby land such as the Indian ruins and neighboring lots.
crow. *Corvus brachyrhynchos.*
eastern meadowlark. *Sturnella magna.*
horned lark. *Eremophila alpestris.*
song sparrow (?). *Melospiza melodia.*

Birds noted at and near Sullivan Lake:
Bullock's oriole. *Icterus bullockii.*
cliff swallows. *Petrochelidon pyrrhonota.*
eastern meadowlark. *Sturnella magna.*
great blue heron. *Ardea herodias.*
kildeer. *Charadrius vociferus.*

Birds noted west of Hwy. 89 near Gunsight.
flycatcher. *Empidonax sp.*
horned lark. *Eremophila alpestris.*
king bird. *Tyrannus sp.*
red tailed hawk. *Buteo jamaicensis.*

Birds noted near Hell Canyon and in the Prescott National Forest about 10 miles north of GCES.
flycatcher. *Empidonax sp.*
road runner. *Geococcyx californianus.*
red tailed hawk. *Buteo jamaicensis.*

Birds noted in the lower section of Prescott National Forest near Ironwood Springs Rd. and Skyline:
chipping sparrow. *Spizella passerina.*
western bluebird. *Sialia mexicana.*

Birds noted in the desert along Alamo Rd.
Lark bunting. *Calamospiza melanocorys.*
turkey vultures. *Coragyps atratus.*

Appendix F

Mammals sighted on GCES land or in similar nearby habitats:
blacktail jackrabbit. *Lepus californicus.*
desert cottontail. *Sylvilagus auduboni.*
pronghorn antelope. *Antilocarpa americana.*
rock squirrel. *Citellus variegatus.*

Appendix G

Temperature data gathered on the mornings of May 12 and 13, 1983, at Sullivan Lake, Paulden, Arizona.

Time and date	lake water °C	soil temp. at 1" °C	air temp. °C	water bottle °C
5:30 a.m. 5-12-83	12	6	—3	0 (with ice crystals)
6:24 a.m. 5-13-83	9.5	3	—0.5	— (no ice crystals)

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When The Origin of Species appeared in 1859 both naturalism and naturalism's surrogate for transcendent hope, the idea of Progress, were in ascendance. . . . Lebiniz had announced a "perfecting principle" operating throughout the universe and in its forms of life. In the 18th century Progressists like Diderot and Rousseau had plumped specifically for biological evolution.

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THE UNIVERSE IS BIGGER THAN 15.71 LIGHT YEARS

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Moon and Spencer's 15.71 light year model universe does not approximate the real universe. Their model universe is far too dense, and far too short-lived. Such a model for the universe should not be used in support of a short travel time for light from the distant stars as a solution for the light from the distant stars paradox.

Introduction

How did the light from the distant stars arrive here on earth, if the universe is only 6,000 to 10,000 years old? Some Creationists[1, 2] have looked to a 1953 paper by Moon and Spencer[3] for an answer.

Moon and Spencer supported an unpopular idea about the effect of motion on the speed of light. Their idea was unpopular, because it was at odds with the theory of relativity. The effect, if it were true, would have nothing to do directly with the light from distant stars paradox.

However, the model of the universe that Moon and Spencer used to support their ideas is the model of the universe some creationists have used to explain the travel time of light paradox. Creationists, and Moon and Spencer are joined by a common model of the universe. However, the two deal with very different issues.

How did Moon and Spencer arrive at their model of the universe? What evidence did they put forth in support of their model? These questions must be answered now, because this article contends that the Moon and Spencer model is incorrect.

Moon and Spencer Universe

A stationary star emits light that travels at a speed of 186,000 miles per second toward the earth. Moon and Spencer theorized that a star already moving toward the earth at 1,000 miles per second would emit light that travels toward the earth at 186,000 + 1,000 = 187,000 miles per second. This proposition is at odds with special relativity. Relativity predicts that the speed of light through empty space is 186,000 miles per second, whether or not the source of the light is in motion.

Moon and Spencer were aware of the classic test that seems to disprove their theory. The thrust of their paper was to present a model universe in which this test is indecisive.

The test measures light observed from binary stars. For simplicity, let us assume that one star of the pair is very massive and that the other star has relatively small mass. Then the massive star essentially remains fixed, while the less massive one rotates about it. Suppose that the earth lies in the orbital plane of this pair.

According to Moon and Spencer, the less massive star should emit light that travels toward the earth faster than 186,000 miles per second, during the part of its orbit when it approaches the earth. It should emit light that travels toward the earth slower than 186,000 miles per second during the part of its orbit when it travels away from the earth.

Suppose, for example, that the orbiting star of the pair is one AU (the distance from the earth to the sun) from the central star. Suppose its orbital speed is 120 km/sec = 0.0004c, where c = 300,000 km/sec. Its orbital period would be about 90 days.

Moon and Spencer would predict that this star emits light which travels toward the earth with speed c + v = 1.0004c when the star moves toward the earth, and it emits light that travels toward the earth with speed c − v = 0.9996c when it travels directly away from the earth. The slow light leaves the binary system one-half period (T/2 = 45 days) before the fast light, but the separation between the two light signals becomes less and less as the fast light gradually overtakes the slow light.

The fast light would reach an observer one light year away in about 1 − (v/c) years or 0.9996 years, while the slow light would reach him in about 1 + (v/c) years or 1.0004 years. The time difference between the travel time of the fast light and the slow light is 2v/c or 0.0008 years. This time difference is about seven hours. For an observer 15 light years away, the amount of catching up done en route is 15 times as much or about 4.5 days. For an observer 150 light years away, the amount of catching up done in route is 45 days. For this observer, the fast light emitted 45 days behind the slow light has caught up with the slow light that began with a 45 day head start.

The observer 150 light years distant would notice in a remarkable way the two light signals, which reach him simultaneously. This observer would seem to see two identical stars in orbit about the central massive star. Actually, the fast light emitted by the orbiting star on the part of its orbit when it moved toward the earth, caught up with the slow light this same star emitted one-half period earlier on the part of its orbit when it was traveling away from the earth. Several weeks later, the same astronomer looking at the same system might see only one orbiting star or maybe no orbiting stars at all. He would be between two pairs of slow light-fast light signals that have caught up with one another. If such observations of multiple identical stars appearing and disappearing were ever made, those observations would be direct evidence that the object emitting light adds its own speed to the speed of the light it emits, just as Moon and Spencer thought. The effect would be more noticeable for more distant observers. More catching up occurs over greater distances of travel.

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No such effect has ever been observed. It would be observed easily, if the speed of light depended on the speed of the emitter, and if the distance of travel were large enough for "catch-up" to accumulate. Moon and Spencer believed the speed of light depended on the speed of the emitter. They needed some explanation for the lack of odd effects for the binaries. Hence, they proposed that the universe was only a few light years in size. Thus, all observable binaries would be only a few light years away. The catch-up time that would accumulate over that short a distance might be unobservable. In our example, maybe 15 light years would do for the size of the universe. So the maximum time difference of 4.5 days of catch-up time might be unobservable compared to the 45 days difference between the time the two light signals were emitted. If the effect required, say, more than 10% difference to be observable, then a 15 light year universe would be so small that the effect would escape detection, even if the effect were real.

Moon and Spencer appealed to curved space-time to give them a small universe. They chose a model universe that was so curved that the real physical distance corresponding to an apparent distance of infinity would be less than the distance required to produce the catch-up effect of light from binaries. This consideration alone determined for them the size of the curved space-time universe they would use.

They chose $5\pi = 15.71$ light years as the maximum size of the universe, because that distance is small enough so that "catch-up" from the binaries they listed would be unobservable. This particular exact value was selected rather than 15.00 or 20.00 light years, because it was a number that fit conveniently into the mathematics of general relativity.

The distance formula they borrowed from general relativity[4] is

$$L = 2r_0\tan^{-1}(r/2r_0) \qquad (1)$$

where $r_0 = 5$ light years exactly, r is the coordinate distance to a star and L is the physical distance to the star. The coordinate distance r is the distance Moon and Spencer use for the distance the star *seems* to be. It can be any distance from 4.3 light years for the closest star to several billion light years for the most distant known light sources. Moon and Spencer's physical distance L is the apparent distance, r, corrected for effects of the curvature of space-time.

In the formula, L (physical distance or real distance) and r (coordinate distance or apparent distance) are essentially equal for distances on the order of one light year or less. For instance, an apparent distance of $r = 1$ light year yields:

$$L = 10\tan^{-1}(0.1) = 0.997 \text{ light years.}$$

That's a difference of only three tenths of one per cent.

The difference between the two distances becomes enormous for larger r values.

Table I. r vs. L in Moon-Spencer Universe.

r (light years)	L (light years)
10.0	7.9
100.0	14.7
1,000.0	15.6
∞	15.71

Moon and Spencer adopt a universe of such small radius of curvature, $r_0 = 5$ light years, that the most distant object is only 15.71 light years of physical distance away. For them, that means no binaries are far enough away in terms of physical distance for fast light to catch slow light. Moon and Spencer can therefore still claim the speed of the emitter adds to the speed of light, and at the same time explain away evidence from apparently distant binaries to the contrary. Their solution is that the universe is too small for the effects to accumulate.

If the universe really is that small, light from even the most distant objects would seem to require only 15.71 light years to reach us. Such a universe would not have a paradox of the travel time of light.

How did light from the Andromeda Galaxy, whose apparent distance is $r = 2$ million light years, get here if the universe was created no more than 10,000 years ago? A candidate answer, using Moon and Spencer's paper, is that it would only take 15.71 years for all light to get here from even the most distant stars. The entire universe has a physical size of $L_{max} = 15.71$ light years. Strangely, a universe in which the most distant object is $5\pi = 15.71$ light years is a universe with a radius of curvature of $r_0 = 5$ light years.

Now consider general relativity to investigate a possible solution for the travel time of light based on Moon and Spencer's 15.71 light year physical size universe.

General Relativity — Static Model

Let us assume the matter in the universe is more or less evenly distributed on a sufficiently large scale, and that the universe as a whole is not expanding, contracting, or rotating. Then we have the static model of the universe.

The standard axiom of general relativity is that curved space-time "tells" matter and light how to travel, and that matter-energy "tells" space-time how to curve. The two parts of this axiom are inseparable in general relativity. The static model[5] yields the average density ρ_{static} that is necessary to produce a universe with a radius of curvature r_0,

$$\rho_{static} = (3/8\pi G)(c/r_0)^2, \qquad (2)$$

where $G = 6.67 \times 10^{-11}$ and $c = 3 \times 10^8$ in SI units. For a five light year r_0 we have

$$\rho_{static} = 7.2 \times 10^{-8} \text{ kg/m}^3. \qquad (3)$$

This is billions of billions of times greater than the observed average density (about 2×10^{-28} kg/m^3),[6] of matter in the universe. This observed density would give the universe a radius of 95 billion light years, if the universe was adequately described by the static model.

As an illustration, consider how much matter there would have to be in a sphere of radius one light year around us. This mass would be $M = (4\pi/3)\rho_{static}r^3 = 2.6 \times 10^{41}$ kg, which is the mass of 130 *billion* suns. There should be a whole galaxy of stars within one light year of us! It would take that much distributed mass to curve the universe so that the farthest distance is $5\pi = 15.71$ light years away from us.[7]

Within the orbit of Pluto, at that rate there would have to be the mass of 33 suns. This great extra mass

within our own solar system would have an enormous effect on the motions of the planets. We would easily observe it with the naked eye.

There is not enough matter per unit volume in the universe to produce the 15.71 light year universe in the static model of general relativity.

Non-Static Models of the Universe

Models of the universe in which its large scale structure is changing can be classified into three groups according to density. The Robertson-Walker metric[8]

$$ds^2 = c^2dt^2 - R^2(t)\frac{[dr^2 + r^2(d\theta^2 + \sin^2\theta d\emptyset^2)]}{[1 + k(r/2r_0)^2]^2} \quad (4)$$

describes a changing universe in which the average mass-density is uniform throughout the universe at a given time, t, but varies as the universe expands (or contracts) with increasing time.

In equation (4) ds is the length of an infinitesimal section of world line in four-dimensional space-time. R(t) is the scale factor by which the universe has expanded or contracted relative to its size in the present epoch. $R = 1$ now. If the universe is expanding, $R < 1$ earlier and $R > 1$ later. The r_0 in the denominator of equation (4) is the radius of the universe in four-dimensional space-time. We will see that it is the same r_0 that appears in the Moon and Spencer equation (1). The constant k in the denominator can take on only one of the three possible values of +1, 0 or −1. This constant k classifies the solutions by density.

$k = +1$ yields a universe in which matter is packed densely enough so that the expansion of the universe will eventually be overcome by gravitational attraction. The universe will reach a maximum size, and then it will begin to contract. Thus $k = +1$ gives a closed universe. The $k = +1$ case will be of greatest interest in this article, since it is the case used by Moon and Spencer.

$k = -1$ gives an open universe. This solution yields a universe in which matter is so thinly spread that its gravitational effect can never overcome the expansion of the universe. The universe expands forever. Even after infinite time, it is still expanding far too fast to stop.

$k = 0$ represents the borderline case between the $k = +1$ and the $k = -1$ solutions. Using $k = 0$ in equation (4) yields a universe in which the matter has exactly the correct density (critical density) so that its gravitational effect slows the expansion, but never quite slows it to a complete stop. Only as infinite time elapses, does the expansion almost slow to a stop.

(A) $k = 0$

In this case equation (4) becomes

$$ds^2 = c^2dt^2 - R^2(t)[dr^2 + r^2(d\theta^2 + \sin^2\theta d\emptyset^2)]. \quad (5)$$

When the physical length is obtained by the usual procedure of setting $dt = 0$ and equating the differential physical length dL to the absolute value of the differential world length ds at that fixed time, we have

$$dL^2 = R^2(t)[dr^2 + r^2(d\theta^2 + \sin^2\theta d\emptyset^2)]. \quad (6)$$

This length is Euclidean. The universe for this case is not curved and the size of the universe is unlimited. Light travels along *straight* lines. This is why the case $k = 0$ is not useful to Moon and Spencer.

(B) $k = +1$

This case of a closed universe *is* the model adopted by Moon and Spencer. We begin with the four-length

$$ds^2 = c^2dt^2 - R^2(t)\frac{[dr^2 + r^2(d\theta^2 + \sin^2\theta d\emptyset^2)]}{[1 + (r/2r_0)^2]^2} \quad (7)$$

from equation (2), and write the differential physical length by setting $|ds| = dL$ when $dt = 0$. We have

$$dL^2 = R^2(t)\frac{[dr^2 + r^2(d\theta^2 + \sin^2\theta d\emptyset^2)]}{[1 + (r/2r_0)^2]^2}. \quad (8)$$

If we consider the earth to be at the center of a spherical coordinate system, then the light coming to the earth from any star travels along a radius, so $d\theta = d\emptyset = 0$ for that light ray. We have, for such a stellar light ray

$$dL = R(t)\frac{dr}{[1 + (r/2r_0)^2]}. \quad (9)$$

Furthermore, if the scale factor R remains constant at $R = 1$ during the travel time of the light ray, equation (9) becomes

$$dL = \frac{dr}{1 + (r/2r_0)^2} \quad (10)$$

which integrates to

$$L = 2r_0\tan^{-1}(r/2r_0). \quad (11)$$

Equation (11) of general relativity relating physical and coordinate distance is the same as Moon and Spencer's equation (1) relating real and apparent distances, both in a closed universe.

The same general relativity that yields (11) under the conditions mentioned above, also requires that the density of the matter in the universe be enough to limit the universe to a radius of space-time curvature in the present epoch to r_0. That density is, from general relativity[9]

$$\rho_0 = \left(\frac{3c^2}{8\pi G r_0^2}\right)k + \left(\frac{3}{8\pi G}\right)\left(\frac{1}{R}\frac{dR}{dt}\right)_0^2. \quad (12)$$

The density at earlier or later times is given by $\rho(t) = \rho_0/R^3(t)$ as the universe expands or contracts. However, comparing equation (12) with ρ_{static} from equation (2) we see that

$$\rho_0 > \rho_{static}. \quad (13)$$

The density required to produce a closed universe as small as Moon and Spencer propose has to be greater than the density to close the static universe model. But we already found that this density is dozens of orders of magnitude greater than the measured density.

Let us examine the mathematics of the model. The universe will expand during the travel time of light from astronomical sources. Therefore R is *not* a constant during the integration of equation (9) as Moon and Spencer must have, so equation (11), the Moon and Spencer equation, does *not* result. The key equation upon which their work is based is gone.

The maximum radius that Moon and Spencer's closed expanding universe eventually reaches can be shown to be[10]

$$r_{max} = r_0[1 + (r/c \times dR/dt)^2_0], \quad (14)$$

and the total time it takes such a universe to expand to its maximum size, if it began its expansion from a point is[11]

$$t_{max} = \pi/2 \cdot r_{max}/c = \pi r_0/2c[1 + (r/c \cdot dR/dt)^2_0]. \quad (15)$$

A zero subscript means the quantity is to be evaluated in the present epoch. Let us classify this expansion time according to the magnitude of the last term in brackets in equation (15).

If $(r_0/c) \cdot (dR/dt)_0 \leqslant 1$, then t_{max} is $r_0/2c = 15.71/2$ years. The universe of Moon and Spencer would expand to its maximum size in less than eight years, even if the expansion started from the smallest possible dimension, a point. From symmetry, the contraction phase would last the same time. In that time, the Moon and Spencer universe would contract back to a point.

Moon and Spencer did not propose that the universe began expanding from a point eight years ago, and neither do creationists who use their distance formula (1). However, such a universe really would have a lifetime of only 15.71 years—about eight years for expansion plus eight years for contraction. If the universe was not created as a point, but was created with finite size, its lifetime would be less. Thus, 15.71 years represents the upper limit on the lifetime of Moon and Spencer's universe. We do not have to add the expansion effect onto the model universe; it *is* the model. Moon and Spencer's 15.71 light years in size lasts only 15.71 years of time, and that is 15.71 years of physical time, our time, real time. Thus we can exclude the case $(r_0/c) \cdot (dR/dt)_0 \leqslant 1$.

If $(r_0/c) \cdot (dR/dt)_0 > 1$, then $(dR/dt)_0 \geqslant c/r_0 = 1/5$ or 20% per year. This rate of expansion would mean the universe is presently expanding at the rate of 20% per year. This rocketing expansion is *not* observed. Such expansion would be even greater earlier, so the universe would be no more than 1/20% = 5 years old at present, even if it began its expansion from the smallest possible size, a point!

The physical content of the above inequalities is clear. A universe with matter packed densely enough to produce a 15.71 light year size for that universe will have to be expanding very rapidly to overcome the tremendous gravitational attraction. One would have to go back in time only a few years to find it the size of a point.

We must also note that in such a dense, small universe as the Moon and Spencer universe, the physical speed of light is *not* constant. Light travels along a null geodesic, ds = 0, so from the Robertson-Walker metric of equation (4)

$$cdt/R(t) = dr/[1 + (r/2r_0)^2] = dL$$

or

$$dL/dt = c/R(t). \quad (16)$$

Hence, the physical speed of light, dL/dt, changes, where L is the Moon and Spencer physical distance as given by their equation (1). Thus, the travel time of light from the distant stars in Moon and Spencer's universe is *not* equal to their physical distance in light years. Of course, the maximum time of travel for light from the most distant star can be no greater than the 15.71 year lifetime of the Moon and Spencer universe, but that is little comfort to anyone.

This speed of light consideration would go in favor of creationists if R = 1 = constant, if somehow there could be a universe with our average mass density whose expansion was small or zero. However, such a universe *cannot exist* according to the theory of general relativity (curved Riemann space-time) whose physical distance formula Moon and Spencer looked to for their model universe.

A final criticism of the Moon and Spencer model universe will be presented here, although it holds equally for all of the model universes discussed. That criticism centers on the interpretaton of the lengths L and r in the key Moon and Spencer equation (1). Creationists[12] have interpreted Moon and Spencer's distance r in that equation to mean the actual distance to a star that an astronomer determines when he makes his best measurement. The astronomer could make a perfect measurement if he would simply stack meter sticks end to end from the earth to the star. In that case, the distance to the star would be r, the apparent distance, the distance we think it is to the star. Creationists interpret the true distance—different from the number of meter sticks from here to there—as th eapparent distance somehow altered by the curvature of space-time. This altered distance is the L in the Moon and Spencer equation (1).

General relativity, which provides equation (1), contrasts sharply in the interpretation of these symbols. According to general relativity, r in equation (1) is only a numerical parameter called the coordinate distance, and L is the physical distance.[13]

Moon and Spencer make the non-physical r in equation (1) bear the role of the distance to the star, while this distance is actually the L of that equation. They make the physical distance L of equation (1) play the role of some non-physical equivalent distance distorted by the curvature of space-time.

(C) $k = -1$

In this case equation (4) yields for the physical distance

$$L = 2r_0 \tanh^{-1}(r/2r_0) \quad (17)$$

and there is no maximum distance. There is no finite radius to the universe. It goes on forever in both space and time. It is expanding so fast that it will never stop. This model universe has no relation to Moon and Spencer's work.

Conclusion

Moon and Spencer's 15.71 light year model universe is not compatible with the real universe. Their model universe is far too dense, and far too short-lived to be real. Creationists should not use such a bad model for the universe in support of a short travel time for the speed of light from the distant stars as a solution for the light from the distant stars paradox.

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PANORAMA OF SCIENCE

Ultraviolet Light Thrown onto Origins?

Recent reports of research by Joel S. Levine and others at the Langley Research Center and by V. M. Canuto and C. Imhoff at the Goddard Institute for Space Studies into ultraviolet radiation from the Sun contain evidence which could be devastating to the old reductionist model of the Earth's early atmosphere.[1]

Levine reported: ". . . the overwhelming majority of chemical evolution experiments since the first in 1952 may have been conducted with the wrong atmospheric mixture." This is a strong statement that cannot have been made lightly. It is backed by C. Imhoff's measurements of ultraviolet radiation from a half-dozen young sun-like stars. Imhoff found that these stars were emitting orders of magnitude more ultraviolet than was previously supposed. Therefore: ". . . ultraviolet radiation at the Earth from the young Sun may have been up to 100,000 times greater than today. The previous (uniformitarian) assumption was that the ultraviolet radiation from the young Sun was roughly comparable to today's level. Oxygen in the Earth's atmosphere may have been at least 1 million times greater than anyone ever thought . . . (however) calculations indicate that levels of ozone in the early atmosphere were insufficient to protect the surface of the Earth from enhanced levels of solar ultraviolet radiation."

Recent photochemical calculations by Levine and others at Langley have the Earth's early atmosphere composed of carbon dioxide, nitrogen, and water vapor (all of volcanic origin) at the time when the (supposed) "precursors of living systems" were first formed. Moreover, both methane and ammonia would have been extremely short-lived. Thus the atmosphere of methane, ammonia, and hydrogen, previously supposed to have existed, "was photo-chemically unstable if it existed at all."

A quotation from Levine is of especial interest here. "In the case of our calculated oxygen levels, one bit of evidence from the early geological record supports our conclusions. It was puzzling (to geologists who accepted the reducing atmosphere which Oparin[2] suggested existed at first); but geologists know from their analyses of the earliest known rocks that the oxygen level of the early atmosphere had to be much higher than was previously supposed. Analyses of these rocks, estimated to be more than 3.5 billion years old, found oxidized iron in amounts that called for atmospheric oxygen levels to be at least 100 times greater and perhaps up to 1 billion times greater than otherwise accepted. . . . High levels of ultraviolet radiation must have had a very important impact on the origin and evolution of life."

Moreover, seeing that determination of age by radioisotopes is not as accurate as it is often claimed to be,[3] perhaps the oldest PreCambrian red beds, which are composed of hematite, are of sufficient age to provide support for Levine's hypothesis.

It appears as if echoes of Yockey continually return to haunt us with increasing vigor. As he said: "The 'warm little pond' scenario was invented *ad hoc* to serve as a materialistic reductionist explanation of the origin of life. It is unsupported by any other evidence, and it will remain *ad hoc* until such evidence is found. Even if it existed, as described in the scenario, it nevertheless falls very far short indeed of achieving the purpose of its authors even with the aid of a *deus ex machina*. One must conclude that, contrary to the established and current wisdom, a scenario describing the genesis of life on Earth by chance and natural causes which can be accepted on the basis of fact and not faith has not yet been written."[4]

Robert H. Dott, Jr., speaking as President of the Society of Economic Paleontologists and Mineralogists in a recent address re-defined the notion of uniformitarianism, apparently for the benefit of the scientific creationists.[5] He made at least two references to creationists, indicating that the "neocatastrophist-creationist cause" is definitely influencing the thinking of at least a few open-minded scientists.

I suggest that a challenge to the scientific establishment offered by the scientific creationists has done much to reopen long-closed doors of scientific inquiry. Perhaps now a greater percentage of scientists will be less intimidated by the unscientific (in the true sense of the word) attitude displayed by certain members of the academic community, so that science may once again make the bold strides characterisitc of nineteenth-century science at its best.

Contributed by Mr. R. L. Mandock

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GLOBAL, CONTINENTAL AND REGIONAL SEDIMENTATION SYSTEMS AND THEIR IMPLICATIONS

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The geologic record displays a trend in which certain lithologies are more prominently deposited during certain geologic periods. The trend is a worldwide phenomenon which seems to better fit within creationist views of earth history.

Introduction

Under the basic assumptions of modern geology, global and continental catastrophes are excluded as possible explanations of the deposition of the geologic strata. The Principle of Uniformitarianism, as proposed by Hutton and Lyell, would predict that lithologies similar to those deposited today are all that is found in the stratigraphic column. Modern work relaxes this constraint somewhat but still would not encourage the view of continental or global sedimentation.

The prevailing creationist view with its extremely short flood (e.g. *The Genesis Flood*) would appear to require a global sedimentation system having few exceptions. The geological column is something in between both expectations. A given lithology, found to be the dominant rock type in a certain stratigraphical position, implies some type of global system at work. There are many exceptions to the rule, but one can find nearly any rock type in any geological period. The purpose of this paper is to outline the predominant lithology.

Three assumptions are made in this paper. The first is that Nicholas Steno, who was a creationist, was correct when he set forth in 1660 the Principle of Superposition. This principle is that the oldest strata are on the bottom and the youngest strata are on top. In Figure 1 the layers 1 and 1a were deposited before bed 2 which in turn was deposited earlier than layer 3. One cannot determine by this rule whether 1 or 1a was laid down first.

Secondly, it is assumed that when terms such as "Cambrian," etc. are used, we are referring to a stratigraphic position, not an absolute age of millions of years.

The third assumption is that there is generally a difference between the usually fossiliferous Lower Cambrian and the usually unfossiliferous Precambrian. Most creationists seem to accept this idea since much effort has been expended discussing the sudden appearance of fossils at the base of the Cambrian.[1]

Beginning with these assumptions a column, similar to the existing one, can be built *without* using the much abused method of fossil correlation. In this paper, lithology alone will be the prime means of correlation. Fossils will be mentioned only when they are unique lithologic components of a rock much like the widespread occurrence of a conglomerate containing an odd purple pebble. This paper will delineate the general trend of the lithology of a given strata system.

Precambrian

Among the stratigraphically lowest rocks occurs a unique type of basalt, an igneous rock, with a chemical composition which has a much higher melting temperature than subsequent basalts.[2] Siever postulates that these occurred because the earth's temperature gradient was different on the early earth. Any number of other conditions could explain these rocks. They indicate that the conditions of the present do not apply to the earliest Precambrian.

In the Middle and Early Precambrian there occurs a rock type which is unique to the Precambrian. These are the Banded Iron Formations or Jaspillites and consist of iron ore interlaminated with a silica-rich rock such as chert or jasper. Preston Cloud notes:

> This rock has long been a major geochemical puzzle. . . . It taxes the imagination, however, to visualize what kind of chemical system might explain the observed continuity of individual iron-rich laminae, often only a fraction of a millimeter thick, for distances of hundreds of kilometers within certain prominant sedimentary basins that were being filled about 2 to 2.2 billion years ago (and less prominently, in older ones). No convincing modern counterpart is known.[3]

Banded iron formations occur in Australia,[4] India,[5] central Asia, the Urals, Siberia,[6] southern Rhodesia,[7] the Great Lakes region of North America and many other places. These are found below the fossiliferous strata. Banded iron formations do not occur ever again after the end of the Precambrian. Once again this implies that current physical conditions are not equivalent to those that existed in the past.

Above these deposits and just below the Cambrian lie a suite of lithologies that have often been interpreted as glacial deposits. Dott and Batten remark:

> The most remarkable trademark of Eocambrian rocks is the presence of peculiar unsorted boulder-bearing deposits slightly below the fossiliferous Cambrian strata. Since they were first described in northern Norway in 1891, they have been found on practically all continents. In North America they are best known in East Greenland, Utah, Nevada, western Canada and Alaska. Peculiar textures, wide distribution and local scratched surfaces beneath the conglomerates led most geologists to regard them as tills representing a major

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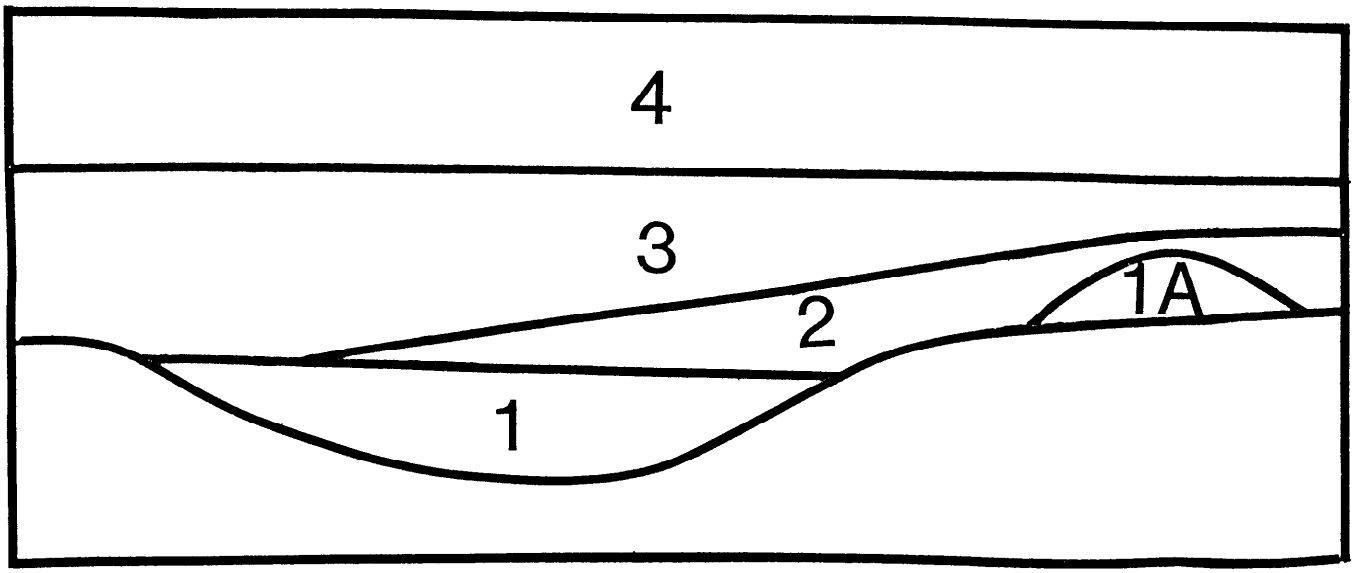

Figure 1. This illustrates the Principle of Superposition which was first outlined by Steno. Since sedimentary material is only deposited from above, the beds must have been laid down in the order shown since new material cannot be laid down below the contemporaneous water bottom.

episode of continental glaciation about 700 million years ago.[8]

Besides the above localities, these types of deposits are known from Brazil, western Australia and Africa.[9] The worldwide distribution of these "glacial deposits" argues strongly that they were caused by other agencies since it is difficult to see how life could survive a worldwide deep freeze, even in the oceans. The importance of this to the creationist is that, due to our limited time frame, several periods of glaciation might be difficult to explain.

One other interesting item concerning the Precambrian concerns the paucity of limestone. Cloud reports:

> Considered on a global scale, however, older sedimentary rocks, up to as recently as about 2.6 billion years ago, include relatively little limestone but are rich in chemically precipitated silica.[10]

In between the Cambrian and Precambrian is usually an unconformity representing a period of erosion. Archibald Geikie notes:

> In those regions of the world where the relations of the pre-Cambrian to the oldest unmetamorphosed Paleozoic rocks are most clearly exposed and have been most carefully studied, it is seldom that any conformable passage can be traced between these two great rock groups . . .[11]

Whitcomb and Morris,[12] as well as Woodmorappe,[13] have pointed out that there are several areas in the world that the Cambrian-Precambrian boundary shows no evidence of erosion. Figure 2 shows fossiliferous Cambrian lying conformably over unfossiliferous Precambrian. In these cases, if one goes lower, eventually an unconformity is reached. One then has the problem of deciding whether layers 6 and 7 are unfossiliferous Cambrian, as is layer 9, or whether it is Precambrian. Not every strata above the Cambrian contains fossils so why must every Lower Cambrian strata contain fossils? Thus it is possible that the conformable areas are really due to misidentified rock strata. In that case the unconformity could be worldwide. Rock strata are not found with labels identifying their age; human beings must decide their age.

Cambrian

Above the unconformity, one quite commonly discovers an unfossiliferous sandstone or quartzite conformably below the fossiliferous Lower Cambrian. This is the case in Kentucky where a basal sandstone (the Erwin) unconformably rests on a crystalline basement and is overlain by limestones and shales. It is true in Scotland (the Eriboll sandstone), in eastern Greenland (the Kloftelv sandstone), and Newfoundland (the Bradore Formation).[14] This is also found in Upper Volta,[15] Arctic Russia[16] and many, many other locations. However, as Ager observes:

> In fact it is even more remarkable than this, in that it is not only the quartzite, but the whole deepening succession that tends to turn up almost everywhere; i.e. a basal conglomerate, followed by the orthoquartzite, followed by glauconitic sandstones, followed by marine shales and thin limestones.[17]

With the exception of the glauconitic sandstone, I have been able to verify the widespread occurrence of that sequence in the regions mentioned above, as well as in the San Francisco Mountains, Utah,[18] Nevada,[19] England,[20] Australia,[21] Bolivia[22] and Chana.[23] As long ago as 1903, Geikie recognized:

> The rocks of the Cambrian system present considerable uniformity of lithological character over the globe.[24]

Another aspect of the Lower Paleozoic is the widespread distribution of lithologically similar sheet sandstones. Each sheet can be traced for hundreds of miles. They are cross-stratified, nearly pure quartz sandstones which also show ripple marks and often contain scolithus, a vertical burrow. When the sands are less pure they often show desiccation features such as

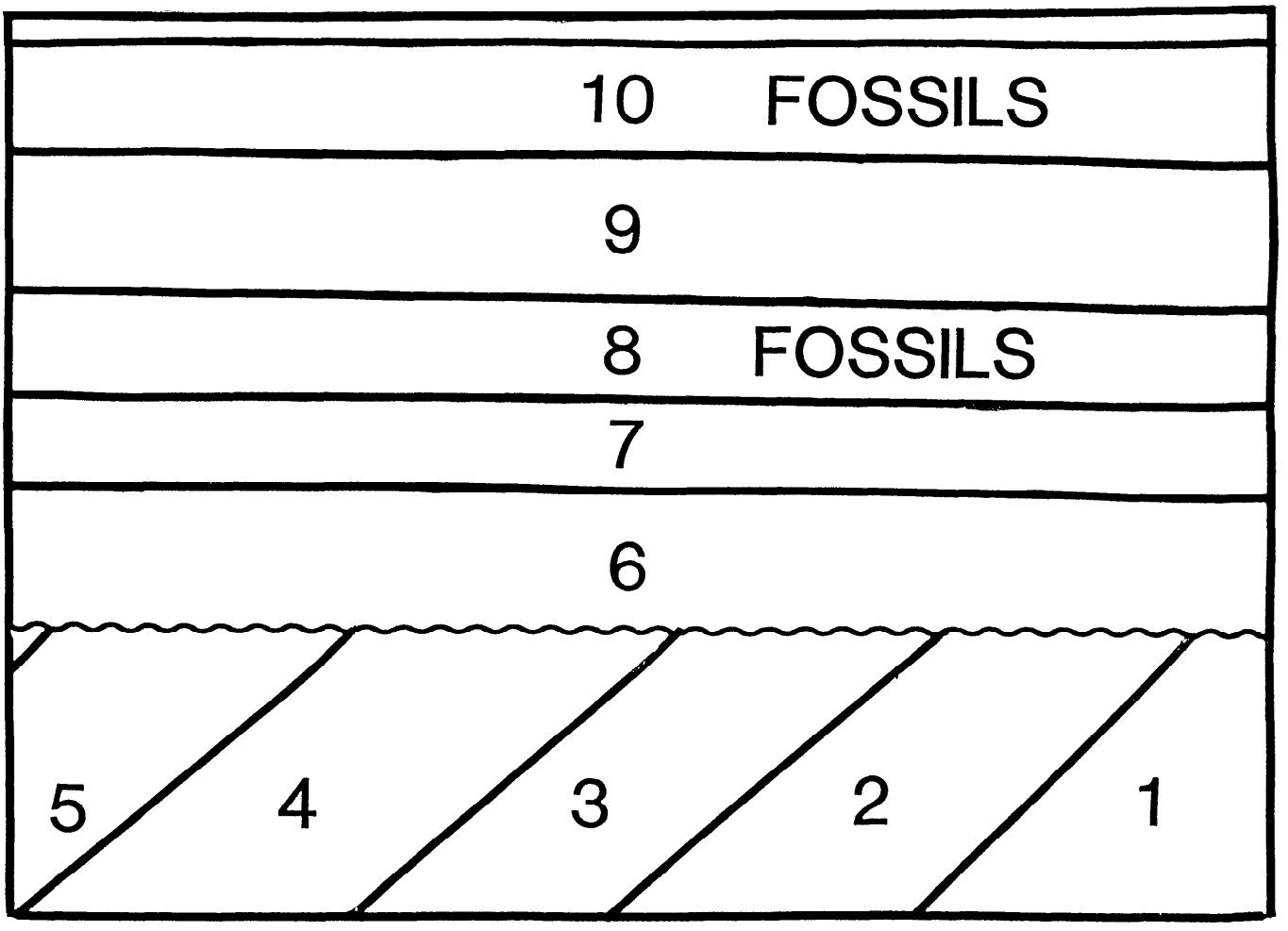

Figure 2. This illustrates the problem of trying to determine the age of beds near the Cambrian-Precambrian boundary. Beds 8 and 10 contain Cambrian fossils which requires that bed 9, which contains no fossils, be Cambrian. The question which the investigator must answer is whether beds 6 and 7 are unfossiliferous Cambrian or Precambrian as are beds 1-5.

cracks, or casts of salt or anhydrite crystals. When they are nearly pure quartz, the associated bedding shows these features. Of one of these Dott and Batten state:

> Cross stratification is one of the most prominent features of the Upper Cambrian sandstones of the craton. Cross stratified Cambrian quartz sandstones occur from Ausable Chasm in northeastern New York to the bottom of the Grand Canyon. Ripple marks are also prevalent.[25]

The Bradore Formation of Newfoundland, the Kloftelv of Greenland, the Eribol of Scotland,[26] the Larapinta of Australia[27] and the 90 percent pure quartz sand of the Precambrian Gronnes Formation of Norway[28] are lithologically similar. The St. Peter sandstone is a huge deposit of sand of Ordovician age.[29] This cross-bedded body of sand extends from the northeastern U.S. down to Oklahoma where these sands are included in the Simpson group. These sands are also found in New Mexico and then can be traced north to Canada. Similar cross-bedded Lower Paleozoic sandstones found in the Transantarctic Mountains of Antarctica contain ripple-marks, mudcracks and vertical burrows.[30] The widespread distribution of these sands with identical features points to processes operating on a global scale.

Huge bodies of sand such as these are not generally found higher in the geologic column. To this author's knowledge only one Mesozoic sandstone, the Nubian, rivals the lower Paleozoic sands in size.

Ordovician

In studying the dolomite deposits of Greenland, Scotland and Newfoundland, Swett and Smit describe the dolomites as containing flake conglomerates (the shingled fragments of mud-cracks), mottled textures, stromatolites, oolites and mudcracked surfaces. The similarities of these features led them to remark:

> The problem of the remarkable continuity of facies is not simplified by tracing these units southwestward (present coordinates). The lithologic correlations of equivalent strata in the areas of Montreal, Quebec, Shoreham, Vermont and western Maryland are not as precise as between Newfoundland and Scotland or as between Scotland and Greenland. Nonetheless, similar environments of carbonate sedimentation prevailed to the southwest during Lower Ordovician time. The

> algal and mottled structures described by Sando (1957) from the Beekmantown rocks of Maryland are similar to those of western Newfoundland, Northwest Scotland, and central East Greenland. If one also regards these as contiguous and contemporaneous deposits, he is confronted by a marine shelf environment roughly 1,500 mi in length that was within the ecological/environmental limits of cryptalgal and oolitic sedimentation. Precise modern analogues are lacking . . .[31]

In addition to a 1,500 mile shelf, similar rocks of similar age outcrop further south in the Appalachians and are found in Texas, Oklahoma and New Mexico. This makes a total length of 3,000 miles, one-eighth of the circumference of the earth.[32] Across the Arctic Ocean from Greenland, Ordovician dolomites are found on the Siberian Platform. I have not found an exact lithological description but the Siberian dolomites represent an interesting possible extension of these amazing Lower Ordovician carbonates.

Ager[33] tells of a purple and white quartzite of Lower Ordovician age which extends from England across France and Spain and then is found in Africa, a distance of at least 1,200 miles. He points out that similar rocks of similar age also occur in Bulgaria and the Canadian Rockies.

The Upper Ordovician dolomites of Western North America are wide spread. Schuchert and Dunbar report:

> As a result the Upper Ordovician is represented throughout the Rocky Mountain region and the Arctic regions of Canada by a remarkably widespread and homogenous formation of massive cliff-forming dolomite. In the northern Rockies of the United States, it is known as the Bighorn dolomite. It is recognized under local names from Mexico to Alaska and northwestern Greenland, and strangely, over this vast area seldom exceeds a thickness of 300 feet. It is everywhere characterized by a single fauna of corals, cephalopods, and large gastropods.[34]

The variation of limestone to dolomite deposition over geologic time should be noted. This ratio is shown in Table I from Chilinger.[35] Presently dolomite is deposited only in very minute quantities demonstrating a difference from the geologic past.

Table I. Calcium to Magnesium Ratio over Geologic Time.

Pre-Cambrian	4.0:1
Cambrian	4.2:1
Ordovician	3.5:1
Silurian	3.0:1
Devonian	7.0:1
Permo-Carboniferous	16:1
Cretaceous	56:1
Tertiary	53:1
Quarternary	40:1

Silurian

In the Middle Silurian the Niagaran limestone was widely distributed across North America. Pirrson and Schuchert note that the limestone occurs from Kentucky to northern Greenland and that over this distance ". . . The species are everywhere identical or much alike, whether it be in Kentucky, New York, the Hudson Bay region, or within the Arctic Circle at Polaris Bay, northern Greenland."[36]

The Upper Silurian and Lower Devonian are represented by redbeds and evaporites such as salt, gypsum and anhydrite. In New York salt-bearing shales cover the Niagaran limestone. The lower part of the Salina formation consists of bright red shale (the Vernon), while the higher part consists of shales interbedded with salt.[37] Similar deposits are found in Michigan, the eastern Baltic,[38] Japan,[39] Siberia,[40] and Australia.[41] Lower Devonian salt and anhydrite are also found in the Williston Basin of North Dakota.[42]

Devonian

The Lower Devonian was dominated by the redbed-evaporite period and one of the most interesting deposits of this period is the Old Red Sandstone of England. Raynor describes it as follows:

> Fossils are only occasionally plentiful in the Old Red Sandstone and there are great thicknesses of rock which have so far yielded none. The most common and the most useful stratigraphically are the vertebrates. Although these are sometimes referred to indiscriminantly as 'fishes,' representatives of modern groups . . . did not appear until Middle Devonian times.[43]

The 'fish' referred to is a unique type of extinct armoured fish. Identical rocks containing armoured fish are found in the Polish-Podola Depression of western Russia,[44] on the Russian Platform,[45] in Greenland, Ireland, Kashmir,[46] and Siberia.[47] Of the Kashmir occurrence, Ager states:

> There not only does the fish fauna closely resemble that of the Middle Old Red Sandstone in Scotland, but the sediments themselves are said to be exactly like the Thurso Flagstone Group of Caithness. [England][48]

The Middle Devonian Onondaga group is widely distributed over the North American continent and is uniform in character.[49] This rock extends from Oklahoma to Tennessee and Kentucky then northeastward across the Ohio Valley and into Ontario and the Hudson Valley. Outliers of this rock are found as far north as Hudson Bay. Over this distance, not only is the lithologic character the same, the same fossils are contained in the rock. Schuchert and Dunbar note:

> Furthermore, the same genera and species existed in Kentucky, Ohio, New York and the Hudson Bay region, showing no regard for latitude.[50]

Lower Mississippian

Above all of the deposits mentioned heretofore, are the Lower Mississippian limestones. These limestones contain innumerable crinoids, marine animals known as lilies. This author calculated that just one of these crinoidal limestones (the Mission Canyon of Wyoming) contained enough dead crinoids to cover the entire

surface of the earth to a depth of eight centimeters (see Appendix). The Mission Canyon limestone, part of the Madison Formation, covers parts of Idaho, most of Wyoming and Montana and parts of North and South Dakota.

However, similar limestones containing primarily crinoids of Lower Mississippian age, are found in Arizona, California, New Mexico, Texas, Oklahoma, Kansas, Iowa, Missouri, Illinois, Indiana, Tennessee, Alabama and Kentucky.[51]

Similar crinoidal limestones are also found in Britain,[52] Belgium,[53] and the Urals,[54] European Russia,[55] Central Asia,[56] Egypt,[57] Australia,[58] and Libya.[59] They are found in Canada,[60] and Alaska.[61] Thus we see a major, almost worldwide, deposit of limestone which has zones of nothing more than smashed and broken crinoids.

The most amazing fact about these limestones which go under different names in all these localities has yet to be mentioned. Many of these limestones show evidence of erosion at the top, form cliffs due to their low erodibility, are overlain by redbeds and are stained red at the top of the formation. This is true in Alaska, Canada, Wyoming, Montana, Arizona (where the limestone is named the Redwall because of the stain), and Britain. In Belgium and Russia no mention was made of staining but the Belgium case shows the erosion and both are overlain by redbeds.[62, 63] In Belgium 24 Iguanodon skeletons were found in an erosional sinkhole in the limestone. Similar Lower Mississippian rocks are found in Kashmir.[64]

In addition to all these similarities one finds much chert associated with these rocks. Without even mentioning index fossils can anyone reasonably doubt that these rocks are one huge system of contemporaneous limestones? And yet this rock does contain similar fossils worldwide.

Upper Carboniferous

Above the Lower Carboniferous (Mississippian) limestones lies the majority of the Carboniferous coal. Beginning in the Lower Carboniferous and extending to the Lower Permian massive coal deposits were laid down. Apart from the coal itself one of the most fascinating features of the Upper Carboniferous is the cyclicity of the sediments during this period. Dott and Batten state:

> Beginning in Late Mississippian and continuing through early Permian times, the strata deposited over the craton and inner parts of the mobile belts displayed a *striking repetitive pattern, which is present in varying degrees in late Paleozoic strata on other continents.* Upper Mississippian deposits in the southeastern craton show clear repetitions of a sandstone-shale-limestone triplet set repeated several times vertically. . . . Practically all Pennsylvanian strata on the continent show some kind of repetitive pattern, but the most striking occurs in coal-bearing sequences. At least 50 late Paleozoic cycles are known, many of which can be traced widely over the southern craton.[65] (my emphasis)

Cyclic deposition during this period seems to be linked to coal. In the Tamworth Trough in Australia, Brown, Campbell and Crook observed:

> Probably by the end of Namurian times [Upper Mississippian-GRM] the whole trough was above sealevel and coarse clastics were everywhere being deposited. Cyclic deposition has been described, and thin coal seams recorded.[66]

Cyclic Permian deposits containing coal are found in another part of Australia, the Sydney Basin.[67] Carboniferous sedimentary cycles containing coal were laid down in Britain as well as the rest of Europe. Dorothy H. Raynor relates:

> Sedimentary cycles have been described in detail from the Middle Coal Measures of Nottinghamshire and Darbyshire, and are especially well developed in the upper part of those measures, where nine cyclothems are found in some 700 feet of strata.[68]

Even coal outside of the Permo-Carboniferous range sometimes displays cycles. Kambe and Tokuyama, in describing Triassic coals in Japan relate:

> Strata like those of the Momonaki formation formed during elevation of the hinterland and characterized by deltaic conglomerate and rhythmic coal beds, including coarse, pure sandstones alternating with muddy and coaly sediments.[69]

Coals are found contained within nearly identical facies from Texas all the way to the Donetz Basin north of the Caspian Sea in Russia and they generally lie above the crinoidal limestones. Permo-Carboniferous coals are found in Scotland, Spitzbergen, Pennsylvania, Nova Scotia, New Brunswick, Great Britain, Germany, Silesia, Moravia, France, Belgium, Russia, Spain, Brazil, Bohemia, Illinois, Michigan, Indiana, Iowa, Missouri, Kansas, Oklahoma, Arkansas, Virginia, New South Wales Australia, The Urals, China, India, Africa, Argentina, Tasmania[70] and Antarctica.[71] Obviously some world wide system was operating since coals are more widespread at this time than any other.

Even as widespread as coal is, the microstructure of coal which extends over far smaller areas is even more amazing. W. S. Gresley describes the Pittsburgh coal seam as follows:

> Given a 'bench' or layer of good bituminous coal, of very uniform quality, varying in thickness from say 22 to 27 inches, with one or two more or less irregular slaty partings or binders here and there in it; and imagine such a deposit spread out over at least 15,000 square miles. The edges or outcroppings of this layer of coal reveal no signs of a beginning or of an end; in other words, there is nothing to indicate that this coal did not originally extend hundreds of miles beyond any of its existing limits. We will not now discuss the question, 'How did this layer of coal get where it is? but we proceed at once to observe that it has a practically dead level and even surface or top. Suppose this vast expanse of dead-level coal vegetation to be completely covered or sealed over by a thin layer or band of shale, or 'slate' as miners call it. We will suppose the thickness of this film of shale to be from ¼ to ½ of an inch only. Imagine a practically unbroken 15,000+ square mile sheet of shale only ⅜ of an inch thick! On top of this shale-band let a second and equally uniform layer of the same coal as the thicker one below, be de-

> posited, whose thickness is about 4 inches—a layer of coal practically free from impurities, and, in every respect, similar to the rest of the seam, regarded as a whole. Again, on top of this 4 inch band of coal conceive a second layer of shale to exist, in the thickness and kind just about the same as the shale-layer 4 inches below it. Then above this suppose we have a uniform bench of coal 3 to 5 feet high.[72]

That is the structure of the Pittsburg coal seam and it does not fit the picture of a swamp deposit. Shale cannot be deposited that uniformly over a swamp since it would be stopped by the numerous trees and channeled by the drainage pattern. A uniformitarian colleague of mine, after reading this, said, "That sounds like a precipitate, as ridiculous as that would be." He is correct—it does look like a precipitate—even though there is no known mechanism for such an occurrence. In any event something was different from current conditions in the deposition of this seam.

The final Pennsylvanian example of the persistence of a rock formation is the Altamont Limestone. Paul E. Schenk notes:

> The Altamont Limestone of the Marmaton Group, Desmoinsian Series consists of three members—in ascending order, the Amoret Limestone, the Lake Neosho shale and the Worland Limestone. The Amoret Limestone is characterized by rapid lateral changes, the Lake Neosho Shale by a medium, black phosphorite, and the Worland Limestone by very slow lateral change. Although the formation is only 1 to 13 m thick, it crops out in a narrow band over 740 km long from Iowa to Oklahoma.[73]

It is fascinating that such a thin layer could be deposited over such a distance and yet retain its lithological character.

Permian

Nearly worldwide, above the dark coal measures, lie red shales and red sandstones. Redbed deposition began locally in the Late Pennsylvanian (as is evidenced by the red rocks of this age in The Garden of the Gods in Colorado Springs) and continued primarily through the end of the Triassic with local areas of redbed deposition in the Lower Jurassic. The Permian and Triassic strata contain 50 percent of all the world's redbeds.[74]

Lithologically, one major difference between Permian and Triassic rocks is that the Permian redbeds are more often associated with salt, gypsum and anhydrite than the Triassic. The Permian also contain different fossils than does the Triassic.

The Rotliegendes formation of the Early Permian consists of extensive coarse red clastic sediments which lie on top of the coal bearing strata. Glennie describes the extent of part of this deposit.

> It has long been known that [the Rotliegendes] were deposited in a post-Variscan basin that extended from Germany to the Russo-Polish border. Following the discovery in 1959 of the Groningen gas field in the Netherlands, and the spread of exploration activity to the southern North Sea, it was confirmed that this basin also extended westwards to eastern England.[75]

He concludes by understating:

> This Rotliegendes basin was fairly large.[76]

Upon the Rotliegendes lies the Zechstein beds which contain salt interbedded with carbonates and clastics. In Germany, the Zechstein contains nearly 1,000 meters or 3000 feet of salt.[77] Amazingly, similar strata occur in Texas. Raynor notes:

> A good example is the considerable resemblance between the Permian evaporite sequences of the Zechstein basin and Texas.[78]

Permian strata containing redbeds are found also in New Mexico, Colorado, Wyoming, Utah and Idaho.[79] Also they are found in Peru,[80] South Africa,[81] southern Russia,[82] central Asia,[83] Argentina,[84] Brazil,[85] and Arabia.[86]

Salt and potash were deposited in great abundance in the Permian. Brinkmann states:

> Owing to its thick rocksalt and potash-salt deposits the Permian was the most important time for salt-formation in the geologic past.[87]

The Permian salt deposits that extend from New Mexico to Kansas are estimated to include 30,000 billion tons of salt which would require, according to uniformitarian calculations, the evaporation of an unbelievable 22,000 cubic miles of seawater.[88]

Triassic

Triassic redbeds are as equally widespread as are the Permian redbeds. They are found in central Asia (the Karduanian),[89] England (New Red Sandstone),[90] Greenland,[91] Australia,[92] North Africa,[93] India,[94] and the eastern United States. The Triassic is recorded primarily as redbeds on nearly all continents.

Ager relates some interesting features found in the Triassic.

> The basal conglomerate in England is full of boulders of a distinctive purple 'liver-coloured' and white quartzites that have been matched with the Gres de May and the Gres Armoricain right across the other side of the English Channel in Brittany (though I regard with some skepticism the notion that the boulders here traveled so far.) Along the Rio Cabriel in Spain, it is the same, but there the source quartzite outcrops immediately below. Near Belgradchik, in northwest Bulgaria, again the basal conglomerate is largely composed of exactly similar purple quartzite pebbles (resting on Permian breccias also like those of Middle England). Even if one postulates continent-wide uplift to produce the conglomerate in such widely separated places, it is very difficult to explain why the source rock is also so remarkably similar from one end of Europe to the other.[95]

The "Building Stones" of the English Keuper are amazingly similar to the "brownstone" which was used to build so many of New York's tenements. Both stones are Triassic. In Morocco, the similarities with the Triassic of eastern North America are such to make one wonder on which continent he is.[96]

The Triassic also contains the Muschelkalk, a Middle Triassic limestone of Europe that extends across Europe into the Middle East,[97, 98] and into India.[99] The pelagic Triassic is equally extensive. Geikie reports:

> Continued study of the pelagic facies of the Triassic as first encountered in the eastern Alps has shown that this type extends throughout the Mediterranean basin, extending into Asia Minor and sweeping across central and southern Asia even as far as Japan and the East Indian Archipelago.[100]

At each end of this vast extent the uppermost Triassic is the same. In Japan, Geikie describes the Rhaetic as consisting ". . . of a thick series of shales and sandstones with seams of anthracite."[101] The Triassic of Europe is described as:

> Grey sandy clays and fine-grained sandstones containing Equisetum, Asplenites, and cycads (Zamites, Pterophylum), sometimes forming thin seams of coal . . ."[102]

This is precisely what is contained in the Upper Triassic of eastern North America!

Jurassic

The Lower Jurassic was a time in which a peculiar type of deposits were laid down in widely separated localities. These are the oolitic iron ores which are not being deposited anywhere on earth today. Thus we do not know what conditions were necessary for the deposition of these ironstones. Economically they are important in Europe but are found in Canada, Scotland, Western Europe, Southern Europe, Western Russia, Siberia, northeast Africa and Australia.[103] These ironstones were more widespread at this time than any other period in earth history. They were also widespread in the early Paleozoic but at other times were quite scarce.

Ager mentions that high-quality, fine-grained lithographic limestones, such as the Solnhofen, only occur in the Jurassic in limited deposits. They are found in Cerin, France; Ager, Spain; Nusplingen, Swabia; New South Wales and in the central Congo.[104] Ager failed to mention an occurrence in Dalmatia. Arkell says:

> The overlying Plattenkalke strongly resemble those at Solnhofen in Bavaria and contain some of the same species of fossils, including ammonites, and are probably of about the same age.[105]

All of these deposits are not only just Jurassic but occur only in the Kimmeridgian series of the Jurassic. Brinkman gives one final characteristic of the Jurassic.

> The petrographic subdivision into Black, Brown and White Jurassic, which originated in southern Germany, is on the whole valid for almost the entire world. In many localities dark shales predominate in the lower subdivision; brown sandstones and oolitic ironstones in the middle; and pale limestones, in the upper.[106]

Cretaceous

Above the Jurassic beds lie the Cretaceous strata. They are named for the chalk deposits which occur in this period, *creta* being the Latin word for chalk. Chalk is not the dominant lithology of this period but most of the world's chalk deposits do occur in the Upper Cretaceous and Lower Tertiary. In general the Lower Cretaceous consists of clastic sediments (sands and shales) while the Upper Cretaceous is predominantly carbonate.

Within the clastics of the Cretaceous, the sandstones are more glauconitic than are the sands of any other period. Glauconite, known only to form in marine environments, is a silicate mineral containing potassium. Thus the presence of glauconite is considered to be proof of a marine environment. When it becomes very abundant, the sandstone is known as a greensand due to the color imparted to the deposit by the green glauconite grains.

Greensands are found in Cretaceous deposits of New Jersey (Merchantville member of the Bass River Formation),[107] the Crimea,[108] central Asia,[109] Argentina,[110] northwestern Australia,[111] the Gault in England,[112] and in oil wells 100 miles east of New Jersey.[113] Greensands are also in Mali, Niger and Chad,[114] southwestern Australia,[115] New Zealand,[116] Japan,[117] Madagascar,[118] and northeastern Australia.[119]

Over the past 14 years the Deep Sea Drilling Project has drilled into the sediments in the ocean basins all over the world. They have discovered the existence of mid-Cretaceous organic rich, black shales in every ocean basin.[120] Cool observes:

> Black clays from these various locales are remarkably similar in appearance and character.[121]

These mid-Cretaceous black shales are also found onshore in the Yezo Group on Hokkaido (northern Japan), the Kennicott Formation in Alaska, the Haida in British Columbia, the Horsetown Group in California,[122] as well as in Nigeria,[123] the Alps, the Caribbean Islands, and the southern Andes.[124]

Even though other lithologies outweigh the Upper Cretaceous Chalk, the chalk is very widespread. Chalk is a very special kind of limestone composed of the shells of microscopic animals, the coccoliths. In North America the Upper Cretaceous of the continental interior includes the Greenhorn Limestone, a chalky limestone, and the Niobrara Chalk. Jenkyns notes:

> The depositional setting of both the *Greenhorn Limestone* and the *Niobrara Chalk* was clearly a large epeiric sea of low relief stretching north-south across the continent of North America. At times of maximum transgression, when pelagic oozes were being laid down, the seaway was some 5,000 km long and some 1,400 km wide.[125]

To the south of this huge chalk deposit lies the Austin Chalk which is in the same position as the Niobrara. The Austin Chalk extends from northern Texas to northern Mexico where it is known as the San Felipe Formation. In England are the white cliffs of Dover which are in the identical stratigraphical position as the Austin Chalk. The Dover Chalk is found in Ireland, England, France, Germany, Poland, Scandinavia, Bulgaria, Egypt, Israel and Georgia in the Soviet Union.[126] The Gingin Chalk in the Perth Basin Australia is in the same position.[127] as is the Issek-djal area of Russia.[128]

One of the most interesting deposits of the Cretaceous is the Hippurite limestones. This limestone is composed of billions of dead pelecypods (Hippurites). Geikie says of these:

> These Hippurite limestones sweep across the center of Europe and along both sides of the Mediterranean basin into Asia, forming one of the most distinctive landmarks for the Cretaceous system.[129]

and further:

> The Hippurite limestone of southeastern Europe is prolonged into Asia Minor, and occupies vast areas of Persia. It has been detected here and there among the Himalaya Mountains in fragmentary outliers.[130]

Tertiary

Overlying the Cretaceous are the Tertiary strata. Only in the Tertiary rocks do we see the end of the worldwide systems of deposition. Geikie relates:

> The tendency towards local and variable development, which is increasingly observable as we ascend through the series of Tertiary deposits, reaches its culmination in those to which the name of Pliocene has been given.[131]

Nevertheless, there are two rather widespread deposits, one in the Eocene and the other in the Miocene. In the Eocene unique limestones occur which are called nummulitic limestones. Much like the Lower Mississippian crinoidal limestones or the Hippurite limestone of the Cretaceous, the nummulitic limestones are the shells of billions and trillions of quarter-sized nummulites. Geikie describes these beds:

> In Europe and Asia the most distributed deposit of this epoch is the nummulitic limestone which extends from the Pyranees through the Alps, Carpathians, Caucasus, Asia Minor, Northern Africa, Persia, Beloochistan, and the Suleiman Mountains, and is found in China and Japan. It attains a thickness of several thousand feet.[132]

Eocene nummulitic limestones are also found in Australia,[133] and Crimea,[134] India and the Himalayas.[135] The pyramids of Egypt are made from nummulitic limestone.

In the Miocene a deposit, similar in origin to the chalk, formed. Like chalk, diatomite or diatomaceous earth consists of the remains of microscopic animals called Radiolarian. In beds overlying the Oligocene strata, dead radiolarians, whose shells were siliceous instead of calcareous, became so numerous that some beds are little more than dead radiolarians. Jenkyns tells us:

> The best documented example of these is the Miocene *Monterey Formation* of California. The rocks are light coloured and vary from quartzose chert, through porcelanite to soft opaline diatomites. . . . The total thickness of the formation varies considerably from place to place but locally extends to around 3 kilometres.[136]

Identical deposits of identical age are found in Japan.[137] Other Miocene diatomites are found in Kamchatka,[138] Sakhalin Island,[139] the Bering Sea,[140] Romania, Spain, Sicily, Algeria, Italy,[141] the Black Sea region, the Caucasus,[142] and Chesapeake Bay.[143]

The Southern Continents

The southern continents from Carboniferous to the Lower Jurassic have their unique sequence of sediments known as the Gondwana series. They were named for the ancient kingdom of Gond in India.

In all the southern continents the Gondwana series begins with a tillite, which is an unsorted boulder-bearing bed, lying on a scratched and grooved substrate with striated boulders. In India it is the Talchir boulder beds;[144] in Africa, the Dwyka;[145] in South America the Palmeira Formation;[146] in Antarctica the Buckeye[147] or Metschel Tillite[148] and in Australia these glacial beds have a variety of names such as the Nangetty Glacials[149] or the Zeehan Tillite.[150] The similarity of these beds is emphasized when it is discovered that even the colors of the Talchir beds in India are identical to those of the Dwyka beds in Africa.

Lying over these beds are sands and shales which contain coal and the leaves of Glossopteris and Gangamopteris. These beds are called the Damuda series in India,[151] the Ecca series in Africa,[152] Rio Bonito in South America,[153] the Coal Measures in the Artesian Basin of Australia,[154] and the Mount Glossopteris Formation in Antarctica.[155]

Overlying these are the sandstones and shales without coal, Glossopteris, or Gangamopteris leaves but containing Dicroidium (Thinfeldia) leaves. Quite often these beds contain vertebrate bones. The Beaufort beds of Africa, the most famous of these bone beds, contain vertebrate bones by the thousands.[156] In India the Panchet and Mahadev series fulfills these criteria.[157] In South America these beds have a variety of names,[158] and in Antarctica these are the Fremouw beds.[159] Many of the sands of these beds show cross-bedding such as the Cave Sandstone of South Africa.

Overlying all these beds like icing on a cake are basalt flows. These volcanics are known as the Stromberg volcanics in Africa, the Serra Geral in South America, the Kirkpatrick Basalts in Antarctica, and the Rajmahal in India.

The wide distribution of these beds is awe inspiring and one wonders what could produce such similarity of strata over such a vast area. One also wonders whether these beds might not formerly have been of greater extent. In Afghanistan a series of coal-bearing sandstones lies on top of a boulder bed remarkably similar to the Talchir beds of India. In England a Permian boulder bed, identical to the Permian Gondwana boulder beds, is found contrary to all expectations of continental drift. Geikie explains:

> The breccias just referred to have much interest in the history of geological investigation, inasmuch as they were claimed by Ramsay in 1855 as proofs of glacial action in Permian time. He pointed out their resemblance to moraine-stuff and boulder-clay, showing that the shapes of stones recall those of ice-worn boulders and pebbles, and that in many cases they are distinctly striated. . . . But the character of the striation on the stones is strongly suggestive of ice-action, as is admitted even by those who do not wholly accept Ramsay's explanation. Since his day observations have multiplied in India, Australia and South Africa, which considerably strengthen his inferences, and make it probable that in late Carboniferous or Permo-Carboniferous times a rigorous climate did really extend for a time over a large part of the southern hemisphere.[160]

The "Continental Intercalaire" or Nubian Sandstone

The final rock layer we will follow is the "Continental Intercalaire" which is part of the Nubian Sandstone. Since this section is not referenced, consult the cited books on African Geology.

The "Continental Intercalaire" consists of continental sandstones containing silicified wood of *Dadoxylon* and a fossil fish, *Ceratodus*. These beds are found in Madagascar, Tanganyika, Kenya, Sudan, Egypt, Libya, Algeria, Chad, Niger, Zaire, South Africa, and Arabia, Iraq and Jordan. In short it is found all over the African continent. In the south, these beds cover the Gondwana sediments. However, once again contrary to the predictions of continental drift, similar strata are found covering the Gondwana sequence in India.[161] In India these beds, known as the Kota sandstone and shales, contain the same fossil fish *Ceratodus* as does the "Continental Intercalaire." Thus once again similar sequences of lithology are seen on widely separated areas.

Implications

There are several implications of this systematic deposition of lithologies that we have studied. First, the present is not the key to the past. As Geikie pointed out the present depositional framework is only local and variable. Nowhere today do we see the widespread deposition of a single lithology on such a vast scale. An actualist (uniformitarianist) would claim that, given enough time, these local depositional systems would eventually cover similar vast areas. This would be wishful thinking since nothing we see being deposited today even remotely resembles what must have been taking place in the past. Dolomite, oolitic ironstones, and phosphate are but three of the many depositional systems that have either little known or no counterpart in today's world. Why is salt less abundant in Precambrian rocks than in Phanerozoic ones? We can only speculate how some of these beds came into being.

The second implication of this work is that the geologic periods used were generally determined by fossils, yet the lithology follows the fossils. Those creationists who feel that the geologic column does not exist and those who feel that index fossils do not work need to explain why the fossils *and* the lithology tend to parallel each other. Of course time will be needed to develop a satisfactory explanation for these phenomena.

The third implication is that since global systems of rock deposition exist, the deposition of the geologic column must be globally controlled. This fits our concept of global catastrophism better than it does the current actualist viewpoint even though we may not completely understand how the deposition occurred.

The number of dead organisms found in ancient rocks presents a problem to the creationist position. The trillions of dead and smashed crinoids found in Mississippian strata, the billions of hippurites and nummulites found strewn from Europe to Asia and the mass of dead microscopic animals found in Chalk and diatomaceous earth require some explanation in order to fit within our preferred chronology. These dead animals represent several times the living organic matter contained on the present earth. Once again, though, we are free to appeal to non-uniformitarian agencies to explain these items. Along with this problem is the question as to why species living today are not found in these rocks. Evolution is not the answer but a creationist answer needs to be found. In a future paper this author hopes to deal with that problem.

Appendix

Clark and Stearn estimate that the Mission Canyon formation contains an estimated 10,000 cubic miles of broken crinoids.[162] Dividing this by the surface area of the earth, 1.9695×10^8 square miles will yield the average thickness of a layer of broken crinoids if they were to be spread around evenly over the surface of the earth. This yields 5.07×10^{-5} miles thick. Converting to inches one finds that the layer is 3.2 inches thick or 8.17 centimeters thick.

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SURVIVAL OF FRESHWATER AND SALTWATER ORGANISMS IN A HETEROGENEOUS FLOOD MODEL EXPERIMENT

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The Noahic flood destroyed all the air breathing animals except those on the ark. No doubt the flood also took a major toll on freshwater and marine organisms due to the turbulance, turbidity, changes in salinity and temperature. Some marine animals probably survived by simply tolerating changes in salinity. Survival of a marine reef fish, Blue Damsel, Abudefduf uniocellatus, was tested at different rates of freshwater dilution. It was found that the salinity where the fish lost the ability to swim was the same when exposed to dilution rates of 15 0/00/hrs (parts per thousand per hour) and 1.5 0/00/hr but was higher with the slow dilution rate of 0.031 0/00/hr. These data suggest that marine organisms could not have survived a homogeneous freshwater deluge.

A heterogeneous flood model was set up in a 55-gallon aquarium. A quantity of saltwater 20 cm deep was overlaid with freshwater and the system was exposed to outdoor summertime weather conditions in western Oklahoma. Marine algae (Phaeophyta and Chlorophyta), brine shrimp (Artemia nauplii), a hermit crab and some marine gastropods were introduced into the saltwater portion. A goldfish (Carassius auratus), two mosquito fish (Gambusia affinis), and freshwater plants were introduced into the surface layer. Although some mixing occurred, all the organisms survived four week exposure to outdoor conditions suggesting that protected pockets of marine organisms may have survived the flood by being overlaid with freshwater.

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Introduction

THE FLOOD AND LIVING ORGANISMS: The flood described in Genesis was a catastrophe of such magnitude that its effects are difficult to grasp. No doubt raging waters during the flood and the receding waters at the end of the flood shaped much of the earth's

topography. Many excellent papers dealing with flood geology have been published in this journal.[1-4] Much of the abundant fossil record was deposited during the flood and such a record is testimony to the death and destruction brought by the deluge.[5]

Terrestrial animals, including man, survived by God's provision of the ark. The Biblical account, however, is silent regarding survival of other organisms. Broadly, one may divide other organisms which must have survived the flood into the following three categories: terrestrial plants, aquatic (freshwater) plants and animals, and marine (saltwater) plants and animals.

Howe[6] provided evidence that some kinds of terrestrial plant seeds can survive long periods of soaking in varying concentrations of salt water. Perhaps other plants survived in floating masses and certainly many land plants survived as accidental and planned food stores on the ark.

Freshwater plants and animals were no doubt drastically reduced in numbers by the flood. As the flood developed, turbulence, turbidity and changes in salinity, temperature and dissolved oxygen would destroy most of the organisms living in the water. The decomposing bodies of drowned terrestrial animals and plants would further reduce available oxygen and alter nutrient balance. Nevertheless, it is quite conceivable that most kinds of freshwater organisms could, at least in small protected places, survive and even reproduce during the terrible deluge and repopulate suitable aquatic habitats following the flood. One such example being the freshwater alga, *Lemanae fucina*, which, although being vegetatively stunted and having its sexual development retarded, does withstand short and repeated exposures to saltwater.[7]

Survival of marine plants and animals during the year of the flood is less obvious. Many estuarine and some tidepool species are euryhaline and thus can tolerate marked changes in salinity. Some organisms complete portions of their life cycle in one medium only to reproduce in another. For example, salmon, striped bass and a few other fish spawn in freshwater and mature in saltwater. Eels reproduce in sea water but grow to maturity in freshwater streams and lakes. Such animals (and euryhaline plants as well) could survive, although many individuals would succumb to the stresses inherent in the flood. Even the euryhaline teleost, *Fundulus kansae*, fish require several days to adjust to rapid changes in salinity.[8]

There are, however, many kinds of marine plants and animals that are stenohaline and thus cannot tolerate large changes in salinity. The internal salt balance of marine organisms is precisely regulated and has been studied for over 50 years.[9] Even the breaking of a small dam and subsequent flooding of a marine harbor by freshwater took a heavy toll on marine fauna.[10]

Two models have been suggested for the survival of the flood by stenohaline organisms. Whitcomb and Morris, among others, have suggested that if the changes in salinity were slow enough marine life could survive.[11] Indeed, many organisms can adjust to moderate changes in salinity if the changes are gradual. Young barnacles can withstand exposure to 3 0/00 salinity if reduced slowly.[12] However, many marine organisms seem not able to survive freshwater dilution beyond certain limits no matter how slowly the dilution occurs.[13] Starfish, *Asterios forbesi*, can survive dilution to 16% for two months and survive indefinitely at 18-20%. They survive short exposures to 3% but die after one hour exposure. Attempts to increase the tolerance of starfish to low salinities by slow, gradual changes of salinity failed. An absolute threshold of 16-18% exists for starfish.[14]

A second model, suggested earlier, is that of a heterogeneous flood. In the heterogeneous flood model, preflood seas were thought to have been overlaid with freshwater during the flood. Such a system is, for a time, physically stable due to the greater density of the saltwater. Limited data from an earlier experiment indicated survival of both aquatic and marine organisms in the same small aquarium is possible.[15] Several examples of naturally occurring heterogeneous situations have been described. In the previously mentioned flooding of Newport Bay, freshwater persisted atop saltwater for several days.[16] Wood and Straughan describe a typical situation where freshwater flows into the ocean forming a freshwater wedge riding above saltwater. Hot brines overlaid with freshwater were described in Venezuela.[17] Deep water brines are found in the Red Sea[18] and Gulf of Mexico.[19]

The purpose of this study was to investigate both models experimentally. Marine fish were tested for their tolerance to freshwater dilution at different rates and a two-layer heterogeneous aquarium was established outdoors to test survival of marine and aquatic organisms and to measure the physical stability of such a system.

Experimental Methods

DILUTION TOLERANCE MODEL: Two 10-gallon aquaria were partially filled with 20 liters of artificial seawater, the bottom was covered with crushed oyster shells and brine shrimp were added to each. The water was aerated and the systems were maintained at room temperature (22-23°C) throughout the course of the experiment. Blue Damsel Fish *(Abudefduf uniocellatus)* were placed in both tanks. All the fish were approximately the same size. Fresh water was added to the experimental tank and saltwater removed to maintain a volume of 20 L. In the first rapid dilution experiment, salinity was reduced in twenty 1.5 0/00 increments over time periods of two hours or a rate of dilution of 15 0/00/hr. Two additional experiments (intermediate and slow dilution) were performed and salinity was reduced in twenty 1.5 0/00 increments over a period of 20 hours (1.5 0/00/hr) and 40 days (0.031 0/00/hr). Salinity was measured with a salinity meter (YSI Model 33). Observations were made on the activity level and behavior of the fish periodically between changes, and fish were removed when loss of locomotive ability (ability to right themselves) occurred. Salinity levels were recorded and the fish were placed in a seawater tank to recover. Ten fish were used in each experiment and means of the salinity where loss of locomotive ability occurred for each individual fish were compared by Student's t-test. Means were considered significant if $P < 0.01$.

HETEROGENEOUS MODEL: A 55-gallon glass aquarium was placed on a metal support stand and set up outdoors with the long axis oriented in an east-west direction to minimize the solar heating of the water in the tank. Styrofoam (1½") was attached to all but the north-facing side to reduce light and diurnal temperature changes. Styrofoam also insulated the bottom of the aquarium. An open lattice-roofed shelter was erected over the aquarium to reduce solar heating.

The 55-gallon tank was filled to a depth of 20 cm with artificial seawater from a commercial mix (Instant Ocean), the bottom of the tank covered with a layer of crushed oyster shell to buffer pH. Marine algae from an established seawater aquarium was added and the system was aerated thoroughly for three days. A good growth of algae to provide oxygen was developed and brine shrimp *(Artemia spp.)* were added. Marine organisms were then added to the system including a 6 cm Striped Damsel Fish *(Dascyllus aruanas)* a 5 cm Hermit Crab and sea slugs (Gastropods). These animals were allowed to adapt overnight to conditions in the tank before adding freshwater.

Freshwater was overlaid above the saltwater to a depth of 16 cm above the saltwater level. It was added by pouring it gently onto the surface of a board floating on the surface. This allowed the filling of the tank without greatly mixing the two layers. Two locally collected 2 cm Mosquito Fish *(Gambusia affinis)* and a 4 cm Goldfish *(Carassius auratus)* were then added to the freshwater. Also added were a freshwater snail and duckweed *(Lemma sp.)* collected locally.

Twice daily, on alternate days, at 8:30 AM and 4:30 PM, measurements were taken at 2 cm intervals from the waterline to the bottom of the tank. These measurements included water temperature, dissolved oxygen content, and salinity. Measurements were made using a Dissolved Oxygen Meter (YSI Model 51B) and a Salinity-Conductivity-Temperature Meter (YSI Model 33). Additionally, environmental measurements were taken including wind speed and direction, air temperature, relative humidity and approximate amount of cloud cover. Observations on the conditions and behavior of the organisms and the general state of the system as a whole were also recorded at these times.

Results

DILUTION TOLERANCE: Blue Damsel Fish exposed to dilute saltwater turned dark just prior to loss of locomotive ability. The rapid dilution rate of 15 0/00 salinity/hr loss of locomotive ability was observed at 0.80 ± 0.08 0/00 salinity. Loss of locomotive ability occurred at 0.88 ± 0.36 0/00 salinity for the intermediate dilution rate of 1.5 0/00 salinity/hr. These results are not significantly different even though rates of dilution are different by a factor of 10. At the slow rate of dilution of 0.031 0/00 salinity/hour the fish stopped swimming at 20.3 ± 1.1 0/00 salinity. Slow dilution then resulted in less ($P < 0.01$) tolerance to dilution for fish in this experiment.

HETEROGENEOUS MODEL: The salt and freshwater layers remained relatively distinct in the heterogeneous aquarium flood model for the 30-day duration of the experiment. All the animals and plants survived

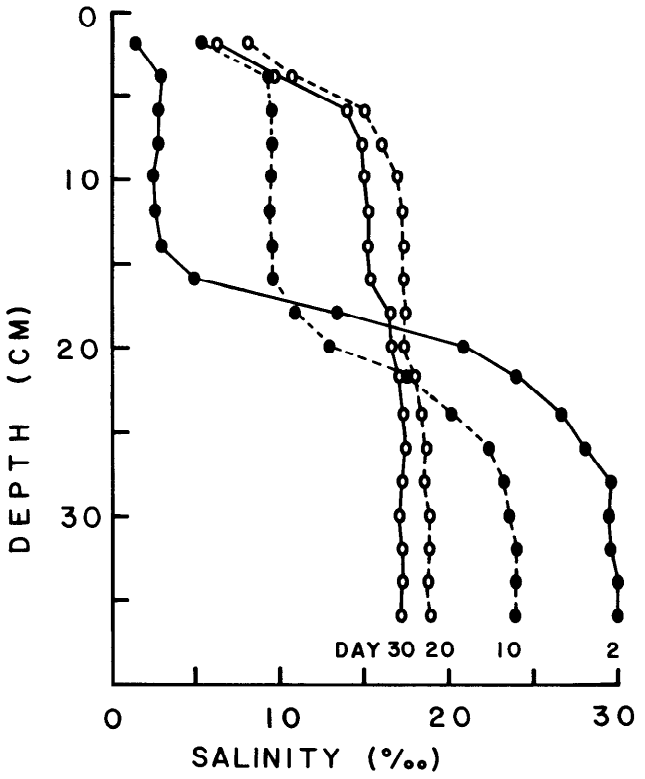

Figure 1. Relation of depth in centimeters from the surface to salinity in parts per thousand (o/oo) during the 30-day experiment.

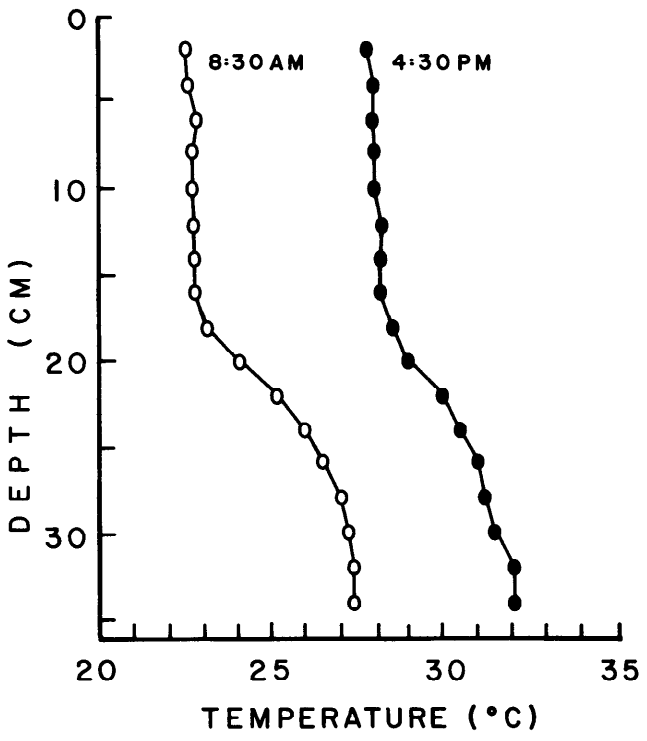

Figure 2. Temperature profile at different depths in the morning and afternoon. Lower saltwater remained warmer especially at night.

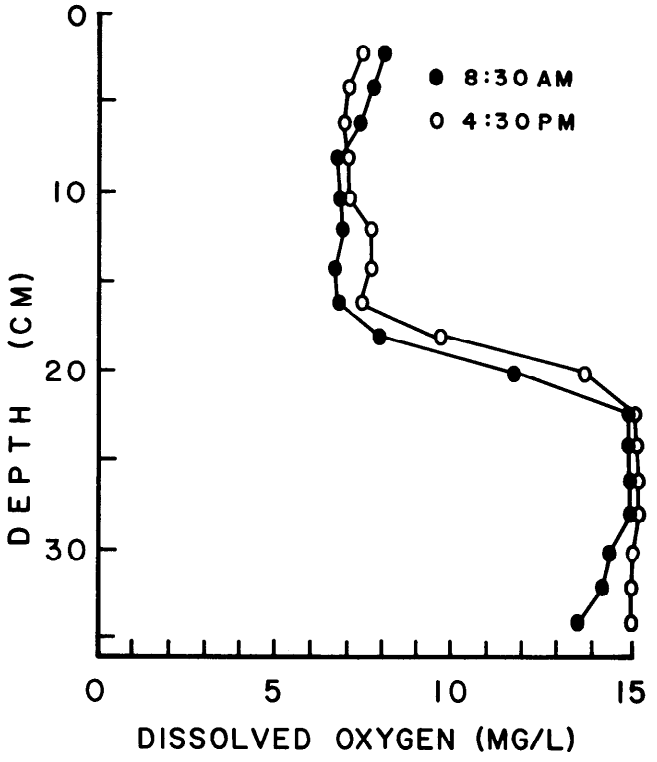

Figure 3. Dissolved oxygen profile at different depths in the morning and afternoon. Lower readings were above 15 mg/L and were off scale on the oxygen meter. The lower saltwater layer consistently contained more oxygen than the upper freshwater due to photosynthesis of marine algae.

even though there was an expansion of the transition layer between salt and freshwater.

Throughout the experiment the goldfish remained in the freshwater layer with only short excursions into the lower saltwater layer during the first few days. Conversely the damsel fish remained in the saltwater layer except for a few feeding excursions into the transition layer and upper region of the freshwater. In contrast the mosquito fish moved freely throughout the aquarium showing no preference for any salinity region. The sea slugs and hermit crabs remained exclusively in the lower portion. Some brown algae were limited to the saltwater and some green algae seemed to do best in the transition layer and increased in area on the glass as the transition layer expanded with time.

Figure 1 shows the salinity changes throughout the experiment. There was some dilution of sea water and salinity increased in the freshwater, however differences were still evident after 30 days. Figure 2 shows morning and afternoon temperature profiles and Figure 3 shows the morning and afternoon dissolved oxygen profiles at mid-experiment. Figure 4 shows changes in isohaline depths during the course of the experiment.

Discussion

Results of the dilution tolerance experiments and much of the literature do not support the suggestion that marine animals can tolerate freshwater dilution. Many organisms have a relatively fixed limit to changes in salinity they can withstand no matter how slow the dilution rate. It is reasonable to expect organisms to withstand a greater salinity shock than that in which they can survive. Such is certainly the case for temperature tolerance. Data from this study suggest less tolerance to dilution at very slow rates. This raises serious questions as to how marine organisms could have tolerated a homogeneously mixed freshwater deluge.

Results from the heterogeneous flood model experiment are more encouraging. All plants and animals did survive and mixing of freshwater and saltwater were incomplete even with exposure to outside environmental conditions (see Figure 4). It is interesting that the highest oxygen levels were found in the lower saltwater layer. This suggests that oxygen would be available for marine life if sufficient light penetrated the overlying freshwater layers. Photosynthesis would therefore provide for the growth of autotrophs and the entire marine food chain. In addition, there no doubt would have been a continual "rain" of nutrients from the upper freshwater layer.

A "natural" system, as occurred during the flood, would obviously be more complex and stable than our miniature model. Increased plant and animal diversity would improve stability. Nutrient reserves would abound and a mixing interface region measured in meters or even tens of meters would still permit stenohaline species to exist above and below.

The vast majority of marine life probably was destroyed during the flood as was true of terrestrial plants

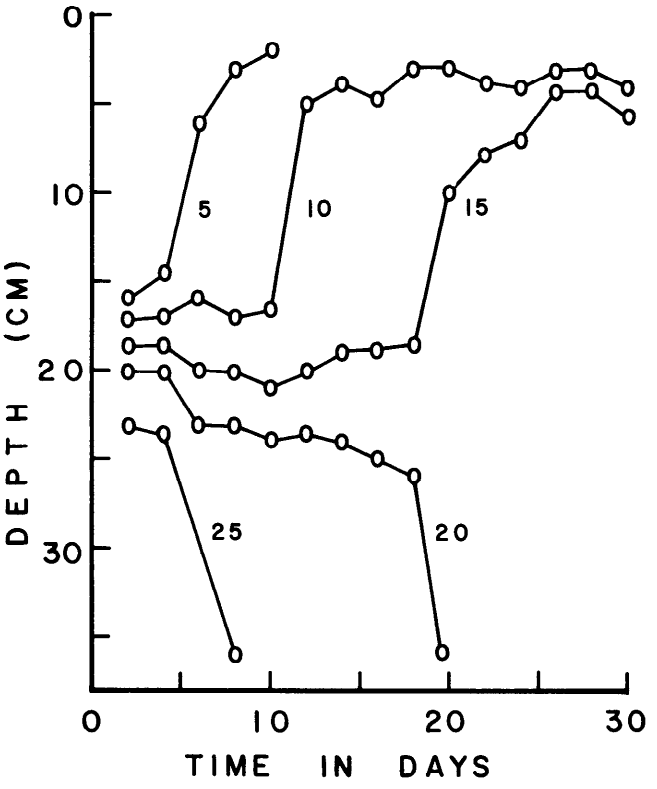

Figure 4. Isohaline depths for different salinities during the 30-day experiment. The thickness of the transition zone separating fresh and saltwater increased during the experiment. Mixing was due to activity of the fish in both regions and wave action (from wind).

and animals and much of the aquatic life. It may be argued, however, that small protected areas of the pre-flood seas were overlaid with freshwater during the flood and marine organisms could have survived. Obviously, additional research is needed, especially regarding the reestablishment of our present seawater salinity at the end of the flood.

Acknowledgements

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DARWIN'S LAST HOURS REVISITED

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The material presented in the tract, Darwin's Last Hours, does not correspond with the facts known about Charles Darwin. It is suggested that Christians not use the tract in any creation-evolution discussions.

Introduction

In 1975 I wrote an article entitled Darwin's Last Hours[1] as an answer to a tract of the same name. Since the appearance of that article, a number of critical references have been made to it in some publications.[2] My original concern was that this tract was being distributed in quantities to high school students for use in biology classes as support for the creationist position. When I was asked to evaluate it, I studied it very carefully. After some research in university graduate libraries, I felt that sufficient reasons had been accumulated to doubt its authenticity and question its proposed use. Apparently wishful thinking dies hard.

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The Darwin Tract

It is true that Darwin's undergraduate degree was a bachelor of divinity. However, he made the Beagle voyage before he could enter the ministry. On his return, he had lost all desire to become a vicar. Later he lost his Christian faith as well. The original tract carried a short account of a lecture, supposedly documenting Darwin's return to the Christian faith. A number of variants have appeared but all agree that the lecturer was a Lady Hope, a consecrated Englishwoman from Northfield, England, according to one version. The location of the delivery of the lecture is not specified.[3] According to another source, the lecture was delivered on August 15, 1915 in Northfield, England. Subsequently it was published in the *Watchman Examiner*,[4] date unspecified. According to yet an-

other source, Lady Hope gave her lecture in America and gave a report to the *Boston Watchman Examiner*.[5] Still another account states tha Lady Hope delivered her lecture at D. L. Moody's educational establishment at Northfield, Boston and her written account appeared in the *Boston Watchman Examiner*. That source does not take into account that Northfield is some distance from Boston.

There are two sources that report an American presentation and the publication in the *Boston Watchman Examiner*[6] (date still unspecified). Finally there is still the confusion of the two Northfields. Until now I am unable to reconcile these conflicts.

Other than these differences, the several accounts are in agreement. In referring to her visit with Charles Darwin, Lady Hope described him as having been almost bedridden for some months before he died. He was sitting up in bed, wearing a soft embroidered dressing gown, gazing out of the window. When she entered the room, he was holding an open Bible "which he was always studying", said Lady Hope. She mentioned that Darwin commented on the book of Hebrews and referred to it as the Royal Book.

A careful examination of the account of her visit reveals a number of discrepancies with known facts. The first one concerned that time of her visit. According to the account, it was made on a glorious autumn afternoon. Darwin died April 19, 1882 so this visit would have been made at least six months prior to his death. Yet, if we check the record of his activities during this period, we find no evidence of his being bedridden. Earlier in August of 1881 he and his wife traveled to London to visit his brother, Erasmus. In the months following, he wrote two short papers for the Linnean Society about his studies on roots and chlorophyll bodies. His correspondence remained rather voluminous through most of these six months and continued until the end of February 1882.[7] As late as March 7, 1882 he still attempted a short walk on the well-known "sandwalk," but suffered a seizure. There is no indication in any other work dealing with his life that would justify drawing the conclusion that Darwin passed through a lengthy period (six months) of being bedridden as the account seems to claim.

A second discrepancy which led me to doubt the reliability of the account of her visit with Darwin was that Lady Hope described him as registering agony when she reminded him of his work, *The Origin of Species*. Supposedly Darwin answered,

> I was a young man with unformed ideas. I threw out queries, suggestions, wondering all the time over everything: and to my astonishment the ideas took like wildfire. People made a religion out of them.

It was this quote that first aroused my doubts about the tract. One of the questions in my mind was the element of time. According to the record, Darwin first wrote on transmutation of species in his four notebooks. According to his journal in 1837, "In July opened first notebook on 'Transmutation of Species'."[8] When he wrote these words he was 28 years old, and one could say that he was in his youth when he *began* his work. However, the public knew nothing of these notebooks at this time and his work did not stop at that point. Reading his correspondence over the next years one sees that his thoughts followed a consistent direction. Twenty-one years later Darwin received the well-known Wallace paper and was astounded to find that it practically duplicated his own work. He recovered from the shock and, under the urging of his friends, Joseph Hooker and Charles Lyell, he hurriedly produced an abstract from his unpublished work on species. This abstract and Wallace's MS were then presented to the famous meeting of the Linnean Society in 1858. This was the first time that Darwin's theories were presented to the general scientific public. Darwin was 49 years of age and could not be referred to as a youth.

Actual Views of Darwin

The first edition of the *Origin*, published in 1859 when Darwin was 50, followed the appearance of this abstract. Considering these well-documented facts, it appears inconceivable to find Darwin referring to his work with the words "I was a young man with unformed ideas" as he is alleged to have done on his deathbed in 1881. One would believe that neither the writer of that account nor Lady Hope (if indeed it was she) had ever read *The Origin of Species*. Certainly anyone who has read the *Origin* cannot reconcile its earnest and lucid convictions with the disclaimers with which Darwin was supposed to have referred to it. Actually Darwin had deliberately prepared and released his abstract to ensure that he would also receive credit along with Wallace for his ideas on the origin of species.

Another point to be considered is that the *Origin* was carefully revised by Darwin for each of the six editions. These revisions extended from 1859, the date of the first edition, to 1872 when the sixth edition appeared. There are documented instances of reactions to criticism by Fleeming Jenkin in the *North British Review*. Also in a letter to Hooker, Darwin noted that Fleeming Jenkin had given him much trouble. At this time Darwin was 63 years old and some thirteen years had passed since the first appearance of the *Origin*. It is understandable why I had such grave doubts as the veracity of the Lady Hope account.

Supporters of the theme of *Darwin's Last Hours* would have to believe in the existence of a monumental conspiracy by hundreds of people working to conceal the fact that Darwin was personally involved in the development of his work. In turn, this would have to mean that through at least 32 years of Darwin's life some other individuals had written papers under his name, published results of laboratory work that he supposedly had performed, and turned in papers consistent with his thoughts to learned societies under his name. Furthermore, what was Darwin doing all of this time? He could not have remained in ignorance of the events for such a lengthy period of years. This would be absurd with the documentation of the known facts about these events.

In writing the *CRSQ* article, I concentrated on the available correspondence of Darwin during the closing years of his life to make the point that none of these letters gave any hint of any change of stance prior to his death. My critics have simply ignored the evidence

of such letters. I had quoted passages from Darwin's correspondence spanning the period from the two years before up to two weeks before his death. The tone of all of these excerpts is consistent with Darwin's views as expressed in his various public writings during his entire active life.

Lady Hope

In his latest work, *The Rise of the Evolution Fraud*[9] M. Bowden of England has discussed the issue of *Darwin's Last Hours*. In referring to my failure to find a Lady Hope, he reports that recently a Mr. L. G. Pine, one time editor of *Burke's Peerage* wrote Dr. C. E. A. Turner, Chairman of the Creation Science Movement, the following:

> Now with regard to Lady Hope, I think that I have uncovered her identity, which should be a help to tracing the story . . . under the article in B. P. for Viscount Combermere I found mention of Elizabeth Reid Stapleton-Cotton, whose date of birth is not given (convention of those times), but who was born soon after 1841. She married in 1877 Adm. of the Fleet Sir James Hope, G.C.B. She was obviously much younger than he. He d. in 1881, and she married again in 1893 a Mr. T. A. Denny. She preferred to be known as Lady Hope right up to her death in 1922.
>
> I think this is the Lady Hope in connection with Darwin, as no other at that time, i.e. around 1882 will fit.[10]

An interesting facet in this discussion seems to be the opinion of my critics that the veracity of the account would be established if Lady Hope could be identified. Nobody seemed at all concerned over the fact that this verification of the mere existence of Lady Hope did nothing towards establishing the truth of the story. I do not believe that the discovery of Mr. Pine of a Lady Hope adds anything in the nature of substantiation to the original tract, *Darwin's Last Hours*. The doubt as to the authenticity of the account rests, not on whether or not Lady Hope existed, but on whether the whole account is consistent with the facts known and the writings of Darwin.

An interesting development that occurred subsequently to the appearance of the Lady Hope account concerned Darwin's daughter, Henrietta. She was born about 1842 and married a barrister, Richard Litchfield. *The Humanist* reports that Mrs. Litchfield wrote to *The Christian*, February 23rd, 1922 as follows:

> I was present at his (Darwin's) deathbed. Lady Hope was not present during his last illness, or any illness. I believe he never even saw her, but in any case she had no influence over him in any department of thought and belief. He never recanted any of his scientific views, either then or earlier. We think the story of his conversion was fabricated in the USA. In most of the versions hymn singing comes in and a summerhouse where the servants and villagers sang hymns to him. There is no such summerhouse and no servants or villagers ever sang hymns to him. The whole story has no foundation whatsoever.[11]

Lest there be come who think that the journal that refers to this letter might be suspect, I would repeat that actually there is no further need for additional evidence. It simply seems consistent with the other evidence.

Conclusions

After considering the above points, in my opinion it is very unwise for Christians to propose the use of the tract *Darwin's Last Hours* in any form as being any kind of worthwhile evidence in a discussion about the validity of macroevolution or creation. The writer believes that those who defend the creationist account of origins have the obligation to examine and study their supportive material as rigorously and painstakingly as they do macroevolutionary material. This means checking back to the sources and examining all relevant reference material. The cause of creation is not served by spurious reporting, nor by the dissemination of unfounded accounts. The use of evidence that is extremely questionable can only weaken the arguments of those who use it.

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QUOTE

Public education in the United States, from kindergarten through to graduate school, is actively (though in most cases not intentionally) fostering scientism and its correlate of ideological arrogance. When the basic humility and restraint of judgment and action consistent with a view of science as indeterminate, probabilistic, and heuristic are lacking, it is easy to turn to scientism, to find appealing the prospect of becoming part of the priesthood of scientism equipped to perform the sacred rites of uncovery.

Eastman, George. 1969. Scientism in science education, *The Science Teacher* (April), pp. 19-22.

THE DIVINE ESSENCE IN EVOLUTIONARY THEORIZING — AN ANALYSIS OF THE RISE AND FALL OF EVOLUTIONARY NATURAL SELECTION, MUTATION, AND PUNCTUATED EQUILIBRIA AS MECHANISMS OF MEGAEVOLUTION

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It is the author's thesis that true science, namely, experimentation and observation, is inseparably united with God. Science as a reasoning process and our ability to reason as human beings have the Creator as their common source. The inseparability between science and God is especially apparent in the question of the origin of life. This article describes the futility confronting materialistic theorizers to explain the origin of life without invoking miracles.

The problem confronting materialistic theorizers is the requirement of formulating a testable, on-going mechanism for the origin of life as opposed to a nontestable, discontinuous mechanism. The former is within the realm of science, while the latter is not. Darwin's on-going evolutionary natural selection mechanism met that requirement. The article goes on to explain how, when Darwin finally did deal honestly and objectively with the data, he abandoned evolutionary natural selection. Then, in order to avoid conceding to special creation and continue to meet the scientific requirement of postulating an on-going mechanism, he switched to Jean Lamrack's theory of acquired characters, which never had credibility. Darwin's correct insistence that a materialistic explanation for the origin of life must be by means of an on-going mechanism, perhaps can only be fully appreciated at a time when special creation is the predominant belief.

Darwin's reaction to the dilemma is contrasted to the reactions of Hugo De Vries and present-day evolutionists, like Stephen Jay Gould, who also found evolutionary natural selection untenable as an on-going mechanism. Their reaction has been to abandon true science by postulating periodic mutability and punctuated equilibria, which, because they are not on-going, are statements of belief. Essentially, they were led back to creation in spite of themselves. Science, within its limitations, will always reveal creation, because it reveals intelligent design in nature, while not revealing an on-going mechanism; together they add up to creation.

Introduction

There exists what may be described as a divine essence in evolutionary theorizing by proponents of evolution. This may sound blasphemous, since the philosophical purpose of evolution is to convince the public that life arose by chance, without the miraculous power of God. This divine essence is not revealed in the success, but rather in the failure of materialistic theorizers to formulate a scientifically legitimate theory for the origin of life. As the textbooks and the history of evolutionary theory reveal, the official version is not theistic evolution; it is atheistic evolution.

Divine essence describes the connection or interrelationship that exists between one's ability to reason as a human being and science which is basically a reasoning process. Divine essence, as manifested in evolutionary theorizing, is an invisible quality of God as described in Romans 1:20. Our reasoning ability and science have the Creator as their common source; consequently, they can never be separated. Because of this, anyone using science in an attempt to deny creation is attempting the impossible. They must, in fact, appeal to something that is a *supranatural* belief, meaning it is nonscientific in the sense that it is beyond observation and experimentation. A supranatural belief is inherently materialistic, rather than theistic.

Exactly what does happen when a theorist attempts to use science to explain the origin of life exclusive of divine creation? Divine essence, that subtle connection between science as a reasoning process and our ability to reason as human beings cannot be denied; therefore, only two futile options exist for the atheistic theorizer. One option will be to formulate a scientifically legitimate hypothesis based upon a testable, on-going mechanism. In the case of evolution, this type of hypothesis is destined for disproof because it cannot possibly be the truth if creation is valid. The second possible option is to formulate a supranatural hypothesis. A supranatural hypothesis is outside the realm of science because it is not on-going, therefore, not refutable. It is more accurate to describe a supranatural hypothesis as a belief based upon the investigator's personal philosophy, religion, or intuition. A supranatural belief is what divine essence drives a materialistic theorizer to formulate once the failure of a scientifically legitimate hypothesis is recognized. A supranatural belief has no scientific legitimacy and exists as a philosophical attempt to "ungod the universe."[1] Obviously, it has no appeal to creationists, nor is it a threat to one's belief in special creation.

As an example of a supranatural belief, let us consider comparative anatomy, which is frequently mentioned as evidence for evolution. Comparative anatomy means to compare body parts and, according to the evolutionary belief, anytime similarities are observed among plants or animals it is taken to mean they evolved from a common ancestor. The impossible test for that belief would be to go back in time and

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witness evolution. One may make comparisons down to the molecular level, but it will never ever tell us how life originated. The *supernatural* belief for comparative anatomy is that life was divinely created with a plan involving similarities. A creationist would not expect every animal or plant to be different from each other in every detail. The creationist belief is no more testable than the supranatural belief, but being no less scientific than the evolution belief, which is itself nonscience, it is equally worthy of consideration. The creation interpretation for this type of evidence is obvious to the layman, but for the more technical evidence we need the aid of creation scientists.

To summarize, then, the two options for a materialistic theorizer of origins are to formulate a scientifically legitimate hypothesis, which will be disproved, or the last resort, formulate a supranatural belief which is nonscience.

Now let us consider the efforts of several evolutionists as they attempt to overcome divine essence as it pertains to the all-important question of a mechanism for evolution.

Three Concepts of Natural Selection

Three concepts of natural selection exist; one concept exists only in the minds of evolutionists and the other two concepts actually occur in nature. Darwin's concept of *evolutionary natural selection* postulated that nature could eliminate certain traits and preserve other traits in healthy organisms, consequently, creating new kinds. A second concept of natural selection, and the original one, dating back to 1836, was conceived by one Edward Blyth, a zoologist, as a conservative, not a creative mechanism, which would preserve the status quo by eliminating defective organisms.[2] This occurs when, for example, wolves tend to prey upon old and diseased deer.[3] A third concept, also a non-creative concept of natural selection, *random natural selection*, postulates that, although variations exist and competition exists, it is chance that determines which live or die.[4] This is observed when, for example, animals graze or when a bat flies around at dusk devouring insects that happen to stimulate its sonar system or when a robin removes an earthworm from the soil, etc.

Only Darwin's evolutionary natural selection is materialistic because it claims to be creative by means of a naturalistic mechanism.

Charles Darwin's And Jean Lamarck's Scientifically Legitimate Hypotheses

Although *The Origin of Species* is a totally biased presentation of the evidence for the origin of life, it must be acknowledged that the alleged mechanism for evolution, evolutionary natural selection, is within the realm of legitimate science. Darwin's evolutionary natural selection is not supranatural. It is on-going and therefore testable, making it legitimate science.

As stated previously, Darwin's concept of evolutionary natural selection postulated that nature could eliminate certain traits and preserve other traits in healthy organisms, consequently creating new kinds. The alleged elimination of short-necked giraffes while preserving longer necked giraffes is an example. Just how on-going natural selection is, Darwin explained as follows:

> It may metaphorically be said that natural selection is daily and hourly scrutinising, throughout the world, the slightest variations; rejecting those that are bad, preserving and adding up all that are good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic and inorganic condition of life.[5]

Obviously, the test for evolutionary natural selection is to observe it in action in the environment. Darwin never observed his concept of natural selection when he wrote the *Origin* and had to fall back on imaginary examples. The lack of observation of evolutionary natural selection combined with the problem of incipient organs (partly developed organs) led Darwin to abandon evolutionary natural selection in the sixth edition of the Origin. In this edition Darwin attempted to overcome the objections of St. George Mivart pertaining to incipient organs. Mivart's objection was that natural selection would be ineffective in preserving rudimentary organs since they would not be of any advantage until fully developed. For example, what advantage would there be in the first minute movement of the eye of the flat-fish to the upper side of the head? This argument can be made for every organ in every organism. To answer this objection Darwin was forced to go to Jean Lamarck's now defunct theory of acquired characters. He finally ended up stating the following about his own theory:

> I have now considered enough, perhaps more than enough, of the cases, selected with care by a skillful naturalist, to prove that natural selection is incompetent to account for the incipient stages of useful structures; and I have shown, as I hope, that there is no great difficulty on this head.[6]

That spells the end of evolutionary natural selection as a credible scientific hypothesis; the inevitable disproof became manifest. Exactly how and why Darwin abandoned natural selection is explained in detail in *The Secret of the Sixth Edition*.[7] The sixth edition of the *Origin* was published in 1872, and we see, then, that Darwin learned what Asa Gray, Father of American Botany, made clear in 1860: Natural selection cannot create organs, but "the organs being given, natural selection may account for some improvement . . ."[8]

But just what did Darwin mean when he stated at the end of the quote "that there is no great difficulty on this head?" Obviously there is the utmost difficulty, if natural selection cannot account for the beginning stages of development of an organ, it cannot account for the existence of fully developed organs either. The statement becomes clear when one realizes that Darwin did not abandon evolution, only the mechanism.

At first glance, it seems incredible that Darwin would switch to Lamarck's mechanism for evolution when it had been published prior to his own theory and had never been widely accepted. On the other hand, it does make sense, if Darwin was determined to be true to science. Any scientifically legitimate mechanism for evolution would have to be slow and continuous or on-going as opposed to sudden and discontinuous. Finding evolutionary natural selection

inadequate, Darwin switched to the only other choice he had that was also slow and continuous, namely, Lamarck's acquired characters. Darwin's line of thought is revealed as follows:

> Under a scientific point of view, and as leading to further investigation, but little advantage is gained by believing that new forms are suddenly developed in an inexplicable manner from old and widely different forms, over the old belief in the creation of species from the dust of the earth.[9]

We see, then, that Darwin had the issue properly in hand. A sudden, discontinuous mechanism had no scientific validity and would open the door to creationism, consequently, failing in the philosophical objective to "ungod the universe." Ironically, today Lamarck's theory of acquired traits is included in introductory biology textbooks as an example of a defunct theory, while Darwin's theory of evolutionary natural selection is taught as valid. Darwin must be given credit for maintaining scientific integrity by not switching to supranatural belief. Now let us learn how Hugo De Vries reacted to a similar predicament thirty-seven years later.

Hugo De Vries' Supranatural Belief

Hugo De Vries' two volume work, *The Mutation Theory*, may serve to illustrate a supranatural belief in origins. Published in 1909, *The Mutation Theory* succeeded in temporarily saving Darwin's evolutionary natural selection theory from growing criticism. The problem was that ordinary variability could not provide the unlimited variability needed for evolution. De Vries concluded that his alleged unlimited variability in the form of mutations still could not save evolutionary natural selection. That part of *The Mutation Theory* has not been made public by Darwin's proponents.

De Vries made his position clear when he stated "the great service which Darwin did was that he demonstrated the possibility of accounting for the evolution of the whole animal and vegetable kingdom without invoking the aid of supernatural agencies."[10] This tells us that in the absence of a scientifically legitimate naturalistic explanation for origins he would choose a materialistic supranatural belief rather than a supernatural belief.

De Vries' mental odyssey is interesting to follow because he began the first volume with an attempt to preserve evolutionary natural selection as a scientifically legitimate hypothesis, but concluded the second volume with an abandonment of evolutionary natural selection as well as legitimate science and is forced to formulate a supranatural belief for origins.

De Vries Attempts to Save Evolutionary Natural Selection

Initially De Vries attempted to preserve Darwin's scientifically legitimate theory by trying to prove that Darwin did incorporate mutations as providing unlimited material for evolutionary natural selection:

> Darwin asserts again and again that it must not be forgotten that under the term of variations mere individual differences are included. His variability is therefore always understood in a double sense. It consists on the one hand of individual differences and on the other of single variations. The latter are sporadic, spontaneous changes corresponding to our Mutations.[11]

But in opposition to De Vries opinion, Darwin dismisses mutations or "sports" as having any part of his theory. Referring to artificial selection, Darwin states that "man often begins his selection by a form or sport considerably departing from the parent form. Very differently does the natural law of selection act; the varieties selected differ only slightly from the parent forms . . ."[12] Not only does Darwin make a distinction between mutations and ordinary variability, but he discounts mutations entirely from his theory.

Darwin's thinking is in agreement with Alfred Wallace's opinion on the subject. According to Wallace, only individual variations or fluctuating variability provide the material from which evolutionary natural selection forms new species. His belief is "that animals and plants do vary in the manner and the amount requisite." While "single variations he regards as absolutely without significance; they have played no part, or at least hardly any, in the origin of species."[13]

We have been discussing three kinds of variability—individual variations or fluctuating variability, single variations, and mutations. De Vries insisted that Darwin meant for single variations to mean mutations or sports. The question becomes academic because in the fifth edition of the *Origin*. Darwin also discounts single variations as being of any significance for his theory:

> Nevertheless, until reading an able and valuable article in the "North British Review" (1867), I did not appreciate how rarely single variations, whether slight or strongly-marked, could be perpetuated.

Darwin continues with the following example of a single variation:

> If, for instance a bird of some kind could procure its food more easily by having its beak curved, and if one were born with its beak strongly curved, and which consequently flourished, nevertheless there would be a very poor chance of this one individual perpetuating its kind to the exclusion of the common form . . ."[14]

We learn from this example that the single variation is not a new trait, as would be the case with a mutation, rather a deviation of a trait that is already present. The one similarity that a single variation shares with mutations is that they would both occur at a very low frequency in a gene pool, and that would prevent it from ever supplanting other traits.

Aware of the concession regarding single variations that Darwin made in the fifth edition of the *Origin*, De Vries blames it on the pressure of criticism: "It was only by the pressure of criticism that he finally gave the place of honor to the ever present individual variations."[15]

De Vries Abandons Evolutionary Natural Selection

Finding himself unable to save evolutionary natural selection by having his mutation theory provide unlimited variability, De Vries attacks what he formerly tried to protect. He enlists the aid of others in this attack by reporting that "E. D. Cope was the first to clearly formulate objections against the doctrine of

selection. Selection preserves the good and weeds out the bad, but whence does the good arise? Obviously ordinary variability is not sufficient, and causes of an entirely different kind must be sought for." Also, "Carl Semper similarly rejects the selection theory."[16] Another of De Vries contemporaries points out "that individual variability is static rather than kinetic; and therefore does not provide material for natural selection."[17] Finally, Lord Salisbury, in his presidential address at the meeting of the British Association in Oxford in 1894, stated:

> The theory of selection is by no means to be regarded as proven; for a host of difficulties stand in the way of the acceptance of the explanation of evolution by the accumulation of ordinary (individual) variations.[18]

It becomes obvious from these quotations that at the turn of the century Darwinian evolution was on the verge of being tossed on the junk heap of discarded theories. De Vries himself categorically states his objections:

> It is an absolutely unproved assumption that individual variation extends its range by selection and increases "to an enormous extent." This is the weak point in . . . selection theory.[19]

And he insists "we require proof that this increase and accumulation takes place 'to the amount requisite' for the origin of species and subspecies; and this proof Wallace neither brings forward nor seeks."[20] He objects that "fluctuating variability is very limited" and "that the ordinary variability, as always manifested, is not sufficient" to create new kinds. He also points out that "fluctuating variability is linear; it oscillates only in a plus and a minus direction, whilst adaptation demands a variability which will produce variations in all directions."[21]

His conclusion is tantamount to informing the scientific community that it had promoted a theory that is incompetent to account for the origin of species: "Thus we see that the current form of the theory of selection cannot supply the kind of variability which the theory demands, whilst the doctrine of mutation can supply it . . ."[22]

What remains of Darwin's evolutionary natural selection hypothesis? Originally De Vries attempted to incorporate his mutation theory into evolutionary natural selection without disturbing its credibility. But now we learn that evolutionary natural selection is no longer a viable creative mechanism; it has been supplanted by De Vries' mutation theory. Mutations have become a means and an end in themselves while evolutionary natural selection has been relegated to its original concept of a conservative, not a creative mechanism, which was its legitimate intent as conceived by Edward Blyth:

> Natural selection is a sieve. It creates nothing, as is so often assumed; it only sifts. In other words, "the sieve of selection does no more than eliminate those of less fitness . . ."[23]

We see, then, that De Vries learned what Blyth made clear in 1836. It is interesting to note that one of the reasons De Vries gives for abandoning evolutionary natural selection pertains to the old problem of incipient organs. De Vries explains the difficulty as follows:

> The first insignificant beginnings of new characters do not come under the operation of natural selection since they are of no significance in the struggle for existence. This is the best known objection against the prevailing form of the theory of selection.[24]

We see, then, that De Vries finally comprehended what Darwin made clear in 1872. He continues by pointing out that his mutation theory overcomes the difficulty of incipient organs: "In the doctrine of mutation, however, these slow transitions and these slight advantages have no place."[25] He also adds that evolutionary natural selection cannot explain the existence of useless or harmful characters.

Thus we see that De Vries began by attempting to preserve evolutionary natural selection, by incorporating mutations into the theory, but realizing that that maneuver would not solve the problem of incipient organs, ends up, like Darwin, abandoning evolutionary natural selection. This leaves him with one remaining option which is evolution without selection, in other words, evolution by mutations. This is a scientifically legitimate hypothesis, the test being to observe mutations in the environment. We know that mutations do occur; the question is whether or not they are the kind that would make evolution possible.

Evolution Mutations Versus Creation Mutations

Previously we noted that De Vries commented as follows regarding individual variations: "It is an absolutely unproved assumption that individual variation extends its range by selection and increase 'to an enormous extent.' And he insisted, "We require proof that this increase and accumulation takes place 'to the amount requisite' for the origin of species and subspecies; and this proof Wallace neither brings forward nor seeks." He also objected that, "fluctuating variability is very limited" and that "the oridinary variability, as it is always manifested, is not sufficient" to create new kinds. These very same criticisms also apply to mutations. Do mutations occur of the type and range to make evolution possible? A mutation that can honestly be said to be evolutionary would have to meet the following criteria:

1. Since existence depends upon survival factors, it must be obvious that the mutation will enable the plant or animal to more easily survive in a natural environment. This would exclude frequently mentioned mutations such as seedless oranges, polled Herefords, and albino plants and animals, which make all of them less fit for survival. It is absurd to expect a useful-for-survival mutation to occur when all plants and animals are and have been surviving indefinitely, at least where there is no technological interference by humans. We can never scientifically prove the causes for any nontechnological extinctions in the past which may have been caused by catastrophes rather than survival inabilities. Technology is the present-day catastrophe for many species of plants and animals.

2. The mutation must be hereditary. There must be evidence that the mutation can be passed on to offspring in natural conditions.

3. The mutation must be natural, not the result of human interference such as with chemicals or radiation.

4. It must be proved that the "mutation" is new and not a previously unrecognized or unmanifested gene in the genotype of a species. This point has proved to be De Vries' downfall. Most of *The Mutation Theory* consists of experiments that he conducted with the evening primrose. *Oenothera Lamarckiana,* an unfortunate choice. Today it is conceded that the "mutations" in *O. Lamarckiana* that De Vries described are really within the range of the fluctuating variability of that species.[26] De Vries even went so far as to give new species names to variations of *O. Lamarckiana.* (Oenothera "species are now recognized as structurally hybrid races within a species.) It is interesting to note that De Vries was warned that confusing fluctuating variability with mutations could occur:

> The extreme opponents of my theory maintain that there are no mutations at all . . . What I have described as discontinuous changes, are, in their opinion, merely the extreme deviations brought about by ordinary variability; for the further these are from the mean, the rarer they are, and the greater are the intervals by which they are separated.[27]

And in another place he quotes a Mr. MacDougal as follows:

> The greatest misunderstanding which may likely arise in the consideration of these results will be that founded on the error of confusing fluctuating variability and mutability.[28]

5. Would the mutation result in megaevolution? For example, a mutation making a plant or animal smaller or larger would not conceivably warrant the belief that the organism would eventually become a new kind.

6. Finally, the mutation must be progressive, not entropic. Evolution postulates that life developed from simple to complex. On the other hand, mutations such as those already cited, including hemophilia and short-legged Ancon sheep, may be regarded as degenerative mutations. From the concept of creation we can assume that the world began in a state of perfection. Since that time, probably beginning with man's fall into sin, entropy has taken its toll. All of the mutations that I have mentioned are something less than what previously existed; a loss of perfection. Viewing mutations as degradations is in line with the second law of thermodynamics which states that matter goes from order to disorder.

These, then, are what I conceive as being the criteria necessary in order to claim honestly that a particular mutation is evolutionary. These are the criteria that the theory of evolution itself demands. When one reads about mutations in a textbook, the author generally states something to the effect that most mutations are harmful, which is an indication of creation and entropy, but does not list any useful mutations. That kind of statement is demeaning to science, because it is the theorist's responsibility to prove that all of the vital components of his theory really do exist. A critic of a theory should not be placed in the position of trying to prove that evolutionary mutations do not occur. It must be this way for the sake of science, otherwise chaos would reign with everyone insisting upon the truth of their theory without having to provide any facts to substantiate it.

Periodic Mutability or Punctuated Equilibria

Previously I stated that mutations, as a means and an end in themselves for evolution were testable by observation. But that requires that the occurrence of evolutionary mutations be regarded as continuous. Unfortunately, De Vries made his mutation theory a supranatural belief by describing the occurrence of alleged evolutionary mutations as periodic. The following quotes from *The Mutation Theory* show how De Vries made the occurrence of alleged evolutionary mutations periodic rather than continuous, converting it into a supranatural belief about origins.

> The ancestors of species that exist today have on this theory passed through immutable and mutable periods; the division of the large species into elementary species would be the result of the last or of some of the last periods of mutability.[29]
>
> But if mutability is a periodic phenomenon, we get around the difficulty of having to suppose that mutations should appear equally at all times . . .[30]
>
> But not all plants and animals are mutable at the present time; on the contrary, mutability is a very rare phenomenon.[31]
>
> Without giving a definite expression of opinion, it does not seem to me to be likely that mutability has continued throughout geological times without interruption. Therefore I think it more probable that there has been alternation between mutable and immutable periods.[32]
>
> How quickly have the individual periods of mutation followed on one another? We have very few data which enable us to arrive at any conclusion on this point. As is well known, the parts of plants which have been preserved in the sepulchers of the pyramids along with the mummies, and in other monuments of the same period, such as flowers, leaves, fruits, cereals, straw, and weeds of the fields, prove the great antiquity of many species which are still existing. Numerous species are no doubt older than the pyramids, and have therefore remained unchanged for a period of at least 4,000 years. The remains of lake dwellings, the drawings on Roman coins, and many other facts of the same kind conduce to similar estimates. We may therefore assume as a provisional conclusion that a few thousand years elapse on the average between two successive periods of mutations.[33]

De Vries seemed to have been unaware that in the last quote he is providing evidence for creation and the immutability of species.

Thirty-seven years after the publication of the sixth edition of the *Origin,* Hugo De Vries was led by divine essence to the same conclusion as Darwin, that evolutionary natural selection is a scientific failure. Both men were forced into a position of having to formulate a new mechanism for evolution or abandon it. But the similarity ends there. Darwin, you will recall, determined to switch to Lamarck's continuous theory of acquired characters, a testable hypothesis:

consequently, preserving both scientific legitimacy and the philosophical objective to "ungod the universe." On the other hand, De Vries, by switching to periodic mutability, a supranatural belief, as the mechanism for evolution, unlike Darwin, abandoned legitimate science but preserved what was more important to him, the philosophy that "ungods the universe."

If God's invisible presence (the divine essence in evolutionary theorizing) will not permit the formulation of a valid, materialistic scientifically legitimate hypothesis about origins, then it follows that the available evidence will ultimately lead theorizers to creation. Now let us see if that is not the case as far as punctuated equilibria is concerned.

Punctuated Equilibria

Recently, some seventy years after De Vries published his mutation theory, some evolutionists have renewed the theory of periodic mutability, without giving De Vries credit, under a new label called punctuated equilibria. Like De Vries and Darwin before them, they were forced to conclude that evolutionary natural selection is a scientific failure. Their reason for abandoning evolutionary natural selection is an additional problem long kept out of introductory biology textbooks, namely, the lack of intermediate fossils which evolution predicts. If evolution had occurred by the slow, continuous process of evolutionary natural selection, we should find numerous weird, transitional fossils in the earth's crust showing a change from one kind to another. Georges Cuvier, Father of Paleontology, explained the problem as follows—before the *Origin* was written:

> If the fossils do not show us the course of the supposed transmutations, what reason was there to believe that these unusual events had actually occurred? The fossils were our only record of life in the remote past and their lesson was obvious and not at all, Cuvier believed, what the transformists would have liked it to be. Not a continuous series of almost similar creatures but rather an interrupted sequence of dissimilar forms was what was discovered. "We may," said Cuvier, "respond to them in their own system, that, if the species have changed by degrees, we should find some traces of these gradual modification; between the paleotherium and today's species we should find some intermediary forms; this has not yet happened."[34]

Here we have a problem similar to the question of evolutionary mutations. Like evolutionary mutations, it is the theorist's responsibility to prove that transitional fossils do exist in a quantity large enough to make it conclusive; a critic need not attempt to prove that they do not. The universal strategy of evolutionists is to emphasize the positive data and ignore the negative. Creation, by the way, does not predict intermediate fossils.

According to punctuated equilibria, massive gene mutations occurred periodically in the past, a discontinuous process not presently observable and therefore not science. To illustrate the belief, let us consider what would be required to change a seed-eating bird into a woodpecking bird? The following mutations would have to occur: A mutation to lengthen the tongue, to make it sticky, to harden the beak, to lengthen the beak, to provide a cushion between the beak and skull, to rearrange toes and strengthen tail feathers, etc. These mutations would have to occur simultaneously in order to make the woodpecker functional. Some of these mutations would actually be detrimental if they occurred in the wrong order. For example, a long tongue in a short beak or the instinct to peck before a cushion of cartilage had evolved. A similar argument may be made for every living thing.

I said that periodic mutability and punctuated equilibria as scientific theories are really materialistic supranatural beliefs, but are they? Haven't evolutionists, in spite of their best efforts not to, been led back to creation? Isn't it obvious that the Creator will not be denied? The purpose of science is to attempt to make true statements about the environment. Science cannot prove the past nor predict the future, but within its limitations and because creation is the truth, the evidence will always lead one to creation and not to a materialistic theory of origins. Long ago Darwin explained where present-day evolutionists have come, as follows:

> He who believes that some ancient form was transformed suddenly through an internal force or tendency . . . will be compelled to believe that many structures beautifully adapted to all the other parts of the same creature and to the surrounding conditions, have been suddenly produced; and of such complex and wonderful coadaptations, he will not be able to assign a shadow of an explanation. He will be forced to admit that these great and sudden transformations have left no trace of their action on the embryo. To admit all this is, as it seems to me, to enter into the realms of miracle, and to leave those of science.[35]

The only difference between creation and punctuated equilibria is that the evolutionists want, for philosophical reasons, miracles without the Miracle Maker.

Conclusion

People and the environment are the subjects of study for scientists. Is their attitude toward their subjects of study altruistic or condescending? It is plain that, as far as the question of origins is concerned, they have a condescending attitude toward the public and young people in particular. Does any other field of science have such an unprofessional record of suppressing information that the public has every right to know? Contradictory information about naturalistic explanations for origins is never widely publicized nor entered into introductory textbooks. Yet, as we have seen, negative data doggedly keep reappearing among evolutionists, but they, just as doggedly, keep suppressing it. Should evolutionists be permitted to dictate a curriculum on their subject? Should we be learning from them when they have made it abundantly clear that they cannot learn from each other?

Has there ever been a greater misappropriation of taxpayers' hard-earned money? How else can one describe the funds absorbed by public school systems, which have been subverted to teach the evolution philosophy of origins? The indoctrination of many students to the evolution philosophy is directly contrary to the wishes of many taxpayers who have made

an effort outside the public school system to teach their children that they are the descendants of a created order and have an everlasting soul.

We creationists may rest assured in our belief in a miraculous creation. We may watch, not in a condescending way, but with sympathy, the futile ceaseless striving of those who would attempt scientifically to "ungod the universe." On the other hand, we should respond with indignation whenever a supranatural belief is presented to students as legitimate science. If there is such a thing as historical science and if speculation is science, then everyone must realize that one individual's speculation about the evidence is as good as another's. This is called "applied creation."[36] As explained at the beginning of this essay in regard to comparative anatomy and all other evidence, students must be informed of creation interpretations of the evidence for evolution. This prevents evolutionists from achieving their philosophical goal to "ungod the universe" and simultaneously reform both science and the curriculum. The basis for applied creation is taken from the National Education Association code of ethics which states: "In fulfillment of the educator's responsibility to the student, the educator shall not unreasonably deny students access to varying points of view." The purpose of applied creation is not to teach special creation apart from the evolution curriculum; it functions to eliminate bias within the evolution curriculum. Stated simply, applied creation is the acknowledgement that, in any scientific theory for the origin of life, students have the right to know when any of the evidence also fits the concept of special creation. In addition, students have the right to know when any evidence contradicts said theory. Applied creation makes no pretense of being scientific; it functions as a curriculum tool to keep the evolution curriculum honest and objective. What many people fail to accept in the creation-evolution controversy is the existence of an educational imperative entirely independent of creation science or evolution science. No student can make judgments on the quality of the evidence if there is no viable alternative to consider. Without an alternative, poor quality evidence for evolution becomes impressive; without applied creation, education becomes indoctrination.

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BOOK REVIEWS

From Fish to Gish, by Marvin L. Lubenow; CLP Publishers, Box 15908, San Diego, Ca. 92115. 1983, 293 pages. $9.95

Reviewed by Douglas E. Cox*

This book tells the story of the creation-evolution debates of the past 10 years, involving Drs. Henry Morris and Duane Gish of the Institute of Creation Research in San Diego. The majority of the debates occurred in universities across the U.S., but others were held in Canada, England, Australia, and even the Netherlands. The book documents the origin of the debates, and the influence they have had in bringing the Creationist viewpoint into prominence in the past few years.

Lubenow recounts his experience in organizing one of the debates at Colorado State University. He explains the presentations used in practically every debate by Morris and Gish, but the greater part of the book describes the various arguments and debating strategies employed by the evolutionist opponents. Lubenow relates often amusing, and sometimes embarrassing incidents, and captures the intense emotions and drama characterizing many of the debates. Appendices list the debates by cities, and names of evolutionist participants.

The book will be especially valuable to anyone planning to organize or participate in one of these affairs, and will interest all those wishing to be informed about the creation-evolution controversy.

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Genetic Engineering by J. Kerby Anderson, Zondervan Publishing House, Grand Rapids, MI 49506. 1982. 135 pages. $4.95.

Reviewed by George F. Howe*

J. Kerby Anderson earned his master's degree in ecology and evolution from Yale University and is director of research for Probe Ministries International. While his book does not center on origins, Anderson uses a literal view of Genesis One and other Bible passages as a basis from which to evaluate current developments in experimental biology.

The question, "What's wrong with amniocentesis?" is answered when he points out that this procedure is often used to persuade doctors and couples to proceed with abortions they may not otherwise choose to perform (pp. 22-23). He distinguishes between artificial insemination by sperm donor (AID) and artificial insemination by the husband (AIH) and then highlights the following pitfalls of AID: legal problems, ethical problems, and the resulting widespread increase in half-sibs within the human population. Here as elsewhere in the volume, his logic is not superficial but each situation is explored, treated fairly, and followed by conclusions based on law and sacred Scripture.

He shows that many current procedures like IVF (in vitro fertilization) can be ruled out both on medical and ethical grounds (pp. 57-58). Concerning IVF he also notes that, "We must make sure that the sanctity of human life is not trampled underfoot in the mad rush for new reproductive technologies." He rightly asserts that one keystone doctrine of medical practice—"prior consent"— is being sadly neglected in all cases of IVF. Abortion, he feels, has paved the way for IVF in that ". . . liberal abortion laws have made fewer children available for adoption today, and in a sense IVF has become a means by which to circumvent the problems brought about by abortion." (p. 68)

In a later section Anderson shows that "recombinant DNA" (r-DNA) is not the potentially dangerous field it was once believed to be. He explores creationist implications of the controversial "guidelines" that were enacted for r-DNA experiments and concludes that "Scientists showed responsible behavior by attempting to formulate guidelines for research while the hazards were still unknown. Unfortunately, they relied too heavily on evolutionary assumptions that kept the guidelines from being what they should have been." (p. 91) Perhaps this heralds an opportunity for design-oriented creationists like Anderson to present some new and better guidelines.

Throughout this book the author avoids slipping into "pat" reflex reactions. His literature search appears to have been thorough and he relates some pointed quotations from the experts. Erwin Chargaff (a worker whom CRS readers may recognize as having laid the foundation in analytical chemistry for the Watson-Crick DNA model) has pled for caution in treading upon biological rights of others as follows: "I may damage myself as much I want but not one iota of danger to others is permissible." (p. 96) Readers may likewise recognize the name of Sinsheimer who, together with Kornberg and Goulian, demonstrated that viral DNA will replicate outside a bacterial host cell (circa 1968). Robert Sinsheimer has asked this searching question: "Would we wish to claim the right of individual scientists to be free to create novel self-perpetuating organisms likely to spread about the planet in an uncontrolled manner for better or worse?" (p. 98) Author Anderson relates some of the frightening attitudes that perhaps underlie replies like this from noted scientists when he writes that: "One day while taking a course in evolution at Yale, I was surprised to hear my professor say that he hoped scientists would soon create a human-primate hybrid. He suggested that a woman be impregnated with primate sperm. Later I learned that some of my female classmates had come forward to volunteer for the experiment if it was ever run." (p. 99)

In another section he deals with cloning, patenting of microbes, and other aspects of genetic engineering. Christians, Anderson suggests, should distinguish between the proper and improper use of new techniques.

> We are in the genetic age. Just as the nuclear age has brought both good and evil, so we can likely expect the genetic revolution to bear both good and bad fruits . . . Christians must be willing to think, speak, and act from a Christian base in this area of genetic technology." (p. 115)

This book will be a valuable introduction of the subject for Christians and other students from high school level upwards. Counsellors, psychologists, and pastors would benefit from this work and the exposure it gives to the legal, biological, ethical, and scriptural aspects of complex subjects that often confront the average citizen these days—abortion, amniocentesis, IVF, AID, AIH, and others. Hopefully Anderson will continue his study of this rapidly-changing field and prepare new treatises as other developments arise.

Challenge and Response by Frederic R. Howe. Zondervan Publishing House, Grand Rapids, Michigan. 1982. 171 pages. $9.95.

Reviewed by George F. Howe*

Believers who work in the field of science naturally find themselves involved in defending the faith or "apologetics" as the task is commonly called. Yet we would each do ourselves a favor by reading this little book, *Challenge and Response*, as it contains some interesting distinctions that we will ignore to the detriment of the work we are trying to accomplish. For example, the author expresses concern that apologetics and evangelism be kept distinct because they are somewhat different enterprises with varying objectives. We shall discuss this concept further and apply it to creationism.

Frederic R. Howe is Professor of Theology at the Dallas Theological Seminary and long time specialist in apologetics and Christian evidences. Although asking that we keep the work of evangelism and apologetics separate, he has taken no schizophrenic approach to defending the faith for he writes of a "common ground" in logic which should be sought as one

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presents evidence in support of the faith. He holds that "Christians should not postulate two different kinds of knowing or epistemologies, one for the knowing of truths of faith and the other for the knowing of truths of history" (p. 62), but believes instead that we must not separate reason from revelation.

The author asserts that the non-believers' thought processes need not bar us from giving them proper apologetic evidences because "Scripture gives no hint that the thought processes of the non-Christian in raising objections differ from the thought processes of the Christian in answering objections." (p. 75)

He has much to say regarding the proper use of that ancient trilogy of arguments for God's existence—cosmological, teleological, and moral or anthropological. Without overemphasizing empirical proofs, Howe has carefully outlined the humanist and naturalist positions and discussed a pattern for answering these. Realizing that the Holy Spirit alone can cause one to internalize the tenets of Christian faith, he strikes a healthy balance between reason and revelation.

The author's high view of the role that Scripture itself must play in all this is obvious as he recommends a system of defense that follows the guidelines evident in the work of Paul and other apostles. He recommends that all apologetes know what they are contending *with* by using appropriate Scripture. Furthermore, he deals with certain passages which some have mistakenly used to assert that human intellect has no valid place in apologetics.

Historically-minded readers will appreciate the fact that the author has taken standard tests for historical accuracy and has shown how these apply quite successfully to the resurrection. In this same regard he also evaluated the landmark testimony of Josephus as a source that is independent of Bible records.

Throughout *Challenge and Response*, Howe has made skillful use of quotations from masters of the apologetic craft and from noted detractors of Christianity to amplify and illustrate points of concern in the text. In this volume he does not hand us some new, ready-made scheme of apologetics but seeks instead to lay a foundation on which readers can erect their own apologetic edifices. For this reason and others it will take its place as an important introductory textbook in this field at Christian schools across the country.

But it will be well to close by going back to Howe's original thesis that evangelistic efforts ought to be made distinct from apologetics. Under the circumstances in which the ACLU and various non-theist scientists have unfairly attacked the scientific creation model as being totally religious, we could take a lesson in wisely separating our efforts—not only distinguishing carefully between apologetics and evangelism but likewise between apologetics and scientific reports. Under the peculiar legal and educational situations that have developed lately, we should become more careful to separate our creation science from our creation theology and apologetics—to decide which articles we are producing to serve as a defense of the faith and which ones we hope will find their places in scientific libraries. In this way we would be far less vulnerable to the unfair charge that we are seeking to promote "religion" in the public classrooms.

A New Non-Doppler Redshift by Paul Marmet; published by the author (Department of Physics, University of Laval, Quebec, Canada G1K 7P4). 1981. 64 pages.

Reviewed by Don DeYoung*

The redshift method of measuring stellar distances was established by Edwin Hubble more than 50 years ago and remains controversial to this day. Many astronomers take the data as an evidence for the expansion of the universe following an ancient big bang explosion. They conclude from the redshift that many stellar objects are moving extremely fast and are by now billions of light years away from us. On the other hand, a minority of astronomers challenge such conclusions. These scientists believe that redshift measurements do *not* necessarily imply a big bang origin or even an expanding universe. Instead, the data may result from alternative known or unknown laws of science. This lively redshift controversy involves basic questions concerning the origin, extent and dynamics of the entire physical universe. The conflict today involves strong personalities, intriguing data and no clear solution! Paul Marmet's book deserves special attention by those interested in a serious alternative to the usual Doppler interpretation of stellar redshift. He is a physicist at the University of Laval in Quebec. The book is quite technical; however, derivations and conclusions are clearly presented.

The proposal developed by Marmet is that part of the observed redshift results from an energy loss of starlight due to interaction with gas molecules in space. In physics jargon, there is an inelastic forward scattering of light photons by interstellar electrons. A fraction of the incident photon energy is lost due to recoil effects, both when the photon is absorbed and again when reemitted. Marmet can theoretically reproduce the observed redshifts, as a cumulative effect, if the interstellar gas has an average density of .01 molecules/cm^3. This is one major shortcoming of the proposal, since the value is much higher than thought to exist in all but the most dense regions of space. Marmet suggests that this high predicted density of matter might be evidence for the "missing mass" which could eventually cause a collapse of the physical universe.

Many interesting implications result from Marmet's study. One in particular is that the acceleration of electrons during photon scattering would necessarily lead to a secondary bremsstrahlung radiation. Furthermore, this radiation might be in the radio frequency range. Marmet suggests that this bremsstrahlung might be the 3°K background radiation which was detected in 1965 and loudly heralded as evidence for a big bang explosion.

What is Marmet's view of the universe? He believes that the redshift observed for quasars is due to a combination of both scattering and quasar motion. The consequence is that the size of the known universe is still billions of light years, but the velocity of expan-

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sion of the universe is less than commonly believed. Also, Marmet's argument leads to the conclusion that the universe is *older* than 15 billion years, perhaps even infinite in age. The literal-day creationist can certainly profit from studies like that of Marmet without accepting all of the implications. Marmet has bravely challenged the standard interpretation of the redshift as evidence for a rapid universal expansion. One would hope that his analysis will find its way into astronomy journals for serious evaluation.

FLIP SIDE OF CREATIONISM

JOHN N. MOORE*

(Excerpts from a statement presented at the Eastern Area Convention, National Science Teachers Association, Atlanta, GA, 11 December, 1975).

Introduction

Evolution is often defined as some "change," or defined as any change in gene frequency. Necessarily, then, at least two degrees of change must be explicated in any rigorous discussion of evolution, i.e., (1) change *between* kinds of organisms, and (2) change *within* kinds of organisms. Change between kinds may be labelled *megaevolution*, and change within kinds may be labelled *microevolution*. Yet the latter is just genetic variation within limits and entails essentially no more than changes of gene frequency. No serious challenge to genetic variational changes within limits of kind need be considered here on scientific grounds.

But how scientific is megaevolution?

The real nature of science is aptly conveyed in the following by G. G. Simpson:[1]

> The important distinction between science and those other systematizations is that science is self-testing and self-correcting. The testing and correcting are done by means of observations that can be repeated with essentially the same results by normal persons operating by the same methods and with the same approach.

And further corroboration is found in the following by Francisco J. Ayala:[2]

> A hypothesis is empirical or scientific only if it can be tested by experience. . . . A hypothesis or theory which cannot be, at least in principle, falsified by empirical observations and experiments does not belong to the realm of science.

Position

I assert plainly that megaevolution does NOT meet such criteria as spelled out in the above quotations from men who are themselves evolutionary scientists. All the evidence grouped under morphology, embryology, anatomy, and blood and protein analyses are itemizations only of the circumstances that prevail. Essentially, any suggestion that basic similarities between kinds of organisms are evidence for megaevolution is based solely upon the *assumption*: that the degree of relationship of organisms depends upon the degree of similarity of organisms. However, as many scientists point out, no family lineage of organisms are established by such evidences contrary to claims of evolutionists.

Actually the only evidences of real import are genetic and fossil evidences. Yet all tests of hypotheses with regard to family lineage on a genetic basis clearly leave one with the impression of "fixity in kinds," i.e., only inviolate genetic barriers are known between major groups of living things. Always researchers, whether in the laboratory or in the field, conclude their work with the same kind of organism with which they began.

And further fossil finds, in general, are identified without much difficulty as previously existing examples of currently present forms or kinds of plants and animals. Also a long list of "living fossils" fits the concept of "fixity in kinds."

Predictions

A major prediction from the megaevolution model would be that researchers would find, as Darwin presumed, small modifications in existing organisms that would give rise to continuous changes such that many transitional variations would end in the appearance of new kinds of organisms. Small, continuous variational changes could be expected to accumulate to the degree that completely new organisms would appear eventually.

No confirmation of such a prediction from the megaevolution model is obtained through any amount of analysis of studies of genetic variation and Mendelian heredity. After over 70 years, a complete dearth of evidence is apparent regarding any prediction of accumulation of small, continuous variational changes from generation to generation of living organisms. Therefore the major prediction from the megaevolution model is a failure.

A major prediction from the creation model would be that researchers would find gaps between distinct kinds, or forms, of living (and past) animals and plants and that different degrees of variability would occur within known kinds of animals and plants. Full confirmation of this prediction from the creation model can be obtained from careful research and interpretation of data from comparative anatomy, embryology, serology, biochemistry, genetics, and fossil materials. Without doubt all of the data of gene combination and recombination, hybridization, mutation, isolation, distribution, and selection may be interpreted meaningfully, and conclusively, in support of the creation model.

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Lest anyone express concern that the creation model is based upon supernatural creation of basic kinds, let it be clearly understood that megaevolutionists repeatedly utilize concepts entailing *events beyond the natural events* observable by careful scientists. In short, megaevolutionists are dealing in the supranatural whenever they insist, (1) that the first life on earth came into existence through spontaneous generation, and (2) that any new physical traits have ever come into existence through mutational means. Neither spontaneous generation of the first life on earth nor the appearance of new physical traits can be documented in any sense of the nature of science as represented by Simpson and Ayala. Many creation scientists are stating explicitly that megaevolutionists *also* base their ideas upon the super-natural in a depth of belief and commitment easily identified as "dogma." Furthermore any belief in spontaneous generation of first life on the earth is a violation of the basic law of biogenesis, and the basic assumption of scientists of uniformity of natural events.

Conclusion

Selected indoctrination of young people at various levels of education in the United States regarding first origins of life and of humankind need not continue. Because the megaevolution model and the creation model are put forth as conceptual frameworks to explain "origins," science teachers are properly exercising their academic freedom and responsibility to present BOTH the megaevolution model and the creation model to their students. On the grounds of constitutional and civil rights of students and science teachers alike, there are no significant reasons why other science teachers in this United States, or in other countries, cannot learn to do likewise for their students.

References

1. Simpson, G. G. et al. 1962. Notes on the nature of science. Harcourt, Brace and World, New York, p. 9.
2. Ayala, F. J. 1974. Biological evolution: natural selection or random walk? *American Scientist* 62:700.

CREATION RESEARCH SOCIETY

History The Creation Research Society was first organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informed committee of 10 scientists, it has grown rapidly, evidently filling a real need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (with graduate degrees in science) and over 1800 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as probably the outstanding publication in the field.

Activities The Society is solely a research and publication society. It does not hold meetings or engage in other promotional activities, and has no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund is maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible.

Membership Voting membership is limited to scientists having at least an earned graduate degree in a natural or applied science. Dues are $15.00 ($17.00 U.S. for overseas) per year and may be sent to Wilbert H. Rusch, Sr., Membership Secretary, 2717 Cranbrook Road, Ann Arbor, Michigan 48104. Sustaining membership for those who do not meet the criteria for voting membership, and yet who subscribe to the statement of belief, is available at $15.00 ($17.00 U.S. for overseas) per year and includes subscription to the Annual Issue and Quarterlies. All others interested in receiving copies of all these publications may do so at the rate of the subscription price for all issues for one year: $18.00 ($20.00 U.S. for overseas).

Statement of Belief Members of the Creation Research Society, which include research scientists representing various fields of successful scientific accomplishment, 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. In 1970 the Society published a textbook, *Biology: A Search for Order in Complexity*, through Zondervan Publishing House, Grand Rapids, Michigan 49506. Subsequently a Revised Edition (1974), a Teachers' Guide and both Teachers' and Students' Laboratory Manuals have been published by Zondervan Publishing House. 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 assertations 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 man, 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 an historic event worldwide in its extent and effect.

4. We are an organization of Christian men of science who accept Jesus Christ as our Lord and Saviour. The account 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 Saviour for all mankind. Therefore, salvation can come only through accepting Jesus Christ as our Saviour.

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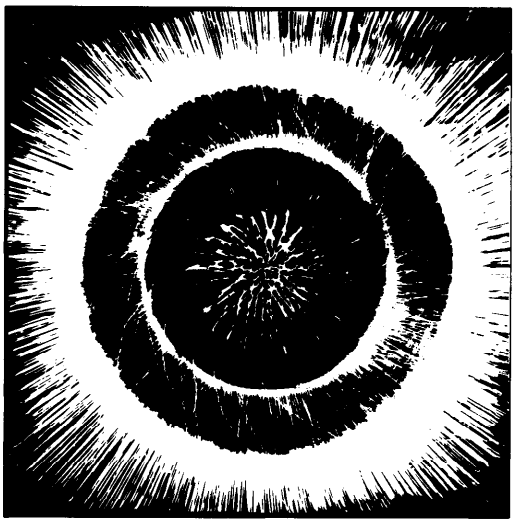

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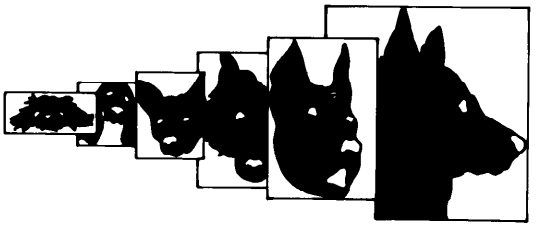

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