

Creation Research Society Quarterly

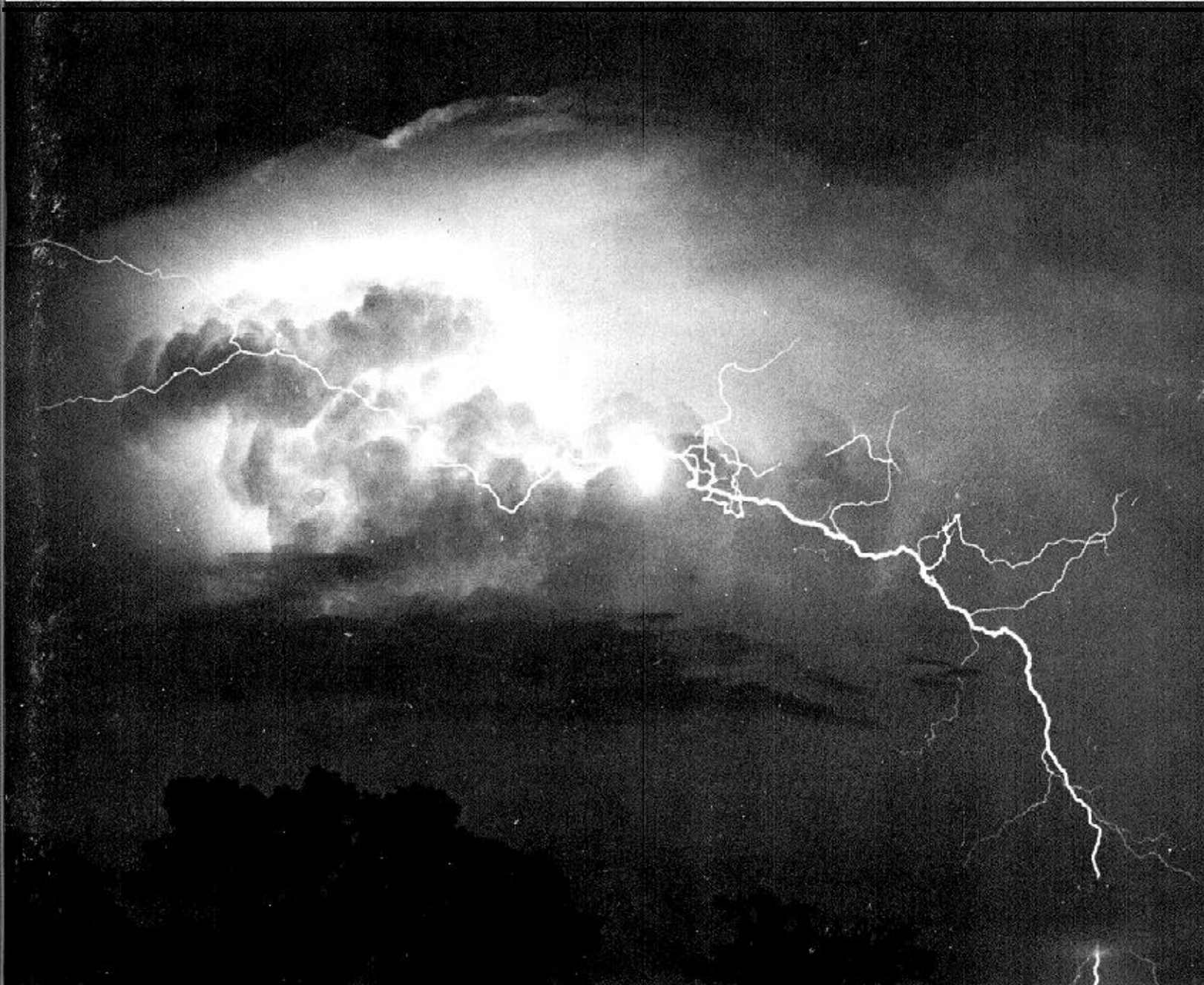
Haec credimus:

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

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RENEW NOW FOR 1987/88

CREATION RESEARCH SOCIETY QUARTERLY

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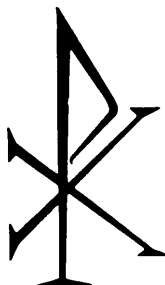
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COVER PHOTOGRAPH

This time exposure of an evening thunderstorm was taken in August, 1986 near O'Fallon, Illinois. Close inspection of the photograph reveals several minor strokes trailing off on either side of the main stroke. The main stroke appears to originate from the cloud's center and then winds and twists down toward the ground. A low cloud, between the observer and the cloud-to-ground stroke, briefly interrupts the lightning's illuminated path. This thunderstorm was in the only cloud in sight that night. The stars overhead shone brightly in the sky making the scene all the more beautiful. Seen from a safe distance, (the storm was at least 10 miles away) one could not help but think of the beauty and majesty of the Creator. We read in Job 38:35 where the Lord says to Job: "Canst thou send lightnings, that they may go, and say unto thee, Here we are?" But, herein lies a paradox: lightning accounts for many of the weather-related deaths in the U.S., especially Florida, each year. On the other hand, afternoon and evening thunderstorms are of great importance in providing life-giving moisture for plants and crops. See CRSQ 23:6-11 for a review of the benefits and detriments of thunderstorm rainfall.

Kenneth A. Nash

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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 informal 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 1500 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 Glen W. Wolfrom, Membership Secretary, P.O. Box 14016, Terre Haute IN 47803. Sustaining membership or 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 a subscription to the *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 assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.

2. All basic types of living things, including 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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EDITORIAL COMMENTS

It is my pleasure to thank the authors, article and book reviewers, letter writers, copy readers and peer reviewers who have contributed to volume 23 of *CRSQ*. Much effort from many people is necessary for the publication of a single quarterly. This editor is indeed indebted to many people and I hope to give them some form of recognition in future issues. I encourage you to help in the endeavor of creationist writing, research and review. Please contact me if you are willing to write or review.

Two letters to the editor suggest that the Society should sponsor creationist conferences. Although the idea sounds feasible, the Board of Directors has avoided sponsoring any type of a speaking symposium. Firstly, the finances of the Society do not allow us to underwrite a conference. Secondly, we do not have the manpower to handle all of the arrangements. It would fall on the shoulders of one Board member to do everything. Please understand our emphasis; we are a publishing and research organization and that requires all of our available finances and personnel.

I am amazed at the lack of scientific creationist reading matter in public libraries. I hope many of our readers will consider giving a subscription of the Quarterly to their local libraries. It would be best to discuss the possibility with library officials before the gift is actually made. This may insure that the periodical will be displayed properly. Also microfilms of past

quarterlies are now available (see the inside front cover).

Dr. Frank Marsh presents some interesting research he did on insects many years ago. The data support the creation model of science and Dr. Marsh discusses a unique interpretation. William Rieman explores a limitation of science, i.e., the inability of scientists to perceive or dismiss non-material causes and phenomena. Also featured in this issue are several items involving the history of science. John Klotz notes some misunderstandings concerning Bishop Lightfoot and Galileo.

The research efforts sponsored by the Research Committee are featured in two articles. Part II of the Precambrian pollen studies centers on the likelihood of contamination of samples. The main thesis is that such contamination is highly unlikely. The interbedding of geologic strata in the Grand Canyon indicates that there was not a 200 million year interval between deposition of the two layers.

Paul Steidl presents information on comets that supports the concept of a young age for the solar system. Tom Barnes answers a theistic evolutionist who had accused young earth creationists of being poor scientists. Many of the technical notes should be of interest to you. Your comments on any subject are always welcome.

Emmett L. Williams, Editor

THE NON-MATERIAL HYPOTHESIS AND ITS IMPLICATIONS FOR MODERN SCIENCE

WILLIAM P. RIEMEN*

Received 14 April 1986; Revised 30 June 1986

Abstract

It is shown that modern science has espoused a materialist hypothesis. This assumption leads modern scientists to state unequivocally that they will reproduce evolution in the laboratory, produce life from nonliving materials, produce machines with conscious human-like intelligence and make the blind and deaf see and hear. It is the contention of this paper that these conclusions must be modified drastically if the non-material hypothesis that there are forces in the universe that science cannot manipulate is assumed.

Introduction

F. H. C. Crick (1979) makes the statements that "... our internal picture of the external world is both accurate and vivid, which is not surprising in view of the fact that human beings are highly visual animals" (p. 219) and "... in a certain sense everything she sees is a trick played on her by her brain." (p. 222)

These statements seem to show confusion between the facts of science and the facts of philosophy which must be assumed by science. Crick indicates that science has proved that we see by internal pictures and that these internal pictures accurately and vividly reflect an external world.

I assert that science is not capable of proving either that an external world exists or that we see this external world by internal pictures. Crick has made science appear to be much more powerful than it is. Science

cannot prove that an external world exists, it must meekly assume its existence and look to philosophy for the justification of this assumption. Also, science must meekly assume that we can attain this external world vividly and accurately by direct or indirect means. Science can then proceed to discuss the nature of this external world via the results of experiments, an enterprise full of difficulties.

That science must make these two assumptions in conjunction with each other can be seen from the following considerations. If we could only reach the outside world, if it exists, by internal pictures, we could neither be sure that what we see is the same for different observers, nor that it corresponds to anything really existing outside our minds. We can see that we are at the point in philosophical history when modern philosophy under Descartes was born. To avoid this, science proceeds to make these assumptions consciously or unconsciously and Crick apparently has forgotten the underpinnings of the discipline.

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The Basic Assumptions of Modern Science

The assumptions which science must take from philosophy in order to be science are listed below.

1. There is an actually existing external world. The opposite philosophical position is untenable as it leads logically to solipsism. The nature of this world has been a major philosophical concern throughout history. (Dubray, 1938, pp. 421-30, Coffey, 1958a, pp. 19-51, Halverson, 1958, pp. 319-24, Joad, 1946, pp. 24-59, Randall and Buchler, 1971, pp. 224-7)
2. This external world is attainable accurately by our senses. There is a rich and colorful philosophical history connected with this assumption but common sense certainly corroborates it. (Coffey, 1958a, pp. 64-138, Halverson, 1958, pp. 326-52)
3. This external world is orderly and endowed with cause and effect and it follows the laws of logic. (Coffey, 1938, pp. 58-119, Coffey, 1958a, pp. 148-249, Dubray, 1938, pp. 431-50).
4. Many correlations with phenomena of this world can be obtained through induction and its correlate that nature is consistent over time. This assumption ultimately depends on the nature of God. It is considered one of the most difficult assumptions to justify. The so-called problem of induction is not solvable without a knowledge of God. (Coffey, 1938, pp. 23-53, Coffey, 1958b, pp. 84-6, Dubray, 1938, pp. 273-8)
5. The basic assumption which is the least justifiable is the materialist assumption. It can be stated as follows: All causes in the world or universe are similar to the causative means that science uses in its experiments. In short, there is nothing in the universe that is nonmaterial in any way. The word "non-material" here simply means things or properties not reproducible or manipulatable by physical and chemical means.

An alternate fifth assumption would be that there may, in some cases, be nonmaterial causes present, causes that are beyond chemical and physical methods. This is the nonmaterial assumption. Using this assumption keeps our minds open to possibilities that we would ignore under the material assumption.

A third version of the fifth assumption that all causes ultimately are not physical and chemical, which we might call the complete nonmaterial assumption, has obviously been disproved in our lives by breathing and eating for instance. Chemical and physical forces are present in our universe.

Thus we have two possible fifth assumptions. I intend to see how science will have different conclusions under these two versions.

The Fifth Assumption and Its Effect On The Physical Sciences

Staying strictly in the realm of the physical sciences, it would in most cases matter very little which version of the fifth assumption was made since all our experiments deal with physical and chemical forces. However, it is proposed that the non-material version (NMH) of the fifth assumption postulate in some cases is more in the interest of science as a lover of truth than the material hypothesis (MH). This is true since science can only disprove hypotheses decisively (Popper, 1968

pp. 35-119, 215-50). For instance, if MH is adopted for the creation of matter and energy, then science will have no means of proving that the creation of matter/energy from nothing is impossible by physical and chemical means alone. In fact, adoption of MH in this case makes science state that it is inevitable that science will create matter/energy out of nothing. Under NMH, it is highly unlikely that matter/energy can be created out of nothing by only physical-chemical forces. If some day scientists succeed in producing matter/energy out of nothing then NMH will be discarded in this case. But in the meantime, science will seem much more plausible and scientific if it proceeds more cautiously in this matter (Coffey, 1970, pp. 74-9, 101-13). This conclusion in no way denies that science should not proceed as far as it can under MH, but only that it not completely shut itself off from possible truth.

Moreover, theories of the origin of the universe, either the big bang theory, the continuous creation of matter or the expansion-contraction of an eternally-existing material universe, (Chapman, 1978, pp. 458-65) will be less plausible under NMH because, until we can create matter/energy from nothing, there will always be the suspicion that physico-chemical forces alone are insufficient to account fully for the material universe.

The Fifth Assumption and Its Effect On The Biological Sciences

The area of life is a sensitive region for many scientists. Most prominent biologists work under MH and, hence, eschew any hint of vitalism, (Tax, 1960, Labarre, 1956). They are quite adamant that physical-chemical forces are sufficient to explain life. In other words, not only will science inevitably be able to reproduce evolution and make animals and plants to specification, but be able to create life *de novo* in the laboratory.

But, all of these possible future accomplishments would not be inevitable if NMH is adopted. As a matter of fact, under NMH, we would say that it is a good possibility that the creation of life in a laboratory situation will never be achieved. Since Pasteur showed that spontaneous generation of life does not occur, there is considerable experimental evidence that has accumulated which has the effect of making adoption of NMH with regard to the creation of life most reasonable. And with respect to interspecies evolution, another large amount of laboratory work has shown that no one has been able to make an existing species evolve into either another existing species or into a new species using cross-breeding, gene splicing, recombinant DNA, radiation or other laboratory methods. Thus the findings of science have shown that interspecies evolution and the creation of life do not seem possible any more than the production of a perpetual motion machine. The burden falls on modern science to show that the laws of nature are such that interspecies evolution can actually take place before it can consider whether or not it occurred historically.

In addition, there are good philosophical reasons for adopting NMH in the case of living things. If one considers even the simplest living organism one is struck by its inordinate complexity. This complexity,

to say the least, is hardly diminished when the human body and human brain is taken into account. In addition, living things have self-movement and, hence, apparently differ from machines in that there is the distinct possibility that a guiding principle is an integral part of them. It has, of course, been postulated by Watson and Crick and others that nuclear DNA is this guiding principle. But the DNA of a cell is located in the nucleus and consequently, its influence on remote non-nuclear parts of the cell can be at best indirect. Also, at death the DNA is largely intact but still not able to revive the cell or keep it alive. And finally, the cell is very highly complex both anatomically and physiologically which means that it needs a strong unifying principle. Putting all these responses together, it appears likely that DNA does not have the properties needed. Other factors may be needed. (Koren, 1955, pp. 14-55)

Some scientists have taken the position that life and evolution can be produced in the laboratory if enough time is involved. They reason that since vast periods of geologic time were involved to accomplish these ends, time is needed to duplicate these feats in the laboratory. However, it is not time per se they say is needed but time to produce the enormous complexity found in life which is what is ultimately responsible for life. But complexity alone is insufficient as a corpse has the same complexity at death as the living entity. Put another way, anatomy is not sufficient for life.

These considerations lead us to adopt NMH with regard to the origin and evolution of life. This position, unlike the MH position, allows for the possibility of refutation by physico-chemical means by the *de novo* creation of life and possible laboratory-induced evolution.

The Fifth Assumption and Its Effect On The Medical Sciences

The effect of MH on two areas that have direct bearing in biology in general and in medical science in particular will be examined. Under MH it must be dogmatically stated that given time and money we should be able to 1) make the blind see and the deaf hear, 2) to cure all diseases, 3) to raise the dead and 4) to achieve immortality. Unfortunately this is not an exaggeration since MH effectively states that life is nothing but a physico-chemical machine.

On the other hand, the adoption of NMH would lead scientists to ameliorate this position somewhat. Under NMH the four positions above would be modified to become (1) it is not possible using only physico-chemical means to make the blind see and the deaf hear; (2) it is not possible to cure all diseases; (3) it is not possible to raise the dead and (4) it is not possible to achieve immortality. When stated thusly, they appear more reasonable than the original versions. In addition, they are refutable by physico-chemical means available to us in the clinic and laboratory. Proceeding further, it can be asked if there are any philosophical reasons for adopting NMH in these four cases.

Curing all diseases, the resurrection of the dead and immortality will be considered first. Remembering the discussion on the possible non-material organizing principle of life, I can state that if life depends on a

non-material factor, then we will be unsuccessful in curing all diseases, in raising the dead and achieving immortality using only physico-chemical means.

Lastly, I will consider the possibility of making the blind see and the deaf hear. At this point it is important to review briefly the theories of sensations as presented by modern physiology. Physiology considers sensation to be the result of the brain under stimulation to produce the internal representation of the outside world. (Montcastle, 1968, pp. 1315-17) For example, consider sight. Light from the outside world enters the eye and falls on the retina. This light starts a whole chain of physico-chemical events in which light is changed into chemical energy in the retina which in turn converted to bioelectrical impulses in the optic nerve which finally arrives at the visual cortex area of the brain which then produces an internal image of the outside world. This picture appears in every aspect to the beholder as if he is looking directly into the outside world, but, in effect, his brain fools him as he really is looking at an internal picture.

Modern physiology arrives at this position because it has adopted MH consciously or unconsciously. The reasoning is largely as follows: Vision and all sensations are only physico-chemical processes. Thus, light, in the case of vision, and other physical stimuli for the other senses, cause in the appropriate organ of sensation a train of physico-chemical events that end in the brain. The brain then produces the sensation of consciousness, a logical conclusion under MH.

However, in order to accept such a conclusion, an observer has to convince himself that what he sees, hears, tastes, touches and smells is really not outside at all but really inside his brain. This "picture" or "image" in his brain is such that it seems as if he is looking, hearing, tasting, touching, and smelling the outside world.

Science assumes that this outside world exists and we have access to it through our sense organs. These are excellent assumptions and their worth is very fully explored by P. Coffey (1958a, pp. 19-51). Consequently, I am not concerned whether the theory of perceptions advanced by physiology would lend itself to doubt the existence of an outside world. But, we need to concern ourselves whether it is a truly scientific method whereby we reach the external world. Philosophically this type of theory is called the mediate or representational theory of perception as against the immediate theory of perception which claims that we perceive the external world directly. (Coffey, 1958a pp. 64-88)

We have seen above that MH will lead to the mediate theory of perception. I propose that NMH will adopt the immediate theory of perception. In addition, I will show that the possibility of serious but opposite practical applications can result depending on which theory is assumed.

Consider some implications for the mediate theory of perception. The mediate theory must explain two things. 1) How does the mediate produce a three-dimensional representation on the sense phenomena? 2) Who or what reads this internal picture which represents the external world so well none of us would have the slightest idea we were not looking out into the world directly unless we were told by the physiologists we were actually looking at our own brains "picture?"

Secondly, it can be asked if a picture (a mediate representation) of the outside world is needed to "see," is it necessary for the brain to produce another picture of the internal representation to "see"? If so, one can immediately foresee an infinite regress of "pictures" to "see" the previous "picture." Science, of course, will reject any such implications. Since science must accept the consequence that somehow this internal representation is grasped directly and immediately, it not only has to explain how this "seeing" occurs as pointed out by Crick above but it must explain further why we cannot view the world directly if we can view an internal picture directly.

I propose that perception might be partly immaterial. Certainly, the two difficulties with the mediate theory of perception outlined above point in this direction. When we add that mankind believes it perceives the external world directly, which the mediate theory has much difficulty in explaining, we see that NMH would lead science to opt for the theory of immediate sense perception of the external world. This theory is abundantly supported by philosophy (Coffey, 1958a, pp. 89-202). In addition, the immediate theory has the scientific advantage over the mediate theory in that the immediate theory of perception can be refuted by purely physico-chemical means by making the blind see, the deaf hear and making a person to see with his eyes closed.

Science, in adopting MH and its consequent the mediate theory of sense perception, must claim, given enough time and money, that science will be able to make the blind see, make the deaf hear, and make men smell, taste and have the sense of feel by immediate brain stimulation. These are strong but inevitable consequences of MH for science.

It is concluded that it is much better to accept the immediate theory of sense perception on both philosophical and scientific grounds and also the consequence that it is, unfortunately, a very long shot that science will ever make the blind see and deaf hear by direct brain stimulation. To summarize, science has shown that the whole optic organ is the eye, optic nerve and brain in combination with each other. But it is highly likely that as necessary to sight as that organ is, it is not sufficient to produce sight and a non-material element is present which allows us to directly perceive the outside world.

The Effect of the Fifth Assumption on the Information and Social Sciences

It has been the dream of philosophers, scientists and engineers for a long time to produce intelligent machines which really can think and converse with human beings with meaning. There is much controversy regarding just how feasible it is in reality to accomplish these admittedly awe-inspiring results (Dreyfus, 1979, pp. 1-136; Taube, 1961, pp. 155-227).

There is no doubt that science working under the MH must state unequivocally that it is impossible not to produce such machines. Science must state equally unequivocally that it will produce machines with emotions as well. This result, of course, is close to producing life itself in a machine. It is sufficient to realize that MH will lead the engineering sciences to state emotions and true intelligence can be reproduced in dead machines which can be seemingly brought to

"life" simply by placing their electrical plugs in an appropriate socket.

On the other hand, if emotions and intelligence might not be completely reducible to physico-chemical forces then the spectacular results listed above may not be achievable. Consequently, we must examine which version of the fifth postulate is most appropriate for science to adopt with regard to the possibility of producing truly intelligent machines with or without internally produced emotions.

It seems impossible to have internal feeling and emotions and internal intelligence without a minimum of consciousness. Feelings, emotions, sensation and reasoning by their very nature require a subject to whom these things are reported. With this stipulation in mind, the problem of producing a machine having internal feeling, emotions and intelligence will require engineers to make it conscious at the same time.

It is highly likely that there is a non-material component involved in sense perception. Thus, the conscious component in a living organism which uses this perception must also be partly non-material. It must be concluded that to place consciousness in a machine will require the use of some nonphysico-chemical methods.

Once again, then, it is more philosophically and scientifically satisfying to state that it is impossible for engineers to produce truly intelligent machines. Science can prove the NMH wrong in this case by producing such machines. However, I must agree with the conclusions of R. J. Henle (1985, pp. 131-55) that artificial intelligence is a "perverse grand fantasy" (Weizenbaum, 1976, p. 203). For a detailed discussion on how far the "intelligence" of computers that do not possess consciousness can be taken in the future see Dreyfus, 1979, pp. 227-305.

We have seen from our discussion on intelligent machines that consciousness is needed in intelligence. This conclusion forces us to state that both psychology and the social sciences must take into account that men have internal states which must be taken seriously. In other words, behaviorism is, at best, a very partial and misleading theory of human and animal behavior. Behaviorism is perhaps fairly satisfactory for animals as they apparently do not have free will. This is so because they do not have true language and true intelligence.

Those who follow MH and claim there is no human freedom have not been very convincing in explaining away this feeling. (Schoeck & Wiggins, 1960, pp. 159-80). Further, human intelligence most likely has a non-physico-chemical component which would be necessary as a basis of human freedom. (Dubray, 1938, pp. 503-24). Thus in the psychological and social sciences human freedom must be taken into account (Schoeck & Wiggins, 1960, pp. 202-60). This is certainly the conclusion of NMH. This position can be refuted by making a true human being *de novo*, from a dead person or by evolution from a lower species.

Summary and Conclusions

The conclusions that have been reached should have profound significance for modern science. Armed with the materialist fifth assumption, science has put forth many claims of dubious value and truth. Science should

become more scientific. This will aid in its important mission of seeking truth. It should become less dogmatic about the origin of the universe and matter/energy, of life and evolution. It also should be less dogmatic about the ability of the human race to cure all diseases, make the blind see and the deaf hear, raise the dead and make truly intelligent machines with feelings and emotions. And finally it must not deny social science the variable of human freedom.

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INVITED PAPER

FIVE-LINKED FOOD CHAIN OF INSECTS*

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Abstract

Within southwestern Chicago the food relations of a five-linked food chain of insects (a case of hyperparasitism) was studied. The larvae of the large Saturniid moth *Hyalophora* (formerly *Samia*) *cecropia* (Linnaeus), while feeding upon black willow, box elder, and wild black cherry, served as the key industry for four successive links of hymenopterous parasites (more accurately named **parasitoids**). The primary parasite was the ichneumonid *Spilocryptus extrematis* (Cresson); the secondary parasite was *Aenoplex smithii* (Packard); and the tertiary and quaternary parasitic positions were held, respectively, by the chalcids *Dibrachys boucheanus* (Ratzeburg) and *Pleurotropis tarsalis* (Ashmead).

Contributing to the delicate dynamic balance of this food chain were the tachinid fly *Winthemia cecropia* (Riley) (formerly *W. datanae* Tns.), two additional ichneumonids *Ephialtes aequalus* (Provancher), and *Hemiteles tenellus* (Say) and the chalcids *Dimmockia incongruus* (Ashmead) and *Cirrospilus inimicus* (Gahan).

Reference is made to an assumed controversy throughout all the natural world between the Creator and Satan. A brief discussion is also included suggesting how, from a creationist viewpoint, a change in food in some animals from plant sources to animal sources, may have occurred.

Introduction

Within the Chicago area near Summit, Illinois, there is a level prairie community supporting scattered clumps of black willow, box elder, and wild cherry. These trees were found to be heavily infested with cocoons of *Hyalophora* (formerly *Samia*) *cecropia* (Linnaeus), the infestation being reasonably constant from year to year. The writer became engaged in a study of the feeding interrelationships existing between

these trees, the *Cecropia* larvae, and the involved chain of hymenopterous parasites and hyperparasites— see Marsh, 1934: pp. I-IV, 1-98). This opportunity is taken to discuss briefly certain general aspects of the problem, e.g. the biotic balance between moth, predators, and parasites.

Methods

In collecting the material for this study, the cocoons were kept in three separate groups: (a) those found on the ground— chiefly beneath brittle-stemmed willow trees, (b) those spun from the ground to a height of 15 ft., and (c) those spun from 15 to 35 ft.— the upper limit of cocoons in this region due to the absence of high trees. Age or condition of cocoon made no difference in the uniform sampling of the area. Thus the regulatory factors of several years were determined. The separation into groups according to the stratum occupied was made in order to learn the vertical spread of the factors involved.

*Throughout the course of this work I have had the advantage of counsel from Dr. C. L. Turner (Northwestern University). It is also a pleasure to acknowledge the criticism of Dr. Orlando Park (Northwestern University) and I am especially indebted to the following taxonomic experts, J. M. Aldrich, R. A. Cushman, A. B. Gahan, C. L. Metcalf, C. F. W. Muesebeck and C. W. Sabrosky for their care in determination of insect material.

**Much of the material in this article first appeared in *Ecology*— see Marsh (1937). Permission for its use here was given May 5, 1986, by the Ecological Society of America.

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The life-history details of the host and parasites were learned from much observation and collection in the field and from laboratory study. In the latter the ichneumonids and chalcids were reared in test tubes lightly stopped with cotton. Honey diluted with an equal part of water proved the most successful diet for the adults.

Ecological Observations

A quantitative analysis of the biological influences acting upon the *Cecropia* cocoons is illustrated in Table I. The table represents the results obtained from a dissection of 2741 specimens. The feeding interrelations discerned in this study are given in Figure 1. From these two groups of data certain interesting facts may be noted. Thus the ichneumonid *Spilocryptus extrematis* (Cresson) appears to be one of the most important influences in regulating the emergence of the moth, destroying 22.8 percent of all cocoons. Again, the birds (Hairy Woodpecker and Downy Woodpecker) were second with a destruction of 6.8 percent, the mice (Meadow Mouse and Whitefooted Mouse) were third with a destruction of 3.8 percent, and finally the tachinid was fourth, destroying 3.1 percent of the *Cecropia* cocoons.

In the Chicago area *Cecropia* begins to spin about the middle of July. From the time the first mature larva surrounds itself with as much as a thin shell of silk, up to the time when the last pupa case has hardened, about the end of August, the moth is open to attack by its chief enemy *S. extrematis*. The abundance of *Cecropia* in the area studied can be imagined from the finding of 19 cocoons in a single cluster on a young black willow tree, while as many as 253 old and new cocoons were found on single adult willows. See Figure 2. Still, a casual visitor in the region would not suspect their presence due to the rapid leaf replacement by the willow and box elder, and to the habit of the larvae while feeding, of scattering over the entire food plant. Table II lists the food plants of *Cecropia* in this region in graduated series from most stimulating to least

stimulating as judged from the abundance of cocoons found on these plants.

The Five-Linked Chain

In Figure 1 it will be noted that *S. extrematis* in turn served as the host of five parasites. However, attention will now be directed to the central chain leading through *S. extrematis* which, in this study, gives the best case of hyperparasitism, ending with the accidental quaternary parasite (Smith, 1916) *Pleurotropis tarsalis* (Ashmead). In this case *Cecropia* is the primary host. It is possible that *S. extrematis* is attracted to its host by the odor of freshly spun silk. As soon as cocoon spinning has progressed to a thin-shell stage, females of the ichneumonid have been observed coming up the wind to it as Canthon beetles follow up wind to fresh horse droppings. The ovipositor is thrust through the cocoon, and eggs are deposited on the inside of the cocoon or on the surface of the larva. Over 1000 eggs have been counted in one early-spun cocoon resulting from the oviposition of several females, while the greatest number of cocoons of *S. extrematis* in a single *Cecropia* cocoon was 172. As no starved larvae have been found, cannibalism is indicated. The average infestation of *Cecropia* cocoons with *S. extrematis* was found to be 33. During oviposition, the host larva is thrust with the ovipositor and invariably dies within a few hours. The larvae of *S. extrematis* move about freely over the dead host larva at first feeding on cuticle, later burrowing down and drinking the body fluids. In cases of heavy parasitism all the host body is eaten except the few chitinized parts. In the Chicago area *S. extrematis* is double brooded, completing a cycle in about 18 days.

Aenoplex smithii (Packard), the secondary ichneumonid parasite of this chain, appeared in about 13 percent of the *Cecropia* cocoons which were infected with *S. extrematis*. Because its host larvae are available throughout the year, the number of broods of *A. smithii* appearing in a season is governed by the duration of

Table I. A General Survey (calculated in percentage) of 2741 *cecropia* cocoons collected in the Chicago area in March. I. Cocoons found lying beneath the trees on the ground. II. Cocoons which had been spun from the ground up to a height of about 15 feet. III. Cocoons which had been spun in the trees at a height of about 15 to 35 feet.

Situation of cocoon	Pupa alive in cocoon	Adult emerged	Adult unable to push through valve	Adult dead in pupa case	Pupa destroyed by bird	Pupa destroyed by mouse	Pupa dead from unknown cause	Larva or pupa destroyed by ichneumon	Larva destroyed by tachina fly	Larva dead from unknown cause	Cocoon crushed	Scorched by grass fire	Number of cocoons in each group
I	14.3 ♂ ♀ 36 64	37.6 ♂ ♀ 53 47	0.2	0.8	1.9	14.9	4.1	13.6	1.3	2.2	8.7	0.4	516
II	35.5 54 46	17.2 49 51	0.5	0.3	2.6	6.0	2.1	25.8	4.3	4.8	0.9	None	1827
III	52.3 53 47	8.1 34 66	None	None	8.8	None	3.3	20.0	0.7	6.8	None	None	398
Average for all groups	33.6 52 48	19.7 49 51	0.3	0.3	6.8	3.8	2.5	22.8	3.1	4.4	2.6	0.1	2741

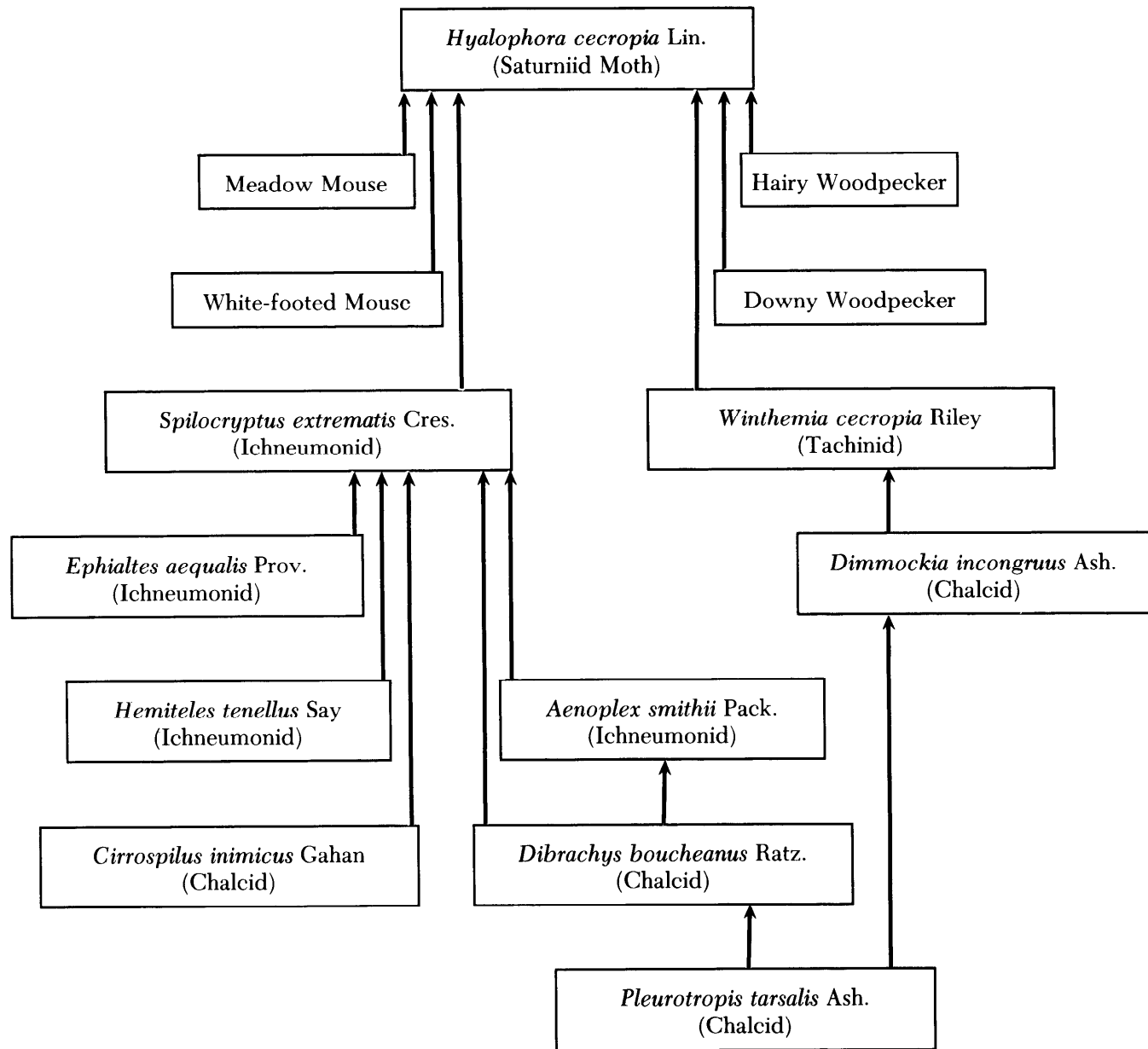


Figure 1. Diagram of the feeding interrelations discerned in the willow-Cecropia community.

the warm weather. Five successive groups of adults commonly appeared in a season in the area studied. The host larvae are located by careful palpation of the infected Cecropia cocoon with the antennae of the female. Due to the rather short ovipositor only those larvae cocooned in the periphery of the cavity inside the Cecropia cocoon can be reached. A single egg (rarely two) is laid inside the cocoon of each host larva. This larva is then thrust with the ovipositor and dies within a few hours. The larva of *A. smithii* is very active, moving about freely over the dead host drinking at numerous punctures made by its mandibles. As in the case of *S. extrematis* the cycle of *A. smithii* required about 18 days.

The omnivorous, cosmopolitan chalcid, *Dibrachys boucheanus* (Ratzeburg) appeared most frequently as a secondary parasite on *S. extrematis*, but because of the biological interest in its very frequent appearance as an accidental tertiary parasite of *A. smithii*, it is so listed here. Entrance to infected Cecropian cocoons is effected through holes previously made by woodpeckers, mice, or escaping ichneumonids, or if no holes are present, by crowding through the loose silk of the valve. Once inside, by palpation of the cocoons of *S. extrematis* with its antennae it determines the presence of a host larva and inserts its ovipositor, placing eggs on the surface of the larva. If a cocoon of *A. smithii* chances to be inside, its thin wall is also punctured and

Table II. Food plants in the Chicago area from which cecropia cocoons were collected, listed in the order of the number of cocoons found on each species of plant.

Scientific name	Common name
<i>Salix nigra</i>	Black Willow
<i>Acer negrundo</i>	Box Elder
<i>Acer saccharinum</i>	Silver or Soft Maple
<i>Prunus serotina</i>	Wild Black Cherry
<i>Populus balsamifera</i> var. <i>virginiana</i>	Cottonwood
<i>Syringa vulgaris</i>	Cultivated Lilac
<i>Maclura pomifera</i>	Osage Orange
<i>Rosa</i>	Cultivated Rose
<i>Arctium lappa</i>	Burdock
<i>Quercus macrocarpa</i>	Bur Oak
<i>Quercus alba</i>	White Oak
<i>Gleditsia tracanthos</i>	Honey Locust
<i>Ulmus americana</i>	American Elm
<i>Rhus toxicodendron</i>	Poison Ivy
<i>Calalpa speciosa</i>	Catalpa
<i>Polygonum hydropiper</i>	Smartweed
<i>Malus ioensis</i>	Wild Crab Apple
<i>Crataegus</i>	Hawthorne
<i>Aster ericoides</i>	Heath Aster
<i>Cannabis sativa</i>	Hemp
<i>Ambrosia artemisiaefolia</i>	Roman Wormwood
<i>Ribes floridum</i>	Wild Black Currant
<i>Ambrosia trifida</i>	Great Ragweed

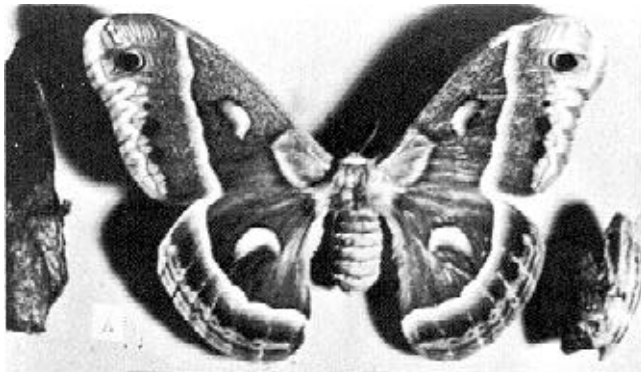


Figure 2. Satumiid, Giant Silkworm Moth. A. *Hyalophora cecropia* (Linnaeus). Female, wingspread 140 mm., cocoon at left, at right Cecropia pupa with cluster of *Spilocryptus extrematis* (Cresson) cocoons; B. Cecropia cocoons on black willow brush, baggy cocoons predominate near ground, tightly spun cocoons at higher levels.

eggs deposited. An average of seven eggs were placed on *A. smithii* and 12 on *S. extrematis*. As many as 53 pupae have been found on the remains of one larva of *S. extrematis*. *D. boucheanus* is a very effective controlling factor. Each female may lay from 300 to 400 eggs and six broods were found in the field in a season. In the laboratory the writer reared 19 generations of *D. boucheanus* in 12 months. Contrary to the report of Muesebeck and Dohanian (1927), the writer found that in the Chicago area *D. boucheanus* always hibernated as a straw-colored pupa.

The last place in this five-linked chain of insects was occupied by the small chalcid *Pleurotropis tarsalis* (Ashmead). According to the easy shifting of its host from the role of an obligatory secondary to that of an accidental tertiary, *P. tarsalis* naturally frequently occurred as either an obligatory tertiary or an accidental quaternary parasite. The larva of this chalcid is an internal feeder. The female, after gaining access to the Cecropia cocoon in the same manner as *D. boucheanus*, places a single egg (rarely two) just beneath the cuticle of the mature larva or freshly formed pupa. In this case the adult parasite does not kill the host, but this is accomplished later in the pupa case by the development of the parasite larva. From laboratory rearings and field observations in this area, *P. tarsalis* appears to complete at least three cycles during a summer. It invariably hibernates in the larval stage.

Associated Parasites

The two smaller secondary ichneumonid parasites *Ephialtes aequalus* (Provancher) and *Hemiteles tenellus* (Say) were with the chain but much less effective than *A. smithii* as parasites of the primary parasite *S. extrematis*. Their handicap in this relation was the shortness of their ovipositors (2 mm. as compared with 4 mm. in *A. smithii*). Where *A. smithii* could easily thrust its ovipositor through the tightly spun wall of Cecropia cocoons and reach those of *S. extrematis* inside, these two smaller ichneumonids could only occasionally accomplish the task. Their effect in this food chain is comparatively minor.

The only dipteran observed in this willow-Cecropia community of parasites was the tachinid fly which J. M. Aldrich of the National Museum at first identified as *Winthemia datanae* (Tns.). See Marsh (1937). Since that time the National Museum told me the insect more properly is not *W. datanae* but *W. cecropia*—which seems likely under the conditions. I will accept the latter species name. At their request the specimen shown in Figure 3 now rests in the National Museum, Washington, D.C.

This tachinid occurs in the Chicago area as a primary parasite, along with *S. extrematis*, of the key industry *Hyalophora cecropia*. Normally this tachinid fly emerges the second week in July, just as its Cecropia larval host has molted the last time before spinning its cocoon. This is important in the life of this tachinid because it lays its eggs on the larval surface and if placed earlier the eggs could be shed with the discarded skin. When considered over the whole area the parasitization of Cecropia by *W. cecropia* is rather light (3.1 percent, see Table I). Its distribution is in highly concentrated areas which frequently are quite widely scattered. In these spots (including several small

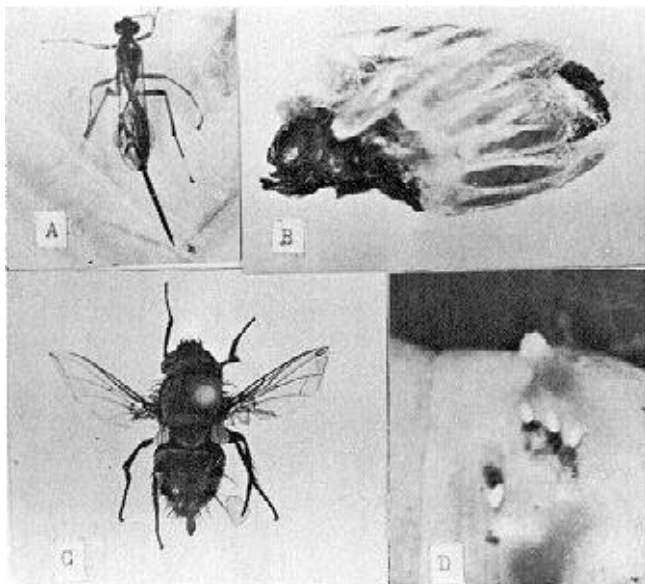


Figure 3. Ichneumon (A) and Tachinid (C). A. *Spillocryptus extrematis* (Cresson), female, body length (exclusive of ovipositor) 12 mm.; B. *Cecropia* larva surrounded by ring of *S. extrematis* cocoons, each about 15 mm. long; C. *Winthemia cecropia* (Riley), female body length 10 mm., this specimen is now in the National museum; D. Egg shells of *W. cecropia* on skin of *Cecropia* larva, dark streak from each shell is due to bacterial infection in the path made by the larva as it tunneled into the interior.

trees) the destruction of *Cecropia* is commonly total. During oviposition the female hovers over the larva's back, clinging to the larva's tubercles while the eggs are securely attached by their adhesive coating to the skin of the host along the dorsal line. An average of 21 eggs was found. In about 36 hrs. the larvae (maggots) hatch and gnaw their way directly to the celomic fluid of their host. The host usually completes its cocoon before dying. The parasites eventually devour everything about the host except its bloated and blackened skin.

The mature tough-skinned maggot of *W. cecropia* finds itself imprisoned in the *Cecropia* cocoon commonly 10 to 15 ft. above ground. The writer has photographs of the escape of the mature maggot through the cocoon valve, and of its burrowing into the ground after falling from the tree (Marsh, 1934). Pupation occurs in a small cavity constructed three to eight inches underground.

The only parasite of *W. cecropia* discovered in this study was the small chalcid *Dimmockia incongruus* (Ashmead). He often observed ichneumonid and chalcid parasites trying to pierce the cuticle of the maggots of *W. cecropia*, but to no avail because of its toughness. However he did once find two puparia of *W. cecropia* which contained 52 pupae of *D. incongruus*, 12 of which were in turn hyperparasitized by larvae of the tertiary chalcid *Pleurotropis tarsalis*. The tough surface of the maggot and also of the puparium of *W. cecropia* rendered it generally safe from danger of parasitization.

Off the main chain but still a very definite deterrent to the numbers of the primary parasite *S. extrematis* was a small, pretty, black-and-yellow chalcid wasp (body length: male 1.5 mm., female 2 mm.; see Figure 4D) which had a life cycle of from 18 to 21 days, and appeared to run at least three broods a summer. As

parasites their behavior was quite identical with *D. boucheanus*. In his identification of the writer's chalcids, A. B. Gahan thought this could be a new species of the genus *Cirrospilus*. A total of about 100 was sent to Gahan (the writer was raising them on his desk) which made the fact of a new species certain. So I invited him to assign the new name: This he did, calling it *C. inimicus* Gahan (1934). For some biology of this new chalcid species, see Marsh (1938). Those readers who desire more detail on the biology of the insects associated in this willow-*Cecropia* community are referred to the sources listed under Marsh in the References. An impressive point in the field study of this five-linked insect food chain is the fact that the fertile parasite arrives exactly at the most vulnerable period in its host's life cycle. This obviously involves perfect timing and points toward design rather than evolution.

This nicely balanced series along with other regulatory factors of *Cecropia* in the Chicago area seems to have produced an equilibrium in the abundance of the moth. The infestation of this moth is abnormally heavy, yet has apparently been of this degree for some time. See Figure 5. As expressed in the words of an inter-rogated "native" who had grown up in the area, the cocoons had "always been just that thick." A reasonable balance does appear to have been reached in the infestation by this moth so that, in recent years at least, *Cecropia* has neither increased nor decreased.

Discussion

True natural science consists of two parts, (1) demonstrable facts and (2) undemonstrable speculation about the facts. It is a *must* in true natural science that the scientist keep very clearly in view what is *demonstrable fact* and what is mere *speculation*. Up to this

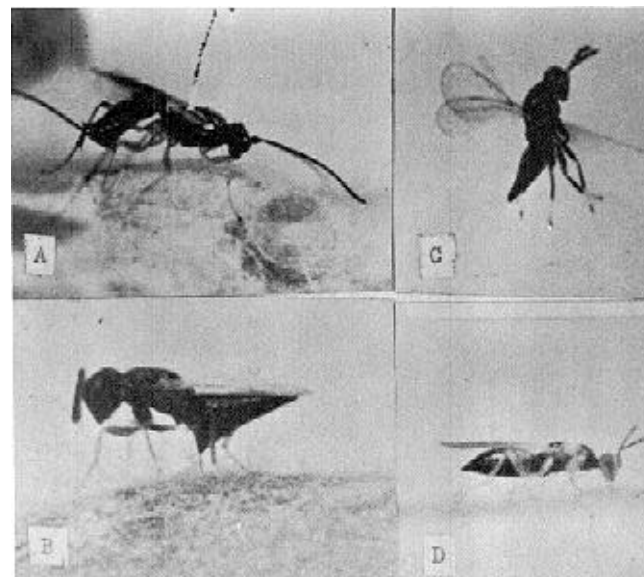


Figure 4. Ichneumonid (A) and Chalcids (B, C, D). A. *Aenoplex smithii* (Pachard), female, body length 8 mm., ovipositing in cocoons of *S. extrematis*; B. *Dibrachys boucheanus* (Ratzeburg), female, body length 4mm., ovipositing through thin cocoon of *A. smithii*; C. *Pleurotropis tarsalis* (Ashmead), quarternary parasite, body length 2.5 mm., parasitized *D. boucheanus*; D. New species of Chalcid genus *Cirrospilus*, *C. inimicus*, female, body length 3mm. discovered by Marsh and identified and named by A. B. Gahan, a parasite of *S. extrematis*, in photo drinking dilute-honey.

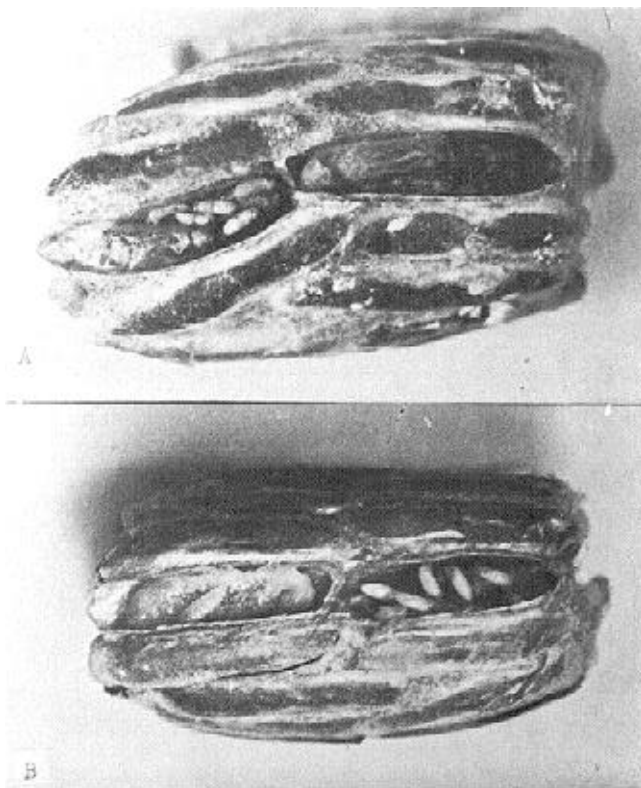


Figure 5. Hyperparasitism in clusters of cocoons of primary parasite *S. extrematis* taken from Cecropia cocoons. A. at left a cocoon of *A. smithii* and several pupae of *D. boucheanus* inside cocoon of *S. extrematis*, at right cocoon of *A. smithii* inside cocoon of *S. extrematis*; B. At left half-grown larvae of *A. smithii* feeding on larva of *S. extrematis*, at right larvae of *D. boucheanus* feeding on larva of host *S. extrematis*.

point in this article the author has reported demonstrable facts. These items should be the same whether reported by Bible-believer or atheist. Scientific facts are simply *facts* to all. The author of this article is a Bible-believer.

In my report I have called the parasitic wasps and a fly "parasites" in harmony with H. S. Smith's recommendations (1916, pp. 477-486). In 1966 R. L. Smith (p. 405) states that insects which attack their host *indirectly* by laying their eggs in or on the host, and later the eggs hatch and the larvae feed on the host until it dies, should be called *parasitoids*. Still more recently (1986) May and Seger (p. 260) continue to call parasitic wasps and flies *parasitoids*. Thus today when discussing predation I am careful as to distinguish between parasites and parasitoids. My present report concerns the latter.

From the writer's point of view (as a Bible-believer) he suggests that the only way to begin to comprehend our natural world is for the student to bear in mind that since a time soon following Creation Week, our world has been the battleground of a controversy between the great and loving Creator (Christ the Son) and the jealous and crafty destroyer Satan (Ezekiel 28). God's wisdom and fairness is shown in His permission to Satan to live and demonstrate his manner of directorship were he the King of the Universe. Briefly, all that is fair, loving, and beautiful comes from the Creator, and all that is evil, hateful, repulsive and selfish comes

from Satan. Both contesters in this controversy use natural laws as their implements.

Satan cannot create new life (Psalms 36:9). But I believe that he can degenerate living forms by gene manipulation. Scientists today know that Genesis kinds of organisms cannot hybridize. But they also know that crossbreeding between varieties *within* a single basic type usually is successful, but not uncommonly the hybrid will produce some poisonous substance or be abnormal some other way. Examples here are known among hybrids between varieties of monkshood (*Aconitum*) and guayule (*Parthenium*). In animals such hybrids often manifest changes in their original instincts. See Marsh (1981, p. 166).

In my opinion Satan has employed this manipulation of genes very widely in his worldwide degeneration of organisms. Let us speculate a little. We know from Genesis 1:30 that the original ancestors of the ichneumonid *Spilocryptus extrematis* were Herbivora (plant eaters) but in our study *S. extrematis* showed a preference for the fluids and tissues of cecropia larvae. Is it not possible that Satan has used his gene technique here to change an original instinct? If we are correct here then he has been quite busy because according to Ross (p. 449) in North America alone there are probably about 11,000 species of parasitic insects.

As in the case of Job, where the Creator set a limit to how far Satan could go in abusing Job, all through nature we can see where the Creator has checked some satanic activity. An example here may be the work of scientists in discovering the use of a Satan-produced poison to kill Devil-generated organisms.

This five-linked insect food chain is in delicate dynamic balance. It is interesting to study what would be the effect on the moth if any certain link were to increase or to decrease in number of individuals.*

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*(Editor's note) Some creationists prefer to believe that the parasitic action of insects developed after the Fall. An alternate explanation would be imagining nature as a battleground (conservation vs. degeneration processes). See Williams, Emmett L. 1976 A Creation model for natural processes. *CRSQ* 13:34-7 or in 1981 Thermodynamics and the development of order, Creation Research Society Books, Norcross, GA 30092. pp. 114-19. If one prefers to view parasitism as part of the balance in nature, it can be visualized as occurring because of the interplay of conservation and degeneration processes. However parasitism originated, it is the result of design rather than accidental natural events.

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CREATION RESEARCH SOCIETY STUDIES ON PRECAMBRIAN POLLEN— PART II: EXPERIMENTS ON ATMOSPHERIC POLLEN CONTAMINATION OF MICROSCOPE SLIDES

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Abstract

In criticizing studies of fossil pollen extracted from rock samples, positive results have been questioned or even discredited with the claim that various grains on the slides are merely the result of atmospheric, non-fossil pollen which contaminated the sample in the field or laboratory. Here we have undertaken to assess the rate at which pollen grains will actually contaminate exposed slides—with the goal of determining just how valid are the claims that pollen contamination might routinely occur in the laboratory or during field work.

Introduction

A. V. Chadwick (1981) attempted to repeat C. L. Burdick's discovery of pollen in Precambrian Hakatai shale samples from The Grand Canyon (1966 and 1972). Chadwick asserted that Burdick's apparent success probably had resulted from contamination:

The simplest hypothesis to explain Burdick's data is that the pollen grains he reported in 1966 and 1972 were modern contamination picked up either during collection and transportation or infiltrated into the sample itself prior to collection (Chadwick 1981, p. 9)

Here Chadwick did not directly attribute Burdick's pollen grains to actual contamination during laboratory processing, but he implied as much and he did assert that the samples probably got contaminated from the atmosphere/during collection or transportation.

In reporting on his own failure to recover pollen grains or spores from similar Precambrian rock samples (1981), Chadwick notes that he had used filtered air maintained at positive pressure in his palynological laboratory. Upon reading the Chadwick paper, one is left with the impression that air is normally loaded with spores and that unless the sample preparation room is supplied with filtered air under positive pressure, any slides examined are likely to show contaminant pollen from the atmosphere of the laboratory room itself.

In their letter to the editor of *Geotimes* (1973) Solomon and Morgan made the following comment concerning the claim that pollen grains in Burdick's 1966 paper were fossil pollen and not the same as those of modern pines or Douglas fir trees now growing along Grand Canyon walls:

The point is important, for if the pine was modern, then Burdick's palynology instructor at that time was more likely correct when he initially identified the pollen as contaminating modern pine pollen (G. O. W. Kremp, personal comment). Coincidentally the pine populations some 1,000-4,000 ft. above Burdick's head were pollinating at the time he was collecting samples. (Solomon and Morgan, 1973, p. 10)

Thus by implication and direct statement these workers have also expressed the opinion that the pollen grains found in Hakatai Precambrian shale by Burdick had entered the sample from the atmosphere during the time the sample was being extracted from the strata.

While we believe that reasonable steps should be taken to avoid atmospheric contamination while gathering samples in the field and when processing them in the lab, we have wondered how much care is really necessary. We were curious regarding just what must be done to insure that spores seen in preparations from rock samples actually represent pollen from that rock and not contaminants from laboratory air or from pollen present in the air while samples were being chipped from strata and put into plastic bags. It is this problem which we address in this paper.

Methods and Materials

In our experiments ordinary glass microscope slides were exposed to the atmosphere under various environmental conditions to determine the likelihood of pollen contamination. Sometimes the particular slide was greased with Vaseline to enhance pollen capture (Table I, Experiments 3-7) and on some occasions a slide was exposed without Vaseline (Experiments 1-6, and 9). In Experiment 8 double-coated scotch tape was placed on a glass slide instead of the Vaseline. On another occasion drops of water were added to the same spot on a slide at different times and were allowed to evaporate while the slide was exposed in a laboratory room for a total of 86 hours (Experiment 10). After

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Table I. Pollen Grains Found on Exposed Slides.

Experiment Number	Date	Location	Conditions of Exposure	Exposure Time	Number Pollen Grains
1	Summer 1983	Freedom, CA	20 feet from sunflower patch; slight breeze; one slide without Vaseline	20 minutes	0
2	Summer 1983	Freedom	Near pollinating corn plants; slight breeze; one slide without Vaseline	20 minutes	0
3	2-20-84	Freedom	Seven feet from pollinating branch of <i>Pinus radiata</i> (Monterey pine) and 20 feet from shrub of <i>Leptospermum sp.</i> in bloom; almost no breeze; two slides— one with, one without Vaseline	20 minutes	0— plain slide 3— Vaseline
4	2-22-84	Freedom	As in Experiment 3 but a very breezy day	10 minutes	12— plain slide 0— Vaseline
5	2-22-84	Freedom	Same day and situation as with Experiment 4	10 minutes	15— plain slide 12— Vaseline
6	2-23-84	Freedom	20 feet from pollinating pine branches; almost no breeze; two slides— one with, one without Vaseline	20 minutes	0— plain slide 0— Vaseline
7	9-23-70	Newhall, CA	On small table under oak trees; one slide— Vaseline coated	48 hours	23— pollen grains and spores
8	12-1-70 12-4-70	Newhall	On small table under oak trees; slide with double-coated scotch tape attached	3 days	3
9	2-25-84	Freedom	Overnight exposure in office; near nine trees: slide without Vaseline	15 hours	0
10	9-12-85 to 9-16-85	Newhall	On laboratory table. Drop of water added and allowed to evaporate five times during interval	86 hours	0

each experiment acetocarmine stain was added and the slides were examined for pollen grains.

In another series of experiments (Table II) a whirling sample collector called a “fly-shield rotobar” was used. Two glass slides with a strip of double sticky tape attached along the long, narrow, leading edge (1 X 75 mm) of each were spun rapidly by the rotobar arm attached to an electric motor for one out of every five minutes during the particular sample interval. The total area of tape thus exposed by both slides being whirled was 1.5 cm². This sampling device was mounted on the roof of the dining hall at The Masters College, Newhall, CA.

Results and Discussion

One feature emerging from these experiments is the relatively low number of pollen grains (sometimes no grains at all— Experiments 1, 2, 3, and 6) found on slides exposed to the air outside. Likewise in these observations the role of wind became obvious. In 10 minutes on a very breezy day (Experiment 5) 27 pollen grains were deposited on two slides near a pine tree. But a set of slides exposed at the same location on a day with little or no breeze yielded no grains on either slide (Experiment 6).

It thus appears that an increase in air movement increases the level of pollen contamination on exposed slides. Evidently on quiet days pine and other pollens generally remain in their cones or inflorescences, as the case may be, and are shaken into the air infrequently.

This breeze factor (or the lack of it) likewise appeared when slides were exposed to the relatively still air in an office and a laboratory (Experiments 9 and 10 respectively). No pollen grains were recovered on two slides in a total of 101 hours exposure— taking Experiments 9 and 10 together. In the same laboratory that Experiment 10 was conducted during the same days, numerous spores were being discovered on the Hakatai Precambrian slides. The data will be presented in Part III of the series and has been mentioned in a Panorama note (Howe *et al.*, 1986).

We also found that pine pollen is quite sticky so that covering the slide with Vaseline evidently gives no advantage (see Experiments 4 and 5). In fact, when Lammerts shook pine pollen onto a glass slide and then inverted the slide, practically all of the pollen stuck to the slide.

Using the rotobar sampling machine (Experiment 11, Table II) only two pollen grains were picked up during a six hour sampling period from 11 p.m. to 5 a.m. In Experiments 11 and 12 together (Table 11)

Table II. Pollen Grains Collected using The Fly-Shield Rotobar Apparatus.

Experiment Number	Date	Elapsed Time in Hours	Number of Pollen Grains per 1.5 cm ² of Tape
11	November, 1970	6	2
12	11-16-70 to 11-18-70	40	3
13	2-13-71 to 2-14-71	23.5	318

only five pollen grains total were collected in a period of 46 hours. It can be properly argued here that November in Southern California is a relatively pollen-free period. It was decided thereafter to sample during daylight hours and to add laboratory grease to the strips of sticky tape.

Using this modified sampling procedure (Experiment 13, Table II) 318 pollen grains appeared on both tapes after a 23.5-hour period in February. Thus the fly-shield roto-bar data are similar to the gravity data in that both the cloudy, non-breezy days of Autumn (Experiments 11 and 12, Table II) and the non-breezy days of Summer (Experiments 1 - 3 and 6) showed very low numbers of pollen grains contaminating exposed slides. During breezy days, however (Table I, Experiments 4 and 5), as well as during the breezy days of Spring when oak trees were pollinating (Table 11, Experiment 13), larger numbers of pollen grains were collected.

Conclusions

The pollen grains of the Monterey pine in this present study were quite unlike those shown in Plate IV of Burdick's 1966 paper illustrating the spores found in Precambrian Hakatai shale. Thus whatever they may be, these later spores are certainly not due to contamination from modern pine plants. Although Burdick portrayed 31 different pollen grains in his two papers (1966 and 1972), Chadwick (1981, p. 10) matched only five of these with modern representative pollen grains.

In these experiments we do not deal with the possibility that the Hakatai shale rocks somehow be-

came contaminated with modern pollen grains during the long time interval after the rocks formed (lithification) and before our samples were extracted. We will discuss that in a future paper.

The present results do not prove that all the grains found on recent slides (Howe *et al.*, 1986) or Burdick's slides (1966 and 1972) were deposited during the formation of Precambrian rock; but they do demonstrate that the chance of contamination by airborne pollen during the slide preparation stage and during periods of field work is extremely low. It would seem, as well, that Chadwick's overwhelming concern (1981) with contamination when preparing and examining slides is unjustified. Evidently whatever pollen might blow into a laboratory on a windy day quickly settles to a desk top or floor where it sticks. It would seem, as well, that reasonable care in cleaning the table, the slides, and the cover slips would make positive pressure and filtered air supplies an unnecessary precaution during the processing of the rocks and analysis of slides.

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COMETS AND CREATION

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Abstract

It is well known that comets are fragile objects and cannot exist in the inner solar system for more than a few hundred revolutions around the sun. Naturalistic theories for their creation and maintenance are shown to be inadequate to explain their continued existence if the solar system were really old. Evidences for a young age for comets are presented.

Introduction

Comets have long been a weapon in the creationist arsenal. They are by nature short-lived objects; their lifetimes while in the inner solar system are measured

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in the thousands of years. Their continued existence, therefore, is evidence for the youth of the solar system. Of course, astronomers are aware of the problem and have devised a number of models of cometary origin in an effort to explain how we can continue to observe comets in a solar system which is supposed to be about

five billion years old. This paper is an examination of those theories to see if they are adequate to explain comets.

Astronomers have particular reasons for wanting to study comets. Comets spend most of their time away from the sun where there is not much to cause changes in their structure or composition over the years. Astronomers believe that most comets are in a cloud tens of thousands of astronomical units from the sun in a sort of cometary deep freeze. Because of this, scientists expect comets to be basically unchanged since their formation. They expect evidence from comets concerning how the solar system was formed, or more correctly, to confirm their theories about the evolutionary nature of the origin of the solar system. In fact, there are even some who say that comets may hold the key to the start of evolution of life on earth. Thus it is in their interest for comets to be as old as they believe the solar system to be. Most astronomers therefore, believe that comets were formed at the same time as the rest of the solar system billions of years ago (Donn and Rahe, 1982, p. 219).

Comets Are Short-Lived Objects

Comets are short-lived objects for two reasons: 1) they lose much of their mass each time they approach the sun, and 2) their orbits are dynamically unstable. The following quote from a paper by two astronomers, Carusi and Valsecchi (1958, p. 261) summarizes the entire situation well:

It is well known that the lifetime of comets in the inner solar system is limited to very much less than the age of the solar system itself both physically, because of progressive gas and dust loss from the nucleus, and dynamically, due to the instability of their motion against ejection on hyperbolic orbits; in fact, these arguments hold for all comets, no matter if of long or short period, and the conventional explanation for the mere fact that we do observe comets is that reservoirs sufficient for the replenishment of both cometary populations exist in the outer solar system.

Thus long- and short-period comets have lifetimes much less than the generally accepted age of the solar system.

Each time a comet passes perihelion, its closest point to the sun, it sacrifices some of its mass to form the sometimes spectacular coma and tail. There are various estimates of how long it would take a comet to disappear entirely, ranging from about 100 (Delsemme, 1985, p. 861) to about 1000 revolutions around the sun (Alfven and Arrhenius, 1976, p. 330; Woolfson, 1978, p. 213). The absolute maximum range is from 20 to 20,000 revolutions (Kresak, 1985, p. 285), but the latter is almost certainly too high. Some estimates of the actual amount of mass lost are 10^{11} kg in one revolution (Elmegreen, 1985, p. 6; Kresak, 1985, p. 281) and at closest approach up to 24,000 kg/sec (Moore and Mason, 1984, p. 26). This means that a typical comet might lose the top few meters from its surface (Delsemme, 1982, p. 87). But in any case the lifetime of a short-period comet (period less than 200 years) against destruction by the evaporation of its volatile materials is in the thousands to hundreds of

thousands of years, far short of the expected billions of years.

Comets move through the solar system in highly elliptical orbits. A periodic comet may be in an orbit commensurate with a massive planet, i.e. an orbit whose period is a simple fraction of the period of the massive planet, enabling it to remain stable over long periods of time. But if it is not, it will certainly be perturbed by the planets' gravity and most such comets, will be ejected from the solar system on hyperbolic orbits (Everhart, 1982, p. 662). The most effective massive planet in changing comets' orbits is Jupiter.

No Evidence for Very Old Comets

So from the very start, scientists acknowledge that they have a problem explaining the existence of comets in a billion year old solar system. This is the reason astronomers have postulated a cometary reservoir as Carusi and Valsecchi said. However it is important to realize from the first that even astronomers acknowledge that there is no direct evidence that comets are billions of years old.

Comet expert Lubor Kresak (1982, p. 57) said:

There is actually no direct evidence that the present flux of comets through the inner solar system is representative for longer time spans.

Brian Marsden (1977, p. 83) wrote:

It is just possible, of course, that comets have been prevalent in the solar system (or at least in its inner part) for less than 0.1 percent of the lifetime of the solar system . . .

Armand H. Delsemme (1977, p. 453) says:

In particular, the spherically random distribution of those comets coming from the Oort's cloud resembles that of globular clusters . . . However, the scaling down of the geometry, plus the residual uncertainty on its accurate shape coming from the small number of observed new comets, does not imply that it be much older than 10^7 - 10^8 years.

Later in the same paper Delsemme (p. 453) says:

"no empirical evidence requests that the Oort cloud be older than a few million years."

The mention of the time "millions of years" in these quotes does not imply that there is evidence that comets have ages in the millions of years. The reason that this time span is mentioned is because the longest period comets have periods in the millions of years. Astronomers assume that they have their origin at the outer edge of the solar system, and hence would have taken a few million years to reach the inner solar system. But there is no evidence that they ever were actually at these large distances. There is no evidence contrary to a recent formation of comets in orbits which would take them millions of years to complete.

Delsemme (p. 453) goes on to explain that though there is no evidence that comets are older than a few million years, the problem is that no one can come up with a theory of how they could have formed so "recently." Therefore it is because of the assumption that the solar system formed billions of years ago together with the astronomers' inability to develop a naturalistic theory for recent cometary formation that most assume comets formed 4.5 billion years ago.

The Origin of Current Theories

Modern theories of cometary formation begin with Jan Oort who in 1950 did an analysis of the orbits of known long-period comets (defined as comets with periods of more than 200 years). He noticed that most long-period comets had aphelia (farthest distances from the sun) in the tens of thousands of astronomical units (AU). There seemed in particular to be a concentration near 50,000 AU. He postulated the existence of a cloud of 10^{11} comets around the sun and reaching halfway to the nearest stars. The passage of nearby stars would so perturb some of the comets in the cloud that they would be sent into the inner solar system to be converted into short-period comets. Later perturbations by the Jovian planets should convert the long-period comets into short-period comets (Weismann, 1982, p. 637). Thus as the short-period comets become burned out, there is always a new supply from those which enter the solar system as long-period comets. All mainline comet theories are variations on this theme.

Scientists assume that this comet cloud is perhaps 50,000 to 100,000 astronomical units from the sun, and contains as many as two trillion of them. This would be about 30 times the mass of the earth in comets alone (Delsemme, 1977, p. 453). It is called the "Oort cloud" of comets, named after the astronomer who suggested its existence. These comets would be in orbits which never bring them near enough to the sun for their volatiles to begin to evaporate. This way they could exist indefinitely. Occasionally a passing star will disturb the orbit of some of them, sending them plunging into the inner solar system to appear as new comets.

However, there is no direct observational evidence for the Oort cloud. It remains an assumption. Something like the Oort cloud is necessary to allow comets to exist for billions of years and so most scientists take its existence for granted. As one astronomer says, "Although there are various difficulties with populating the cloud and its subsequent evolution it is the basis for nearly all current studies on the origin and evolution of comets." (Donn, 1976, p. 663). Thus, though there are difficulties with this theory as we shall see shortly, astronomers are forced to accept it. There are, however, a few astronomers who doubt the Oort cloud even exists (Everhart 1984, p. 215; Witkowski, 1972, p.419).

As we get into the details of the source of long-period comets, it becomes apparent that there are as many theories and variations of theories as there are astronomers. Most still hold to the existence of an Oort cloud. But some, realizing the problems involved with such a cloud, postulate different sources for comets. Each one is more than willing to point out the fatal difficulties of the others' theories, but somehow has trouble seeing them in his own. In fact, at each major step in dealing with the origins of comets, there is at least one optimistic astronomer who considers himself to have solved it. So if at each step one accepts the statements of the most optimistic writer, it would appear that all problems have been solved. This, however, is far from the truth.

It will be useful to describe further the two categories into which comets have been divided, long-period and short-period comets. The periods vary widely, from about three years to nearly infinite. But

at a somewhat arbitrary point of 200 years they are separated into long- and short-period comets. This point is not totally arbitrary, however, for the properties of long- and short-period comets differ. Short-period comets are the more familiar ones for they come back again and again, like Halley's. Most short-period comets have prograde orbits, meaning that they revolve around the sun in the same direction as the planets. They also tend to lie close to the ecliptic plane, the plane containing the orbit of the earth. Long-period comets, on the other hand, are oriented randomly. They are not confined to the ecliptic but may have any orientation. Long-period comets are seen only once because the time between their apparitions is so long or because they have never entered the inner solar system before.

The long-period comets can again be divided into two categories, those which are "new" and those which are not. What is a new comet and how can astronomers tell if a comet is new or not when all of them are seen only once? The new comets have something in common; when their orbits are computed they all have large aphelia, or maximum distances from the sun. These vary from a few tens of thousands of astronomical units to about 100,000 AU.

This, scientists feel, implies that all long-period comets started at the same distance, that of the new comets. Some have entered the inner solar system before and when they did, the gravity of the planets disturbed their orbits enough so that their aphelia were no longer the same. Thus after a single passage through the solar system a "new" comet becomes a non-new but still long-period comet (Van Flandern, 1978, p. 89). But the "new" comets have never entered the inner solar system previously. Consequently when they are seen for the first time they all appear to have similar orbits. The fact that "new" comets have similar aphelia is used as evidence supporting the existence of the Oort cloud at 50,000 A.U. This, of course, is circular reasoning since the new comets were defined as those having aphelia of about this distance.

The Formation of the Oort Cloud

A natural question to ask about the Oort cloud is from where did the cloud come? Oort himself considered this question and decided that there are only two possibilities. Either the comets in the distant cloud formed there at great distances from the sun, or they formed in the inner solar system, among the planets, and were later ejected (Vanysek, 1976, p. 44). Astronomers have not agreed on the answer and it is still a wide open question (Donn and Rahe, 1982, p. 219) because there are problems with all possibilities.

Among those who believe comets were formed in the solar system, the most popular place is the region of the outer planets from Jupiter to Neptune. They have to be formed at least that distance from the sun in order for ices like methane, ammonia and carbon monoxide to form. In this case they must be ejected to the Oort cloud by the outer planets. But Jupiter is too inefficient. Only one percent of the comets ejected by Jupiter would enter the Oort cloud; the rest would be ejected from the the solar system altogether. Uranus and Neptune would take too much time to form—the time scale would be 100 billion years. The efficiency of the ejection process, taking all the giant planets into

account, is only a few tenths of a percent. This means that to have the estimated two trillion comets in the Oort cloud, the initial mass of comets must have been about one-tenth of a solar mass (Donn and Rahe, 1982, p. 219). Mendis and Alfvén (1976, p. 643) say: "this seems to require an embarrassingly large number of comets within the solar system at some time ($>10^{16}$)."

In fact, Alfvén and Arrhenius (1976, p. 328) say:

Oort has suggested that the long-period comets were produced in the inner regions of the planetary system and ejected by Jupiter. Detailed orbital evolution calculations show that this mechanism is impossible. The result is also fatal to Whipple's theory of an origin in the Uranus-Neptune region. One is forced to conclude that the comets were formed by some process in the transplanetary region.

Then what about the theory that comets were formed where they are? The usual objection to this is that the solar nebula from which the solar system is supposed to have formed is much smaller than the distance to the Oort cloud. There would have been no material at that distance for comets to form (Vanysek, 1976, p. 44; Whipple, 1976, pp. 44, 628-9; Fernandez, 1985, p. 45). And there are scientists who still say that there would not have been enough material available for comets to form (Greenberg, 1985, p. 3).

More recently it has been suggested that comets formed at intermediate distances from the sun, in somewhat massive fragments of the solar nebula which became disconnected from the portion which became the inner solar system. Or perhaps, if stars form in clusters, there may have been massive fragments of material floating around from which comets could form (Dorm and Rahe, 1982, pp. 220-2). These are just *ad hoc* assumptions and there is no reason to think this would happen. Safronov (1977, p. 483) said that this theory is not supported by the facts. It is apparent from reading the papers of those astronomers who propose such things that they are grasping at straws because they can think of no other way to form the Oort cloud at large distances from the sun. All these ideas are clearly just guesses and there is no evidence for any of them.

Alternative Theories of Oort Cloud Formation

Some astronomers have realized that the evidence simply makes the formation of the Oort cloud impossible and seek other ways to explain comets. For instance, some say that comets were not formed as part of our solar system at all, but are captured from giant molecular clouds in interstellar space through which it passed (Yabushita, 1985, p. 11). But this suffers from problems also. First is the lack of observations of comets with hyperbolic orbits, meaning comets which were not originally bound gravitationally to the sun. Second, Jupiter could not capture such comets into elliptic orbits. Third, any comets which were captured this way would tend to have low inclinations, that is, they would tend to have orbits close to the ecliptic. This is not the case (Fernandez, 1985, p.45). And fourth, chemical abundances of comets seem to be the same as solar abundances, which would not be expected if they were formed somewhere else (Delsemme, 1977, p. 45.3).

Astronomers who postulate this are forced to make a number of assumptions, including a high density of comets in these interstellar clouds, and even that the giant molecular clouds are formed from the comets rather than vice versa. Some astronomers try to get around the objection of low capture probability by assuming special conditions within the molecular clouds from which the comets would come. But they admit that the processes are unknown (Clube, 1985, p. 19). Fernandez has calculated that their mechanism would be inadequate to create a sizable comet cloud (Fernandez, 1985, p. 45). The evolutionists' first uncrossable hurdle: there is no way to form the comet cloud.

Preserving the Oort Cloud

Assuming that somehow a large number of comets came to be in a distant cloud around the sun, we find further difficulties. The life of such a cloud over 4.5 billion years is not entirely quiescent. Destructive mechanisms are at work making the persistence of the cloud impossible.

The solar system is moving through the Galaxy, the Milky Way, in which it resides. In fact it is in orbit about the center of the Galaxy at a distance of 10 kiloparsecs (2×10^{17} miles). It is moving at a speed of 25 km/sec relative to the spiral arm nearest the sun. The spiral arms of the galaxy are where the molecular clouds are densest. Therefore during the 4.5 billion years during which the sun is supposed to have been doing this, it should have passed through about 15 massive clouds. In 1979 Napier (p. 455) concluded, "Clearly the outer part of the Oort cloud, from which long-period comets are supposed to derive, would be very efficiently cleared . . ."

More recently it has been shown that the only way a comet cloud could survive repeated passages through such molecular clouds is for it to be much more concentrated close to the sun than was previously thought (Bailey, 1984, p. 65). Therefore some have proposed that there are really two comet clouds (Fernandez, 1985, p. 45; Clube, 1985, p. 19), one relatively nearby which cannot be swept away by the passages through the molecular clouds and which can replenish the outer one and the second, traditional Oort cloud at large distances. But replenishing the outer cloud from the inner is an inefficient process. To put hundreds of billions of comets into the outer cloud from the inner means that the inner cloud must have 10^{15} to 10^{16} comets (Napier, 1985, p. 31). This is almost the mass of the sun itself. A mass of comets this large would be in conflict with other aspects of solar system formation (Clube, 1985, p. 19). And there is no way that the less massive outer planets could put this large a mass into longer period orbits (Napier, 1985, p. 31). I would also question whether this process could move two trillion comets from an inner cloud to an outer one in the time between passages through the molecular clouds. Further, Napier says that the half-life of such an inner cloud would be only one billion years and is therefore ruled out (Napier, 1985, p. 31). This is the second hurdle: the Oort cloud cannot survive for 4.5 billion years.

Bringing the Comets Back

Oort was indeed able to show that a passing star could change a comet's orbit enough to send it into the

solar system as a new comet. But this is a long-period comet. The astronomers' dilemma is to account for the short-period comets. It is the short-period comets which spend so much time near the sun that their lifetimes are unacceptably short. Some way must be found to change the long-period comets into short-period comets.

The theory that long-period comets are changed into short-period comets by gravitational interaction with Jupiter is almost two centuries old, originating with Laplace. But it was shown in 1891 by H. A. Newton that a single close encounter with Jupiter or any planet cannot change a long-period comet into a short-period one. The probability is extremely small that it could happen, and even for those whose orbits are changed sufficiently, the characteristics do not match those of real comets (Mendis and Alfven, 1976, pp. 649-50). Everhart (1969 p. 735) who has done extensive computer modeling of cometary orbits, says;

Every calculated distribution is in serious conflict with the corresponding distribution for the known short-period comets. These cannot be the immediate or unmodified result of capture by Jupiter.

More recently Everhart has shown that greater success in reproducing the orbits of short-period comets from long-period ones can be obtained after several hundred encounters with Jupiter by the same comet (Alfven and Arrhenius, 1976, p. 234). Unfortunately there are so many short-period comets that this process would produce them 1,000 (Bailey, 1984, p. 65) to 10,000 times too slowly (Alfven and Arrhenius, 1976, p. 330). Transitions from long-period to short-period comets cannot be made at a fast enough rate to account for the observed number of short-period comets.

Here is the third hurdle: comets from the Oort cloud cannot account for short-period comets. We have encountered three uncrossable hurdles for the Oort cloud theory: there is no way to create the Oort cloud, the Oort cloud could not survive for the supposed age of the solar system, and the comets cannot be returned from the Oort cloud at a fast enough rate.

The Age of Comets

The conclusion is already obvious—some form of Oort cloud is necessary to preserve intrinsically short-lived comets for billions of years. No way has been found either to create or maintain such a cloud, therefore comets are young. But there are other indications of a young age as well.

Lubor Kresak has analyzed the dynamics of long- and short-period comets. He concludes that the long- and short-period comets differ substantially in their dynamical history. In fact he says, "... the end fates of long- and short-period comets and, hence their structure and physical evolutions are different." (1985, pp. 296-298). This means that the short-period comets did not come from long-period comets. So here is another break in the chain linking the Oort cloud with short-period comets.

But there is something more significant in his analysis than he realizes. His conclusion that long- and short-period comets are intrinsically different is partially based upon observations comparing the orbits of asteroids and comets. There is a theory that once a

comet has outgassed until most or all of its volatiles are gone, it looks very much like an asteroid. Some of the objects which we have identified as asteroids may in fact be burned out comets. Short-period comets which return to the sun every few years or decades would be expected to lose their volatiles in a relatively short period of time and turn into asteroid-like objects. And in fact there are some asteroids whose orbits resemble short-period comets.

Now some of the longer period comets should also have made enough passages to the sun to lose their volatiles and turn into asteroid-like objects. It would take them longer than for short-period comets, since they return to the sun less often, but there has been plenty of time if the solar system is 4.5 billion years old. Despite the fact that solar system objects with aphelia beyond Saturn should be especially easy to spot, *not one* asteroid in a comet-like orbit has been found in this region (Kresak, 1985, pp. 296-8). Kresak is puzzled by this. The only way he can explain it is that short- and long-period comets are physically different, the short-period comets being able to turn into asteroids and the long-period comets being unable to turn into asteroids. But he notes "... that there are no observable systematic differences in their radiation mechanism." (1985, pp. 296-8). What he is saying is that long- and short-period comets are the same in every way except that apparently, one produces asteroids and the other does not.

What does this mean? Some short-period comets may have turned into asteroids, but no long-period comets have done so. The conclusion is clearly that while there has been enough time for some short-period comets to turn into asteroids, there has not been enough time for any long-period comets to do so. This is a clear indication that comets are far younger than the supposed age of the solar system. The exact lifetimes of comets are unknown, but we can make some estimates. A comet with an aphelion at Saturn's distance would have a period of about 15 to 30 years. If it lasts a maximum of 1,000 orbits, its lifetime would be 15,000 to 30,000 years. It seems that none have lasted that long.

There is still a great deal of dispute about whether or not comets really do turn into asteroids. But whether they do or not, evolutionists still have trouble. If comets do turn into asteroids, then the lack of asteroids in long-period comet orbits demonstrate the youth of comets. If they do not turn into asteroids, then, as Kresak said, there must be two independent populations of comets, with no transitions from long-period to short-period comets, and therefore no way to repopulate the short-period comets from the long-period comets.

There is further evidence that the long-period comets have not been around very long. Recall that new comets are long-period comets which are entering the inner solar system for the first time. Once they have entered they should continue to return to the sun again and again as long-period comets which are not new. However most long-period comets are new (Vanysek, 1976, p. 44). Only about one fourth as many non-new comets as expected are really observed (Everhart, 1979, p. 23). If this has been happening for billions of years and comets can survive for hundreds of orbits,

there should be many times more "old" comets than new ones. There simply has not been enough time for many old ones to come back for a second trip.

The usual answer to this is that there are selection effects in the observation of comets. If comets diminish in brightness in the course of time, we are more likely to observe new comets than dimmer, old ones (Shtejns, 1972, p. 347). Kresak (1977, p. 93), however, disagrees. He states that the lack of old comets can only be explained if almost all new comets vanish after one perihelion passage or dim appreciably after a single passage.

Even deep space is not empty. One resident of space is the cosmic rays. Over billions of years a large number of cosmic rays would pass through a comet. The effect would be to polymerize the simple compounds and ices that make up the comet. This means that the small molecules would be made into larger and less volatile compounds, molecules which would not evaporate from the surface as easily when the comet at last reached the inner solar system. Cosmic rays would penetrate the outer layer of a comet from one to a few meters deep (Donn, 1976, p. 617). Schulman (1972, p. 265) has calculated that during a time interval of 2×10^7 to 2×10^8 years every molecule in the surface layer will be struck by cosmic rays and take part in these chemical reactions. This is in sharp contrast to what is actually observed. New comets are very bright, meaning that they are losing large amounts of gas and dust. Thus there is no indication that comets have spent a large amount of time in space.

There are some who say that the effect of cosmic rays would actually be to increase the activity of new comets (Whipple, 1981, p.1). But experiments may indicate otherwise. Methane gas, when exposed to radiation is transformed into a viscous oil (Shulman, 1972, p. 265). Another experiment exposed low temperature ices to ultraviolet radiation, not cosmic rays, and produced something they called "yellow stuff" which did not evaporate even when heated. This would happen in space in only 10 million years (Greenburg, 1982, p. 131).

Cosmic rays can have another effect. Cosmic rays are primarily composed of protons (nuclei of hydrogen atoms) moving at speeds close to that of light. They have extremely high energies and are capable of inducing nuclear reactions. One type of reaction that can be induced by cosmic rays is called spallation. A spallation reaction is one in which a high energy proton strikes the nucleus of a relatively heavy atom and breaks it into smaller fragments, each of which is then the nucleus of a different kind of atom (Harwit, 1973, p. 35). Carbon, nitrogen and oxygen are among the more common heavier elements which are likely to be targets of the energetic protons (Harwit, 1973, p. 421). They exist in such compounds as methane, ammonia and water. These compounds exist in comets. Over a long period of time the spallation reactions should result in a relatively large amount of the element lithium as a spallation product (Harwit, 1973, p. 35). The longer the exposure to cosmic rays, the greater should be the amount of lithium in comets. However, when spectra of comets are examined, no lithium is present (Donn, 1976, p. 620). Again we see that comets

cannot have been exposed to cosmic rays for very long.

Non-Oort Cloud Theories

What we have just seen is that there is no way to explain how comets can exist for a period of billions of years. Comets are much younger than this. Some astronomers, realizing this, have abandoned the Oort cloud type of explanation and have tried to explain how comets might have been created recently.

Some astronomers who reject the Oort cloud give as one of their reasons the so-called distribution of perihelia. If the comets were truly oriented randomly in space, these perihelion points would appear to come from all directions with equal probability (Weismann, 1985, p. 87). In fact though, they do not. There are about five directions from which comets prefer to come and one direction in particular. This is not consistent with an old Oort cloud whose comets are perturbed by passing stars since comets should be coming from all directions with equal probability. Furthermore, all long-period comets, both old and new, have their perihelia clustered in the same directions (Yabushita, 1985, p. 11). Now the old long-period comets are supposed to have been through the solar system before and had their orbits severely changed by the gravity of the planets. But if the old and new comets all have the same distribution, it is clear that neither has ever been influenced by the planets while traveling through the solar system before. Thus we do not have to assume that comets are even as old as one period of the old, long-period comets.

Again, this observation is often attributed to selection effects in observation. Witkowski cites several studies whose purpose was to eliminate these selection effects from the data in order to show that the true distribution is random. Contrary to the expectations of the investigators, the non-random distribution is real. And in fact their motion is similar to the motions of stars in the solar neighborhood (Witkowski, 1972, p. 419).

Another observation indicating that comets did not come from a uniform Oort cloud is the distribution of the orbits of some comets. Major solar system objects fall in the plane of the ecliptic. Comets have orbits of all orientations. But of course there are some comets whose planes are perpendicular to the ecliptic. Of those there are 54 percent more in the retrograde than in the prograde direction. This is too large to come from primordial or galactic effects; it would be dissipated by orbital diffusion in 20-30 million years, hence these comets must be younger (Delsemme, 1985a, p. 19; Delsemme, 1985b, p. 896).

One even less orthodox theory for the origins of comets is a revamping of an old theory proposed by the two astronomers Ovenden and Van Flandern. They observed that the comets tend to come from certain directions more than others in the sky. This suggested to them that there was once a planet in orbit between Mars and Jupiter where the asteroid belt is now. It exploded and its fragments are the asteroids and comets. They say the planet was about 90 times the mass of the earth and it exploded about six million years ago (Van Flandern, 1977, p. 475; Ovenden, 1973, p.319; Van Flandern, 1978, p. 89). This actually answers

some problems that other theories do not. It is one of the few which can explain the preferred direction of cometary perihelia. And it is the only one, in my opinion, which has any explanation of why most new comets seem to have about the same aphelion distance. The answer is simple: if the explosion took place six million years ago, only those comets given a period of six million years by the original explosion would be seen coming back now for the first time. If it did not have one unsurmountable flaw, it might be tempting to try to find a way to fit this into a creationist time scale. The problem is that no known process could cause a giant planet to explode. (Perhaps, though, a collision could account for it.)

A rather strange theory says that comets are continually forming even now in the solar system. Alfven and Arrhenius have developed an entire theory for the formation of the solar system based upon what they call jet streams. They say that instead of spreading out, dust in the solar system tends to concentrate into dense rings they call jet streams. The dust thus concentrated is able to accrete into larger bodies. They contend that for instance, all the dust in the orbits of comets is not really spreading out along the orbit, as most believe, but is in fact accreting into the comet, making it larger. Thus comets are continually forming from loose dust in the solar system (Alfven and Arrhenius, 1976, p. 330). This is against all reason as well as against the second law of thermodynamics. Most astronomers dismiss the process as impossible.

And the most bizarre of all is that supported by a number of Soviet astronomers who say that comets were erupted from volcanoes of all the planets. This is supposed to be going on still, with Jupiter's volcanoes as the major source, but in the past it has occurred on all planets, even the very hot Mercury and Venus (Vsekhsvyatskij, 1972, p. 413). It is rather obvious that of the two solar system bodies known to have active volcanoes, the earth and Jupiter's moon Io, neither one is spouting comets. Jupiter does not seem capable of having volcanoes, and if it did, it is not likely that anything coming out of them would be able to escape its tremendous gravity. It is just another feeble guess.

Conclusion

It is clear that evolutionary theories are totally incapable of accounting for comets in an old solar system. They cannot explain the formation, maintenance or return of comets. The chemical composition, behavior, and orbits of comets are not consistent with large ages and naturalistic formation. Comets are young objects. And since there is no natural mechanism which can account for a recent formation of comets, they must have been created recently in a recently created solar system.

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MISSISSIPPIAN AND CAMBRIAN STRATA INTERBEDDING: 200 MILLION YEARS HIATUS IN QUESTION

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Abstract

Two field trips were made to study the supposed unconformity between Mississippian Redwall Limestone and Cambrian Muav Limestone along the North Kaibab Trail, Grand Canyon. Characteristics indicative of unconformable stratigraphic relationships are described. Such characteristics were not observed along the Redwall-Muav contact line. Field evidence supports the belief that continuous deposition of sedimentary strata occurred, one formation on another. Thus there need not be any 200 million year depositional hiatus between the two formations.

Introduction

Geologists believe that there exists a 200 million year hiatus between the top of the Cambrian Muav Limestone and the base of the Mississippian Redwall Limestone-Collier (1980, p. 10). This belief is contradicted by Burdick (1974) who reported that elements of the Redwall Limestone and Muav Limestone were intertonguing with each other to form repeating sequences:

Now we come to the Cambrian Period, and walking down the trail, we see where the Mississippian will come down to a certain level and then we find a layer of Muav limestone. Still lower we find a layer of Mississippian and again another layer of Cambrian. It is strange that they can jump back and forth, these alternations of rocks over 100 million years. This is called recurrent formation or faunas. Mississippian life is supposed to have ended at the end of that period and an entirely different type of rock should be in the Cambrian. In the Cambrian, the oldest rock, are trilobite fossils and

other shell fish, distinctive of that type of rock. When you progress to the Mississippian, you are supposed to be leaving that type of life and coming to another. Instead, we find another layer of Cambrian. Something is wrong. Evolutionists say you can't put evolution in reverse: it is always forward.

So here is another puzzle, recurrent faunas. p. 61

If it can be shown that there is no hiatus between the Redwall Limestone and the underlying Muav Limestone, then this conclusion would 1) discredit geologic time as promoted by some geologists and 2) do great damage to the macroevolution model of origins.

Observations

The CRS Research Committee authorized two trips into Grand Canyon in 1986 to study stratigraphic relationships within that area publicized by Burdick (1974). Key exposures exist along the southerly trending, principally southerly descending, sinuous North Kaibab Trail, in the Grand Canyon. Burdick's stratigraphic section is situated just southerly of a National Park Service information sign. The sign identifies to the reader the base of Redwall Limestone lying on top of Muav Limestone. The stratigraphic section can be reached from North Rim, Grand Canyon, commencing at the trailhead for North Kaibab Trail. Merely walk down North Kaibab Trail for a horizontal distance of about 4 miles, dropping vertically about 2000 feet to reach the study site.

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This is very scenic terrain. Except for a drinking fountain atop the Supai Formation there is no available water along higher parts of North Kaibab Trail. Hence it is advised that one bring adequate supplies of water for that trek. It is also advised that the National Park Service be contacted to determine if North Rim is accessible. Since North Rim is above 7,000 feet sea level, this indicates annual early fall closing of North Rim trailhead by snow.

During colder months, Burdick's stratigraphic section can be reached from the South Rim, Grand Canyon. Merely follow the South Kaibab Trail to Phantom Ranch and then ascend the lowest part of North Kaibab Trail to the specific site. This southerly access road involves over 30 miles of hiking and such a trek will require spending at least one night in Grand Canyon.

Nature of The Contact Line

During the 1986 trips, the aforementioned National Park Service sign identifying the contact between the Redwall Limestone and the Muav Limestone was reached. It reads as follows:

AN UNCONFORMITY

Rocks of Ordovician and Silurian Periods are missing in Grand Canyon. Temple Butte Limestone of Devonian age occurs in scattered pockets. Redwall Limestone rests on these Devonian rocks or on Muav Limestone of much earlier Cambrian Age.

Note — The sign indicates by arrow that at this locality Redwall Limestone lies directly on Muav Limestone. Temple Butte Limestone of supposed Devonian age appears absent.

The supposed unconformity between Redwall Limestone and Muav Limestone is not at all obvious when one attempts to trace the contact along North Kaibab Trail. Commencing from an area about 100 yards northerly of the National Park Service sign and terminating about 100 yards southerly of the sign, all beds seemingly interfingered, one with another. Among strata observed were Muav Limestone beds of blue-gray, micaceous shale exhibiting what has been described as fossil worm tubes— see Figures 1 and 2.

Using the National Park Service sign as the basis for separation of Muav Limestone strata from Redwall Limestone strata, it was determined initially that the yellowish appearing micaceous shales (Figure 2) were the uppermost Muav Limestone beds. Immediately above these shales were more massive beds that typified reddish-colored Redwall Limestone beds. Yet any attempt to trace individual beds laterally southerly or northerly along North Kaibab Trail resulted in a reverse stratigraphic relationship. Allegedly older Muav Formation yellowish beds rested on alleged younger reddish-stained Redwall Limestone beds.* See Figure 3.

The previously described Muav Limestone's blue-gray micaceous shale bed seen below the supposed unconformity was traced laterally so that it too could be seen to rest on allegedly older Redwall Limestone strata as illustrated in Figure 3 and the diagram in Figure 2. The described relationships suggest the probable presence of lateral and vertical facies changes within both formations. Lateral and vertical facies

*Redwall Limestone is actually light gray in color. The red color is due to staining from the overlying Supai.

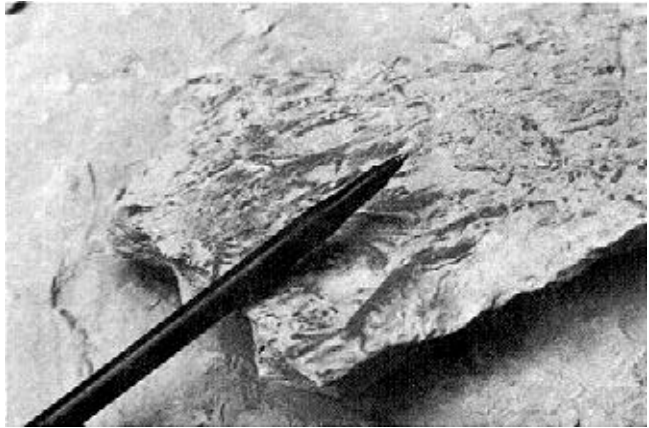


Figure 1. Micaceous shale. There were layers of micaceous shale like this present in both Redwall and Muav Limestones, supporting the idea that these Mississippian and Cambrian deposits were formed almost simultaneously. Note fossil worm tubes.

changes within both formations indicate the absence of unconformable relationships between the Redwall Limestone and the Muav Limestone. Other alleged Muav Limestone beds observed here include strata described as mottled limestones by McKee (1945, pp. 21-2)— Figure 4. These mottled limestones exist within the Redwall Limestone also.

Muav Limestone and Redwall Limestone strata situated about 50 feet above and 50 feet below the presumed unconformity were searched for erosional features supportive of an unconformity. None was seen. All of the beds were seen to be homoclinal, each bed resting directly on another bed with no known structural deviation. Joint planes commencing in alleged Muav Limestone beds seemingly intersected Redwall Limestone similarly.

If in fact a 200 million year hiatus existed, and if in fact pertinent principles of structural geology and stratigraphy were applied to this stratigraphic section, one would expect to see 1) obvious, pronounced erosional features incised into the highest of Muav Limestone beds, 2) Basal Redwall Limestone beds exhibiting boulders and cobbles of eroded Muav Limestone beds, 3) Muav Limestone beds dipping somewhat more steeply than overlying Redwall Limestone beds, 4) Muav Limestone beds being somewhat more folded than Redwall Limestone beds, 5) more complex joint systems in the Muav than in the Redwall, 6) more faulting in the Muav than in the Redwall, and particularly 7) a decidedly different lithology within each of the formations, due to supposed changing regional environments.

Redwall Strata in Muav Limestone well below the Unconformity

More than 100 yards southerly of the National Park Service sign for the Redwall-Muav contact there is a stratigraphic section which is impressive— see Figures 2 and 5. In this area, there are interbedded supposed Redwall strata, mottled Muav Limestone and micaceous shale. This sandwiched section was observed to be well below the presumed contact, and entirely within the Muav Limestone. Redwall strata are not expected to exist here within the Muav Limestone. Yet these interbedded strata grade abruptly southerly into

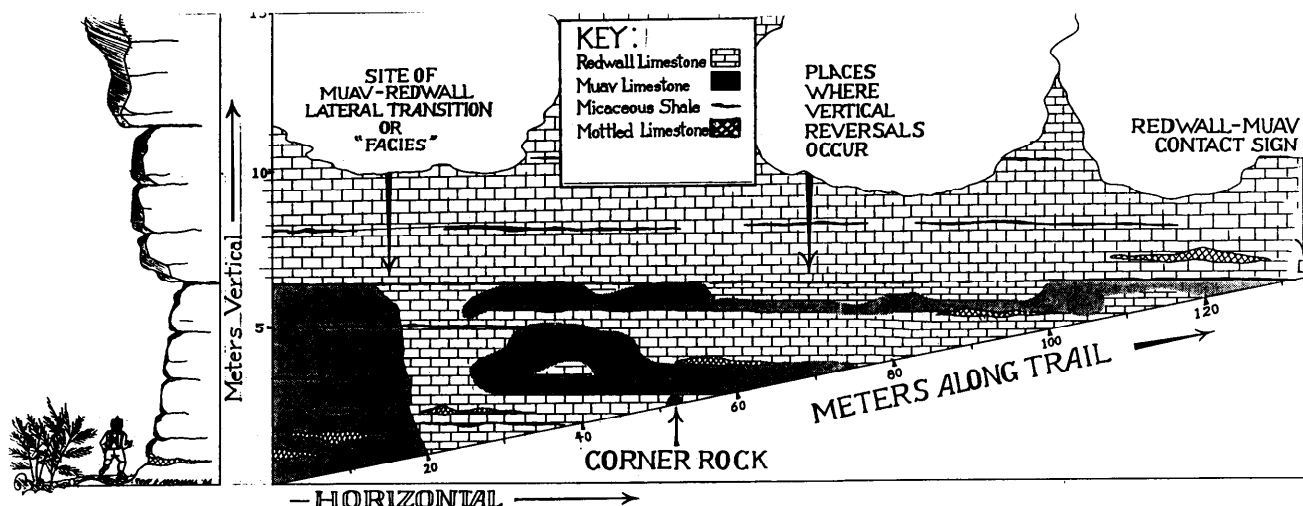


Figure 2. A diagram of the rock strata near the Redwall-Limestone-Muav Limestone contact, North Kaibab Trail, Grand Canyon, AZ. From the starting point at the left, distances were paced along the trail and these three-foot paces were later converted to meters. The trail, which curved in and out, has been drawn straight, with a gradual slope as shown. The "corner rock" sketched here is visible on other figures.

The vertical distance was estimated from other photographs containing a member of our party who was about 5 feet 10 inches tall. See sketch of 510" hiker for vertical perspective. Vertical distances are exaggerated four-fold in comparison to horizontal distances.

Evolutionary geologists assume that Redwall Limestone was deposited 200 million years after the Cambrian Muav Limestone beneath. We found, however, that beds of both were deposited in exactly the same horizontal fashion and there were no signs of the Muav having eroded before the Mississippian Redwall Limestone was laid down. In one place Muav and Redwall clearly graded laterally into each other and they also manifested a vertical intertonguing at other localities. All of these facts support the belief that Redwall was deposited only after shortly Muav Limestone. Diagram drawn by Ross Marshall.

strata which are obviously Muav, by descriptive definition (Figures 2 and 5).

A close-up view (Figure 6) reveals that there is no fault where the interbedded strata grade directly into obvious Muav material.

A Contrasting Post Pre-Cambrian Unconformity

Along a lower segment of the North Kaibab Trail, trending southeasterly towards Phantom Ranch, one can view an undoubted unconformity. In this area, a



Figure 3. Vertical and horizontal reversals. To the left of W. Waisgerber and the "corner rock" are beds which undergo intertonguing in that there is a transition vertically between such layers as micaceous shale, Muav-like rock and Redwall Limestone. It is obvious as well that the lighter Muav-like material near Waisgerber's head becomes darker laterally, shading into typical Redwall beds. Transitions such as these do not fit with the usual geological concept that vast ages separated the deposition of rocks above and below. Note also the perfectly conformable and horizontal character of all these strata. No marks of any erosion, tilting, or other disturbance are here, suggesting contemporaneous deposition.

sedimentary formation, the Precambrian Bass Limestone (basal member of the "Grand Canyon Supergroup") lies unconformably on older, metamorphosed, Precambrian, Brahma Schist. See Figure 7. In this area this unconformity can be discerned readily. The rocks above differ markedly from the rocks below in lithology and in the presence of differing structural elements. There is a somewhat jagged interface between the two formations which is considered to be indicative of an erosional interval of time into Brahma Schist prior to deposition of elements of Bass Limestone.

DISCUSSION

Formational contacts

When basal strata for one geologic formation (or member) lie directly on uppermost strata of an older formation (or member), in a uniform manner, then it is common practice for a geologist to conclude that the two formations (or members) are conformable. However, should an evolutionary geologist determine on the basis of fossil evidence that there are millions of years of missing geologic time situated between the formations, then he must postulate the existence of an unconformity. Then that evolutionary geologist must search for confirming structural geologic evidence to support his belief. Evidently fossil evidence from the Redwall Limestone and the Muav Limestone have convinced evolutionary geologists that there must be such an unconformity.

As was mentioned previously, some relationships between formations (or within formations) are undeniably unconformable. If for example the subjacent formation is metamorphic, whereas the superjacent formation is sedimentary, the result can be described as an unconformable relationship—a nonconformity. A nonconformity is illustrated in Figure 7.



Figure 4. Mottled limestone. Mottled limestone of this type was found in both the Muav and Redwall-like deposits below the supposed contact surface. Its presence in patches within both types of strata is another evidence favoring simultaneous deposition. McKee (1945) discusses this mottled limestone as part of typical Muav formations.

If subjacent strata are folded or significantly inclined, more than superjacent strata, this describes another kind of unconformable relationship—the angular unconformity. Thus there is the existence of hiatuses between formations (or members) when these stratal elements exhibit angular unconforming relationships or nonconforming relationships.

One other stratigraphic relationship between formations (or members) is commonly described as a disconformity. A disconformable relationship supposedly exists when two formations exhibit similar structural geologic elements except that the lower formation may have been incised. Basal strata for the higher formation then fill in the notches and grooves brought about by prior erosion of the uppermost part of the older formation.

The Redwall/Muav contact is evidently a disconformity by definition. Yet in the previously mentioned study site along North Kaibab Trail, strata did not reveal notches and grooves to confirm the current geologic conclusion that a disconformity existed.

How do most geologists account for the various Paleozoic deposits in Arizona?

According to historical geologists, Cambrian, Devonian and Mississippian strata were formed when a broad, onlapping sea moved into Northern Arizona to cover the general area with sediments. Certain “isopach” maps which were drawn by a previous investigator (McKee, 1951) reveal depths of respective formations suggestive of Cambrian, Devonian and Mississippian oceanic advances. Because Cambrian, Devonian and Mississippian strata do not associate with the so-called Defiance Positive area of northeastern Arizona, it is presumed that Cambrian, Devonian and Mississippian seas never covered that area.

Following recession of the post-Cambrian (and Ordovician and Silurian) sea, the advancing Devonian sea deposited sediments well to the west of the Defiance Positive area suggesting that the Defiance Positive area had been extended farther westerly than it had been during Cambrian times. Thus areas such as

North Kaibab Trail were supposedly above sea level and hence not covered by Devonian sediments.

Following recession of post-Devonian seas, the advancing (onlapping) Mississippian sea covered a greater area than did Devonian seas. This resulted in the covering of Devonian strata where Devonian strata had been deposited. Where Devonian strata were absent, such as along North Kaibab Trail, Mississippian seas deposited sediments directly on Cambrian deposits. Such a historical geological scenario pleads for a hiatus of 200 million years between Mississippian and Cambrian depositional sequences. A 200 million year hiatus demands an undoubted unconformity between Mississippian and Cambrian deposits.

Continuing the historical geological scenario, Ordovician and Silurian seas supposedly receded from the Grand Canyon region. Consequently, one would expect to find fauna-dated Ordovician and Silurian strata somewhere in the general region, particularly in areas to the south. McKee (1951) raises a very significant, unresolved geologic time and time-rock problem by writing: “Strata of the Ordovician period are confined to the southeastern and possibly to the northwestern parts; those of the Silurian are not known within the state.” p. 484.

McKee’s comment above merely reinforces the belief by the writers of this paper that geological time as developed in western Europe during the 19th century cannot satisfy the stratigraphy of the Rocky Mountain region of North America. Because 19th century western European geologic time was adopted by 20th century North American geologists, mid-20th century consequences have been monumental non-solvable stratigraphic correlation problems across North America. It is not at all surprising that the Redwall Limestone-Muav Limestone hiatus cannot be confirmed by an undoubted unconformity.

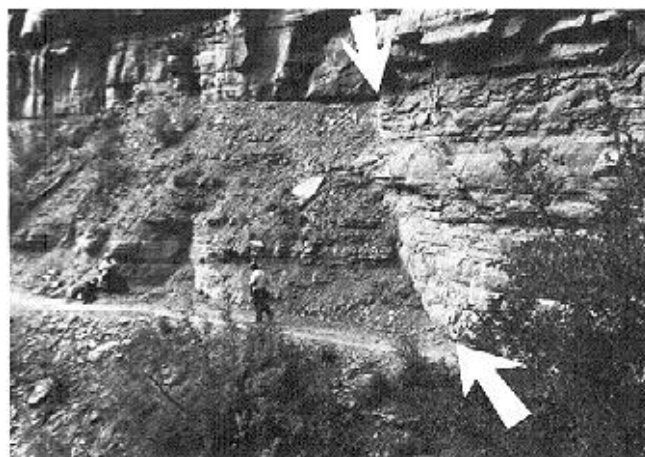


Figure 5. Lateral transition or facies shift from a sandwich of Redwall, micaceous shale, mottled limestone and Muav to solid Muav. At the right a sandwich of Redwall, micaceous shale, mottled limestone, and Muav-like beds grade laterally into a solid deposit (left) of Muav. A facies relationship of this type would be expected only if both the Mississippian and Cambrian rocks were being deposited at approximately the same time. J. Meyer is seen left and W. Waisgerber to the right. The arrows point to the top and bottom of this line of lateral transition.



Figure 6. View of the lateral transition. Even upon close analysis there is no sign of faulting at the line where the sandwich of rocks (see Figure 5 caption) grades laterally into pure Muav Limestone.

Mississippian (Redwall Limestone) and Devonian (Temple Butte) strata reported as unconformable

At places throughout the Grand Canyon region, Mississippian Redwall Limestone is known to rest on Devonian Temple Butte strata, rather than on Cambrian Muav Limestone. A number of workers have studied and described that Mississippian-Devonian contact. Based on established geologic criteria, some exposures reveal an apparent unconformity, and thus Walcott (1888, p. 438) wrote concerning the lower Carboniferous, which is synonymous with the Mississippian, that:

A plane of unconformity by erosion, not dip, was found between the Carboniferous and Devonian, and also a strongly marked fauna compared with the Tonto beneath and Carboniferous above.

McNaire (1951) also viewed the Mississippian-Devonian contact as apparently unconformable:

The contact between the Mississippian and Devonian rocks can be identified by a change in the weathering of outcrops. The weathered surface of the Devonian is brown gray and the Redwall is light gray. The erosion surface between the two systems is irregular, and in many places the basal 2-10 feet of the Mississippian contains angular blocks of Devonian Limestone. Although local scattered chert nodules occur in the upper part of the Devonian limestones, the Mississippian contains much more chert. In many places a thick, conspicuous band of dark-weathering, chert-bearing limestone, 20-60 feet above the base of the Mississippian, gives a clue to the position of the contact. p. 518.

McKee and Gutschick (1969) found in western localities of Arizona that:

Surfaces of relief developed on pre-Mississippian rocks of western Grand Canyon consist chiefly of small hills and shallow depressions ranging from a few feet to an observed maximum of about 10 feet within horizontal distances of 100 to 200 feet. At one locality, Havasu Canyon, pre-Mississippian erosion is recorded in the form of a beveled surface developed on folded Devonian rocks . . .

The folding here apparently was accomplished before consolidation of the strata, possibly the result of overloading. . . In most of western Grand Canyon and in a few places to the east, the lowest member of the Redwall is a cliff-forming limestone, whereas the underlying Devonian strata are dolomite and form a series of ledges. In other areas, however, Mississippian dolomite rests upon Devonian dolomite so that recognition of the uppermost Devonian depends largely upon distinctive lithology and primary structural features within that system. p. 16

Stoyanow (1948) also implied that in his study this contact between Mississippian and Devonian strata was unconformable as witnessed by its uneven character: "The Redwall Limestone—the lower Mississippian stratigraphic unit of north-central Arizona—rests on the uneven surface of different older strata." p. 314. Longwell (1928) likewise wrote of an unevenness at the contact between Carboniferous and Devonian strata in the Muddy Mountains of Nevada:

The base of the Carboniferous in the Muddy Mountains is marked by an irregular surface, which appears in section as a slightly wavy line at the top of light-colored limestones assigned to the Devonian. p. 28.

Two other authors noting an unconformity between Devonian and Redwall strata include S. S. Beus (1969, p. 130) and E. D. McKee (1969, p. 83)

But unconformity at some Mississippian and Devonian contacts is questionable

Various workers have reported that in certain sites the Mississippian Redwall strata rest conformably on the underlying Devonian. Thus after a study of these contacts in several localities, Noble (1922) concluded that:

. . . if an unconformity separates the Temple Butte limestone and the Redwall limestone in the region which I have examined, it is so obscure and exhibits so little irregularity that it can be detected only by obtaining determinable fossils in the strata within which it lies. Certainly no surface of erosion exists which is at all comparable in irregularity



Figure 7. A nonconformity. There is obviously nonconformity here in line of arrow separating the Precambrian Bass limestone above from the twisted and eroded Brahma schist metamorphic strata below. No clear indicators of unconformity like these were visible where Mississippian contacted Cambrian far above. E. Williams is seen hiking here.

with that which separates the Tonto group from overlying beds. p. 54.

One page earlier, Noble made this same point after noting that although Walcott found a line of erosion separating Redwall Limestone from Devonian layers at Kanab Creek:

. . . I am unable confidently to trace this unconformity in the region between Garnet Canyon and Cottonwood Creek and at all places to separate Devonian beds from the Redwall limestone. p. 53.

Describing the contact line between the Martin formation (also Devonian) and Redwall Limestone in central Arizona, Huddle and Dobrovolsky (1952) indicated that: "*Although the contact appears to be conformable, there was probably a break in deposition between the Martin formation and the Redwall limestone.*" p. 81 (Emphasis added). McKee and Gutschick (1969) noted that:

At 11 of 21 localities examined, including most of those in eastern Grand Canyon, no evidence of an erosion surface could be detected at the contact: the surface appeared even and flat . . . Where evidence of an erosion surface is obscure, recognition everywhere of the basal contact of the Redwall Limestone is not easy . . . In summary, no large uplift such as would result in conspicuous dissection of the region or in an angular unconformable relation between formations is represented at the base of the Redwall. Nor is there any strong evidence that a major uplift in surrounding areas furnished large amounts of gravel across the surface. pp.16, 18.

In a later paper, E. D. McKee (1976) admits to an apparent enigma:

Evidence that an unconformity occurs between rocks of Devonian age and those of Mississippian age in Grand Canyon is furnished both by the physical record and by faunal evidence of a hiatus. *Nevertheless, the boundary between rocks of these two systems is in most places difficult to recognize. Nowhere has any angular discordance been recognized and in only few places, mostly in western Grand Canyon, have conspicuous relief and local conglomerates been observed.* p. 54 (emphasis added)

Shelton (1966) likewise affirms that:

The extraordinary flatness of the disconformable contact at the base of the Redwall limestone, which generally lacks even the minor channeling seen beneath the Temple Butte, implies that the landscape that developed in the interval between the accumulation of the two formations possessed remarkably little relief. p. 276

That there is conformability between Mississippian Redwall and Devonian strata becomes even more thought provoking when contrasted with observed aberrant stratal relationships between lithologic members within one formation—the Mississippian Redwall Limestone. Thus McKee and Gutschick reveal the existence of a striking unconformity and irregular contact between the Mooney Falls member and the Horseshoe Mesa Member of the Redwall— see Figure 24, p. 58 of the McKee and Gutschick paper of 1969.

Here then could be another enigma for the stratigrapher. Why would lithologic members within one formation exhibit more pronounced stratal differences than occur between members of entirely different formations such as Mississippian and Devonian?

Cambrian-Devonian contact is unrecognizable in some localities

Although we had not intended to study existing contacts between Cambrian and Devonian, we located two references describing these. At such sites evolutionary geologists would also argue that many millions of years are missing and they would expect to find unconformities. Beus (1969) notes, on page 130 however, that: "The Devonian-Cambrian boundary is difficult to recognize in many sections owing to the similarity of lithology and absence of fossils in adjacent strata." Likewise McKee (1969) intimated that although erosional marks of unconformity were present, sometimes there was a lack of stratigraphic discordance that might otherwise have been expected:

Erosion surfaces may be the time equivalents of great numbers of strata elsewhere in the geological column. Thus, between rocks of Cambrian and Devonian age in eastern Grand Canyon is an *unconformity involving no recognizable discordance in stratification*, yet marked by many irregularities or by erosion and representing a hiatus of considerable magnitude. (Emphasis added) p. 83.

Perhaps this contact and many others previously assumed to be unconformable should be reanalyzed in greater detail.

Mississippian-Cambrian contact at the North Kaibab Trail as reported in literature

We examined the literature to determine if other workers had viewed and commented on the relationship of Redwall Limestone on Muav Limestone along North Kaibab Trail. We located only a few scattered remarks concerning this contact and only one closeup diagram. Walcott (1888) wrote concerning various places where he saw Redwall Limestone resting directly on what he called the "Upper Tonto" (probably Muav Limestone) that: "The line of unconformity is slight and often none exists except to the eye of the geologist looking at that exact horizon for it." p. 438. Our observations would support Walcott's analysis as we found no line of unconformity.

Schuchert's observations (1918, p. 361) were evidently different from these, however, in that he reported: "The Redwall usually reposes disconformably on the Muav member of the Tonto formation of Cambrian, age . . ." McKee and Gutschick (1969) merely quoted Stoyanow's (1948) one sentence statement: "The overlap of the Redwall Limestone on the Cambrian platform is well shown in the Grand Canyon sections." p. 314. McKee and Gutschick published a diagram of the North Kaibab Muav-Redwall contact showing a surface with wavy undulations. But the only comment they made about the drawing (their Figure 4b which is reproduced herewith as our Figure 8) was that the contact was an "unconformity" with "Irregular wavy surface of Muav Limestone" having "relief of 1-2 feet in areas of channeling" p. 625. We found no such undulating channels in our observation of this same contact.

On their Table 2 (1969, p. 18) McKee and Gutschick have put an asterisk beside all strata having well preserved fossils. It is informative that they did not use an asterisk beside the rocks at the North Kaibab Trail contact in question. Evidently this indicated that they did not find enough fossils there to allow proper paleontological evaluation. Further fossil analysis of these particular strata should be carried out.

As was true in our own study along the North Kaibab Trail, Noble (1914) experienced great difficulty trying to determine just where the Cambrian strata stopped and the Mississippian began in Bass Canyon because fossil and lithologic data failed to suggest an unconformity:

Because of the lack of fossils and the failure to detect the line of erosion that would mark a division between the Muav Limestone and the Redwall in Bass Canyon it has been necessary to fix tentatively the base of the Redwall by means of lithology. The Muav Limestone is here overlain by alternating layers of calcareous sandstone and dense blue-gray crystalline limestone, which have a thickness of 110 feet. These layers are taken *arbitrarily* as the base of the Redwall. (Emphasis added) p. 66.

It is obvious that in Bass Canyon, as well as along the North Kaibab Trail, the contact line is not easily discerned. Further studies of this Bass Canyon contact should be undertaken. Such a situation casts great doubt on the concept that 200 million years elapsed between the deposition of the two formations.

Undoubtedly the Redwall-Muav stratigraphy along North Kaibab Trail has been studied by other geologists. Yet no other papers than these few mentioned here have been found by the writers of this paper. E. D. McKee, who did so much to publicize the stratigraphy of the Grand Canyon region, died in 1985. Consequently a very valuable resource for continued study of Grand Canyon was lost with his death. His colleague, R. C. Gutschick, informs us (1986) that E. D. McKee published no more material on this North Kaibab Trail contact than what we have discussed here. Another accomplished field geologist, G. Billingsley (1986) states that the literature citations on this contact given here are all those of which he is aware. Readers are asked to help. Any information regarding other pertinent papers will be appreciated.

Evolutionary geologists, by virtue of their training, must insist on the presence of an unconformity between the Redwall Limestone and the underlying Muav Limestone. According to those geologists who accept "geologic time" as taught in many colleges and universities, the Muav is part of the Cambrian system whereas the Redwall is part of the Mississippian system. Therefore it is to be expected that professional papers include sketches which illustrated supposedly unconformable conditions. Figure 8 is one example of such a sketch. We found no such unconformity.

Other sketches illustrate the Mississippian-Cambrian contact as an erosional feature which associates with brecciated material— see Nations and Stump (1981), their Figures 3-5, p. 21. The precise locations of such surfaces within Grand Canyon are not apparent because authors do not discuss the sites.

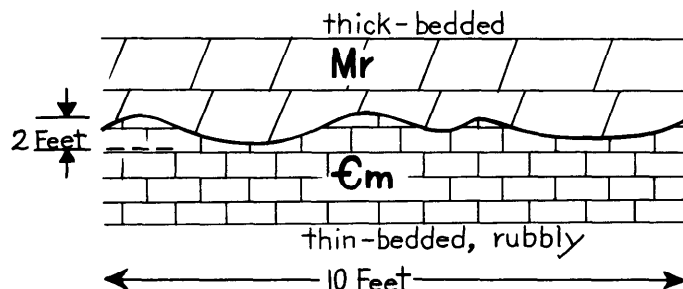


Figure 8. Figure 4b after McKee and Gutschick (1969, p. 17) They labeled this figure as follows "Basal contact of Redwall Limestone. (b) Kaibab trail, north." Their designation Mr stands for Redwall Limestone and Cm for Cambrian Muav. Note that they show an undulating line of erosion between these two strata. We would estimate this undulation to involve an amplitude of about two feet in places, according to their figure. On page 625 of their paper they refer to this as an "Irregular wavy surface: with relief of 1-2 feet." Nowhere along the North Kaibab Trail could we find any contact that resembled this drawing. It is not clear why there is this strange discrepancy between their findings and ours. Redrawn by Ross Marshall.

Contacts viewed in the study area along North Kaibab Trail by the writers of this paper have been deemed conformable. The so-called unconformity could not be determined because the uppermost Muav Limestone grades laterally and vertically into Redwall. No erosional features were seen. See Figure 2 herein for our interpretation.

Conclusions

1. The unconformity supposedly separating the Redwall Limestone from the underlying Muav Limestone does not exist. Consequently there cannot be any 200 million year hiatus.
2. Since the 200 million year hiatus cannot exist, the dating of Redwall Limestone and Muav Limestone as Mississippian and Cambrian, respectively, cannot be valid.
3. Because the Paleozoic periods shown above cannot be valid, then the longer time unit known as Paleozoic Era cannot be real.
4. Since Paleozoic Era cannot be a real geologic time unit, historical geologic time must be suspect.
5. Because historical geology is suspect, the mega-evolutionary model cannot be confirmed by historical geology because there is no true definition of geologic time.
6. Since the evolution model cannot be sustained historically, it behooves all scientists to search for alternative models as regards the origin of the earth, the origin of life on earth, and the time necessary to effect such origins.
7. The various formations within the Grand Canyon area could have been deposited one formation on another without the need for millions of years of depositional time and millions of years of unaccountable time (hiatuses).

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THE DILEMMA OF A THEISTIC EVOLUTIONIST: AN ANSWER TO HOWARD VAN TILL

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Abstract

Regardless of the attack of a theistic evolutionist, the gravitational contraction theory arguments used by creationists are still valid. Some other young earth arguments are discussed.

Introduction

The theistic evolutionist is a classic example of an antagonist trapped between the horns of a dilemma. He cannot have his cake and eat it. The argument is sharply defined when one horn of the dilemma is a recent creation and the other horn is evolution. These are mutually exclusive positions.

It takes but one proof** of a young-age limit on the earth, the moon, or the sun to refute the whole gamut of evolution. There are many proofs. Lord Kelvin gave two young-age proofs that have never really been falsified. Lord Kelvin chided the evolutionary geologists for their ignorance of the fact that limits on the earth's age can be established from straightforward physics. There is much more evidence of a young-age of the earth, moon, and sun now than at the time of Kelvin.

Two attributes of a valid proof are: 1) Founded on sound physical theory. 2) Consistent with the scientific evidences.

There is no lack of scientific evidences of a young age for the earth, moon, sun, and some of the other astronomical bodies. There is no lack of sound physical theories upon which to found those proofs. The problem is with the attempts of evolutionists (theistic

and secular) to gloss over the physical theory and to suppress the evidence.

Theistic Evolutionist Van Till's Strategy

In a recent paper theistic evolutionist Howard J. Van Till, Professor of Physics and Astronomy at Calvin College, Grand Rapids, Michigan, challenges the scientific evidences and theoretical support for a recent creation. His paper is entitled "The Legend Of The Shrinking Sun: A Case Study Comparing Professional Science and Creation-Science in Action" (Van Till, 1986, pp. 164-74). His strategy is:

- 1) Attack the credibility of all creationist scientists, the *ad hominem* approach.
- 2) Concentrate on one young-age case he thinks is most vulnerable.
- 3) Cite a multiplicity of conflicting papers to give the appearance of neutralizing the evidence.
- 4) Claim that this demonstrates the lack of credibility of all young-age evidences.
- 5) Gloss over the fact that he never provides evidence for the billions-of-years age position he holds.

One can dismiss his *ad hominem* attack on the credibility of creationist scientists. The eight creationist scientists whom he attacks all have equal or better professional credentials than Van Till.

Van Till objects to creationist scientists raising so many cases for a young age. He classifies them as non-professionals who merely list young-age arguments

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**From valid logic and the scientific evidence.

without adequate scientific support. Whereas Van Till himself resorts to the listing of a multitude of papers. But he is selective. He omits papers that do not support his position.

Papers Van Till Did Not Cite

Two papers that Van Till did not list are: 1) a paper by John A. Eddy, an evolutionist. 2) a paper by Robert V. Gentry, a creationist. Those two papers were presented April 13, 1978 at the Geochronological Symposium, Louisiana State University, in Baton Rouge (Kazmann, 1978, pp. 18-20). That symposium specifically addressed the evidences for a young-age vs. those for 4.5 billion year age.

Van Till chose to isolate shrinking-sun evidence from all other evidences. But Eddy's paper is on shrinking sun evidence. Why did Van Till omit that paper? There might be two reasons: It provides not only shrinking-sun evidence of a young sun, it provides other theoretical and observational evidences of a young sun. This same reference (Kazmann, 1978) also contained companion support for a recent creation, the paper by Gentry. The combination of Gentry and Eddy's papers shows the overall consistency in creation-science, evidence of creation and young-age.

Eddy's 1978 Symposium Paper

Here are quotes from the *Geotimes* report on Eddy's paper (Kazmann, 1978):

There is no evidence, based solely on solar observations, that the sun is $4.5\text{-}5 \times 10^9$ years old.

Astronomy, as an observational science, can say nothing about chronology as far back as 4.7×10^9 years. Theoretical astronomy says that in the distant past the sun should have been cooler and radiating less. This is the faint star problem, but climate models say that given 1% less radiation from the sun you have a little ice age. If the sun were 15-20% less bright, ice would have covered the Earth . . . Resolution of that mystery is a task for the future.

The research reported in Eddy's symposium paper was based on the time it takes the sun's diameter to cross the meridian, measured at the Royal Greenwich Observatory. Those measurements showed that the transit time is getting smaller. The sun's orbital speed is not increasing. So the diameter of the sun must have been getting shorter, a shrinking sun.

This included more than a hundred years of observations. Everyone agrees that a shrinking sun implies a young-age sun. The debate is whether or not the sun is shrinking. Eddy's research shows that it is. At this same symposium Gentry provides another blow to the evolutionary hypotheses.

Two of Gentry's Papers

Gentry's paper gives radiometric evidence of the creation of the earth's basement granite in less than a day's time. Here is a quote from the *Geotimes* report on Gentry's paper:

Polonium 218 halos are the center of a mystery. The half-life of the isotope is only 3 minutes. Yet the halos have been found in granitic rocks at considerable depths below land surface, and in all parts of the world . . . The difficulty arises from

the observation that there is no identifiable precursor to the polonium; it appears to be primordial polonium. If so, how did the surrounding rocks crystalize rapidly enough so that there were crystals available ready to be imprinted with radiohalos by alpha particles from polonium 218?

Van Till excluded not only that paper but another related paper by Gentry. It supports not only the creation but also a young age for the earth. It was published in the *Annual Review of Nuclear Science* (1973) Volume 23. Here are quotes from that paper (p. 24):

The simple evidence of halos is that the basement rocks of the earth were formed solid . . . Halos in other minerals can be shown to give equally startling evidence of a young earth.

Van Till Attacks The 1979 Eddy-Boornazian Paper

Van Till attempts to discredit the data and analysis in a 1979 paper jointly authored by John A. Eddy, the astronomer, and Aram Boornazian, the mathematician. The title of their paper is "Secular Decrease in the Solar Diameter 1836-1953." Their paper is based on the solar meridian transit-time data at the Royal Greenwich Observatory. The conclusion is the same as that of Eddy's symposium paper, namely the sun's diameter is shrinking two arc seconds per century. That translates into a shrinkage of five feet per hour. In so far as the data are concerned this shrinkage is a secular phenomenon, a continuing process. There is no way a theistic evolutionist, such as Van Till, can live with Eddy and Boornazian's data and analysis. It provides scientific evidence of an age limit of thousands of years, not billions, on the sun's age.

Scientific evidence, such as this, completely demolishes the theory of evolution. It is no wonder that evolutionists (theistic or secular), put up such a fight against this evidence. They can not repeat those measurements, made over the last hundred plus years. But they really try to reinterpret them.

The pioneering researchers, Eddy and Boornazian were careful not to make judgmental adjustments. They took the results as they are. As an evolutionist, Eddy does surmise that this may be temporary shrinking, but he acknowledges no evidence to support that conjecture. He stands by his data and has the integrity to state:

However . . . I suspect that we could live with Bishop Ussher's value for the age of the Earth and Sun. I don't think we have much in the way of observational evidence in astronomy to conflict with that (Kazmann, 1978).

Eddy was aware of a solar eclipse observation that supported the sun shrinkage for more than 400 years. That evidence is provided by a 1567 solar eclipse (Lubkin, 1979, p. 17). The sun was too large to be blocked out by the moon. That is known as an annular eclipse, an annular portion of the sun showing. No record of an eclipse with as large an annulus has been recorded since 1567. This is visual evidence that the sun was larger in 1567.

Van Till's Bias Is Showing

The following quote illustrates Van Till's mind-set, his unquestioning faith in the evolutionary long-age.

But truly secular shrinkage, that is, a steady decrease in size over an indefinite long period of time, would be at odds with contemporary models of solar behavior and inconsistent with geological evidence (p. 166).

To keep the faith, Van Till must refute Eddy and Boornazian's data and analysis. So he asks the question: "Where did Eddy and Boornazian go wrong?" Then he nit-picks at the data of the Royal Greenwich Observatory, one of the most noted observatories in the world. He provides nothing of quantitative value:

It appears that the Greenwich data contain some systematic errors . . . there were changes in both the methodology and the instrumentation employed in the Greenwich data . . . along with significant variations in both the skill of observers and the quality of observing conditions . . . The data on which Eddy and Boornazian based their conclusions are plagued with subtle flaws (p. 168).

These alleged flaws must have been subtle indeed. One would be hard pressed to detect them in the plot of the original data, adapted from Gloria B. Lubkin's article in *Physics Today* (1979). That plot supports the credibility of Eddy and Boornazian's analysis and shows only one discontinuity, and that does not alter the trend.

Van Till cites papers that are supposed to prove that the sun is not shrinking. But he does not apply the same criteria. He does not nit-pick that data, no mention of such difficulties as: 1) observational times of a hundred years or so, 2) changes in both methodology and instrumentation, 3) variations in both the skill of the observers and quality of observing conditions.

In spite of his special treatment of those papers, almost all of the authors acknowledge or "allow" some decrease in the sun's size. Those acknowledged shrinking rates, or reluctantly "allowed" shrinking rates, yield an age too short for evolution. Continuous shrinking even at a much much smaller rate than the two arc seconds per century rate demolishes his billions-of-year hypothesis.

Papers Van Till Quotes

"S. Sofia, J. O'Keefe, J. R. Lesh and A.S. Endal (1979, p. 1306) published an article in *Science* which expressed the judgment that, on the basis of available data (mostly from meridian transit observations), the sun's angular diameter did not diminish by more than 0.5 arc second between 1850 and 1937." That is no help to Van Till. That rate of shrinking yields a limit on the sun's age in the thousands of years.

"Irwin Shapiro (1980, p. 51) published his analysis of the transits of Mercury in front of the sun from 1736 to 1973. Shapiro concluded that no significant change in the sun's diameter could be detected, and that the maximum shrinkage rate allowed by the data was 0.3 arc second per century, about one seventh of the Eddy and Boornazian value." He adds a graph with large error bars. It is nothing like as definitive as the Lubkin graph. But here again, evolutionists can not live with a 0.3 arc second per century shrinking sun.

"Similarly, D. W. Dunham et alia (1980, p. 1243) analyzed solar eclipse data and concluded that between 1715 and 1979 the sun's diameter may have decreased, but only by 0.7 arc second, equivalent to a

rate of about 0.25 arc second per century." That is about one eighth of the Eddy and Boornazian value, still a high enough shrinking rate to restrict the solar age to thousands of years.

J. H. Parkinson, Leslie V. Morrison and F. Richard Stephenson performed a "re-evaluation" and concluded that the trends in the Greenwich data reported by Eddy and Boornazian are "the result of instrumental and observational defects rather than real changes." They state that "In their judgment—no secular change over the past 250 years was detectable, but a cyclic change with an 80-year periodicity was indicated."

This "re-evaluation" was an obvious case of attempting to "realign" the Eddy and Boornazian data to a no-shrink condition. The conclusion that the shrinking is "the result of instrumental and observational defects rather than real change" appears to be more arbitrary than objective. It is somewhat redeeming that the phrase "in their judgment" was included to acknowledge that there was judgment involved.

"R. L. Gilliland (1981, p. 1144) confirmed the presence of a 76-year periodic variation in the sun's diameter, but suggested that the data do allow for a very small long term shrinkage at the rate of 0.1 arc second per century during the past 265 years." That rate still yields an age limit far below anything evolutionists will concede.

One thing is clear: the preponderance of the evidence indicates a shrinking sun. Whose judgment was it that discarded the 1567 solar eclipse data? That evidence went back about 150 years further. It provided visual evidence of an oversize sun. Its appreciable annulus was showing.

The case for a shrinking sun still holds. The only valid argument is its precise rate of shrinking. That is important and is a worthwhile goal of research. The Eddy and Boornazian rate may be too fast—too much heat energy, for a straightforward potential to heat conversion. A somewhat slower rate may provide the heat production rate that is consistent with gravitational contraction theory.

Nuclear-Fusion Theory In Trouble

The evolutionist is in trouble not only because of the evidence of a shrinking sun. He is in trouble on the theory of energy production for the sun. The widely held nuclear-fusion theory of the source of heat energy for the sun ran into serious trouble in the 1960s. The famous experiments by Raymond Davis showed that: The magnitude of neutrino flux which the theory predicted just is not there.

Van Till (p. 168) acknowledges the problem.

During the past several years, measurements have been performed to determine the rate at which neutrinos, a byproduct of these fusion reactions, are being received on earth. The puzzling result is that the measured rate is only one third of the expected rate.

The failure of this theory is devastating to evolutionary astronomy. It has been the basic theory for the evolution of stars, the sun included. As might be expected astrophysicists have been trying to come up with another thermonuclear theory for stellar evolution.

Some have claimed new properties for the neutrino. Instead of the neutrino having no rest mass, it is claimed to have rest mass. There are attempts to fabricate a theory to fit the smaller neutrino flux. These are still in a conjectural state. The undeniable fact is, stellar evolution has been kept afloat for decades by means of an invalid theory.

Gravitational Contraction Theory

The gravitational contraction theory of solar heat energy was the prevailing theory until sidetracked by the invalid nuclear-fusion theory. The gravitational contraction theory was rejected, not on the basis of any defective physics. It was rejected because it does not provide the billions-of-years age demanded by evolutionists. It is still a valid physical theory that has not been falsified.

The basic principle is that the potential energy lost in contraction is transformed into heat. If there is contraction, this transformation will take place. Heat will be produced. The aforementioned evidence of a shrinking sun is evidence of gravitational contraction that generates heat in the sun.

Kelvin used that theory in support of a young-age limit on the sun. With the data mentioned in this paper, there is stronger support of gravitational contraction energy production in the sun. Even if the total sun shrinkage rate were only one tenth of the Eddy-Boornazian value, the gravitational contraction energy would be more than enough to produce the sun's entire luminosity. (Steidl, 1980, p. 64).

Van Till's Assertions

Van Till's assertions picture creationist-scientists as:

- 1) Merely listing others' "scientific evidences" of a young earth, no research of their own.
- 2) Biblically naive, taking the creation account literally.
- 3) Destroying the credibility of Christian witness.

Here are samples of Van Till's assertions (pp. 164-5):

- 1) Advocates of the young earth hypothesis frequently publish extensive lists of 'scientific evidences' which they claim provide observational support for their recent creation scenario.
- 2) According to the young earth proponents, the universe must have been created in a mature and fully functioning form by divine fiat.
- 3) We must be aware of their persuasive impact on the Christian community and of their negative effect on the Christian witness to a scientifically knowledgeable world.

Only one of those assertions is correct. We do indeed believe in the Biblical account of fiat creation of a mature and fully functioning universe. We are not caught in a dilemma, attempting to adapt Scripture to the false science of evolution.

Christianity Today Article

Van Till was particularly concerned with this author's article (Barnes, 1982, pp. 34-6) in *Christianity Today*, which was one of four articles in the Origins Debate: two supporting the creation-science position, Duane Gish and Thomas Barnes, and two supporting the theistic evolution long-age position, Davis A. Young of Calvin College and V. Elving Anderson. (pp. 28-45).

Van Till (p. 170) states that: "Thomas Barnes presents a list of six evidences for a recent creation." Van

Till only attempts to challenge one of those evidences, the shrinking sun evidence. Since he has such a weak case against the shrinking sun, one wonders why he did not challenge the other five evidences.

One of those other five evidences is Robert Gentry's radiometric evidence of rapid creation. That has already been discussed. But since Van Till considers it naive to believe in fiat creation, one would think a scientist of his caliber would stand up and challenge Gentry's radiometric evidence. Of course it might be somewhat of a task, since Gentry is the world's best scientist in that field.

Another one of those recent-creation evidences that Van Till chose to ignore is the small depth of accumulated dust on the moon. Before the Apollo landings on the moon, evolutionary scientists had given NASA much concern about deep dust. "Sand shoes" were installed on the lunar landing craft. Their evolutionary advisors predicted great depths of dust on the moon, a "quicksand" hazard. *Astronomer Thomas Gold (1985, p. 70) predicted that spacecraft to land on the moon would encounter a mile-thick layer of dust.*

The rate of influx of cosmic dust had been known within reasonable limits. If the moon really were 4.5 billion years old, the depth of dust would have been great and a real hazard for the Apollo astronauts. However, it is clear now that there is only a few thousand years of dust on the surface of the moon.

One measure of the credibility of a scientific theory is how well it predicts. There is no credibility in how well its failure is explained away later by those "trained in science."

Magnetic Evidence of a Young Earth

Another one of those recent-creation evidences, that Van Till chose to ignore, is the magnetic evidence of a young earth. Contrary to Van Till's assertions that the creation-scientists only list others' evidences and do not keep up with the literature, it is he that has not kept up with the literature. Eight of this author's research publications, from 1971 to 1986, are on the magnetic evidence of a young earth (Barnes, 1971, pp. 24-9; 1972, pp. 47-50; 1973, pp. 222-30; 1975, pp. 11-3; 1977, pp. 41-6; 1981, pp. 39-41; 1983; 1986, pp. 30-3).

All of the historical evaluations of the earth's magnetic dipole moment, the only valid measure of the state of the earth's basic magnet, indicate a monotonic decay. The half-life of its magnetic field is 1400 years, and of its magnetic field energy is 700 years. There is no way one can account for more than a few thousand years for the earth's basic magnet.

This decay process is precisely what one would expect from the electromagnetic solution to the problem. One must begin with an initial postulate. The only reasonable initial postulate for a consistent scientific theory of that decaying system is an initial fully functional electromagnet. Fiat creation is the only sensible postulate. One thing is certain: the evolutionists have no justifiable initial postulate nor physically valid theory to go with any of their postulates. Does Van Till have one to offer?

New Research

New research is continually bringing out additional evidences of the consistency of the fiat creation and

young-age position in science. Van Till notwithstanding, a listing of publications of that research should not be suppressed.

A new approach to astronomical ages is being developed by Dr. Harold S. Slusher. The first three publications to be released on Dr. Slusher's research are in the form of short technical papers called *Tutorial Papers*. They are: 1) *The Stars— Their Birth* (1986a) 2) *Star Birth in the Milky Way: One Aspect* (1986b) and 3) *The Protoplanet Hypothesis and Tidal instability in the Solar System* (1987). They give strong support to equal ages for stars in the Milky Way, and young-age limits on certain astronomical bodies.

A number of recent graduates' *Master of Science Theses* have provided additional evidences of young age. There are too many to list here. But Stanley Rasmussen's new book *Geologic Age of River Deltas* (1987), which provides strong evidence of a very young age, is a follow up on his thesis research.

The important point to make is that creationist scientists are producers. No amount of suppression is going to stop their progress. They have no dilemma. Their science is founded upon sound fundamentals and the sensible postulate of a created origin, yes, a mature and functioning universe.

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MINUTES OF THE 1986 CREATION RESEARCH SOCIETY BOARD OF DIRECTORS MEETING

On Thursday, 17 April, a meeting of the Executive Committee was held at Howard Johnson's Motor Lodge, Ann Arbor, Michigan. On Friday 18 April, between the hours of 0800 and 1600, the Research, Quarterly, Publishing, Constitution and Financial Committees held meetings of approximately two hours. An appointed secretary recorded the discussions in preparation for the Saturday plenary sessions.

The official annual meeting of the board was opened at 1900 hours by President Rusch in Room 102 of the Science Building at Concordia College, Ann Arbor, Michigan. Present: W. Frair, G. Howe, D. Kaufmann, R. Korthals, J. Meyer, G. Mulfinger, W. Rusch, E. Williams, G. Wolfrom, D. Gish, D. DeYoung, J. Klotz, P. Zimmerman, J. Moore, Absent: D. Boylan, N. Smith, C. Burdick. Also present were 17 visitors. The President welcomed everybody to this the beginning of the 23rd year of the Creation Research Society (CRS). This was followed with a silent prayer.

The President introduced Dr. David Schmiel, President of the host college, who welcomed CRS members

and then talked about the program of Concordia College and the training of their students.

The minutes of the 1985 Board of Directors meeting were read. The following have been elected for a three year term on the Board: D. Boylan, D. DeYoung D. Kaufmann, E. Williams and P. Zimmerman.

The Treasurer's report from Klotz indicated that expenses have been reduced. Money in the Laboratory Fund and total cash assets have increased. The property in Arizona contributes to this. One problem is the income decrease in the General Fund. Mailing expenses will rise this coming year due to a postal increase.

Glen Wolfrom reported that the domestic membership has decreased from 1959 in 1985 to 1729 in 1986, but foreign membership has increased. He distributed a new, improved membership form. Membership breakdown in percentage: Voting 33, Sustaining 43, Subscriber 19 and Student 6. Membership may be down due to competition from other effective creation groups.

John Meyer, new Research Committee Chairman, reported that some evolutionists claim that creationists do not do research. From 1964-84 in the *CRSQ* there were 72 data-collection research articles published along with 95 theoretical papers. The CRS now has 20 research projects either in progress or completed. Current research projects are: Canyon Formation Rates, Lichen Growth Rates, Species Origin in Pine Trees, Turtle Taxonomy and Tassel-eared Squirrel Taxonomy. The Grand Canyon Experiment Station (GCES) is fenced and welled on 2.5 acres with electricity and telephone.

George Howe described his pollen research study in Hakatai Shale spores have been found in Precambrian shale correlating with Burdick's findings. Howe intends to do a study patterned after Chadwick's work using hydrofluoric acid and also a study on the taxonomy of Arizonan Yucca plants.

The President expressed the gratitude of the Board to Mr. David Golisch and others who were visiting from the Southeastern Michigan Creation Science Association (SEMCSA). Mr. Golisch spoke briefly expressing his appreciation of the work of the CRS. The meeting was recessed at 2025 hours for refreshments provided by the SEMCSA.

The meeting was reconvened at 2045. George Mulfinger reported that gross sales on books was \$12,377 with original cost of \$10,744 resulting in a profit of \$1633. Concordia Publishing House (CPH) has agreed to sell *The Argument* by consignment, and Dave Kaufmann, a member of the CPH Board, will follow through with this. Emmett Williams reported that the breakdown of pages published in the *CRSQ* in Volume 22 by percentage were: Physical Sciences 14.4, Biological Sciences 24.7, Geological Sciences 10.0, Philosophy of Science 24.9, Book Reviews 7.3 and Society Business 18.7. The peer review system is very successful. A new reference system will be used in future issues of the *CRSQ*. The meeting was adjourned at 2130 hours.

On Saturday, 19 April, the closed meeting was called to order at 0835. Present: D. DeYoung, W. Frair, D. Gish, G. Howe, D. Kaufmann, J. Klotz, R. Korthals, J. Meyer, G. Moore, G. Mulfinger, W. Rusch, E. Williams, G. Wolfrom, P. Zimmerman. Absent: D. Boylan C. Burdick, N. Smith. Don DeYoung was recognized as the newly elected member. The minutes of the 1985 meeting were adopted and the membership and treasurer's reports were received.

The Research Committee reported that George Howe plans to continue his leave of absence from the Board from 29, April, 1986 to 29, April, 1987 to complete research projects at a cost of \$5000. The Committee is seeking money from Foundations to complete the physical facilities at the GCES. The Committee plans to update Gish's *A Decade Of Creation Research*. Gish will add a review of 15 years of creation research to the decade monograph.

Editor Williams reported the invited article concept and educational articles are working well. There is a need for more-Panorama articles. A Key Word Index will be placed in the *CRSQ* once a year. Gish moved and Kaufmann seconded the concept of publishing notices of importance in *CRSQ* under the discretion of the Editor. Motion carried. Wolfrom moved and Klotz

seconded and the motion was passed that the Editor solicit articles from authors on answers to criticisms of creationism by evolutionists for future *CRSQ* publication. The Board empowered Kaufmann to contact CPH about the publication in book form of previous *CRSQ* articles on *Darwin's Last Days*.

The following recommendations of the Finance Committee were adopted:

1. The number of funds be reduced to:
 - a. General Fund-operating expenses, Quarterly publication expenses and textbook funds
 - b. Reserve Fund-principal invested; interest transferred to General Fund
 - c. Research Fund-all current and capital research expenses
 - d. Laboratory Fund-principal invested and interest transferred to Research Fund
 - e. Life Members Fund-restricted fund, interest transferred to General Fund
 - f. Book Fund-expenses and income from books
2. That restricted funds be invested at the discretion of the Financial Advisory Committee (Klotz, Korthals, Zimmerman) on the basis of the following principles:
 - a. No more than 50 percent of funds are to be invested in CDs, top corporate bonds and T-bonds with a maturity date of no more than 10 years.
 - b. Remainder is to be invested in same type of funds with a maturity date of no more than 5 years.
3. That a fund drive from Thanksgiving to Christmas, 1986 be conducted by the Vice President to subsidize the publication of *CRSQ*.
4. That the Vice President send a special appeal to those who have not renewed their membership from 1980 to 1984.
5. The Board establish the following budget for research:
 - a. \$7000 for research between 1 April, 1986 and 31 March, 1987.
 - b. \$8000 be made available for research between 1 April, 1987 and 31 March, 1988.
 - c. That funds be transferred from the interest on the Laboratory Fund to the Research Fund retroactively to 1 January, 1986 to bring the Research Fund up to \$15,000.
 - d. That the Treasurer notify the Research Committee of the balance in the Research Fund as of 1 January, 1987. This sum will be made available for allocation between 1 April, 1988 and 31 March, 1989.
 - e. The Research Committee be authorized to borrow up to \$15,000 from the Laboratory Fund for capital expenses. The loan must be repaid by transferring back to the Laboratory Fund annually 50 percent of the money in the Research Fund. A larger sum may be requested for capital expenses from the Board of Directors.
6. At the next annual meeting consider a new membership category: Contributing Member, with dues of \$25 per year. They would have voting rights only if they met the criteria for voting membership with \$5 of their dues transferred to the Reserve Fund.

7. Regular and Sustaining Members be encouraged to make a special contribution to the Reserve Fund at the time of paying their dues.
8. Effort be made to increase the number of Life members.
9. The following policy regarding the expenses for Board members attending the annual meeting be adopted:
 - a. CRS will pay either the cheapest (Supersaver) airfare or \$0.20 per mile, whichever is less.
 - b. Board members agree to stay over Saturday night so they qualify for the cheapest airfare.
 - c. CRS will pay half the double room rate for Thursday, Friday and Saturday nights.
 - d. CRS will provide transportation to and from the Detroit Airport and all meal costs in Ann Arbor from Thursday thru Sunday.
10. That until 30 April, 1987 the Treasurer be authorized to borrow from the Life Membership Fund, the Reserve Fund and the Book Fund money needed to meet obligations of the General Fund.
11. That a per page charge of \$50 per page in Volume 23, \$75 per page in Volume 24 and \$100 per page in Volume 25 and following volumes for research sponsored by the Research Committee to be transferred to the General Fund for reports published in *CRSQ*.
12. That five percent of the interest received by the Laboratory Fund be transferred to the General Fund for administrative costs.

The meeting was adjourned for lunch at 1130.

The meeting was reconvened at 1300. It was recommended that a written job description for each officer

be prepared and given to each officer. It was pointed out that the word "men" in the CRS position statement was always meant to be understood in the generic sense and not the masculine sense only.

A motion was made by Moore and passed that a Board Member receiving compensation for CRS-sponsored research need not leave the Board during that time, but he should abstain from voting on projects for which he is receiving remuneration. The following were nominated for the Board next year (87-89): W. Frair, G. Howe, J. Meyer, G. Mulfinger. It was moved, seconded and passed that the CRS Board have only 15 members for 1988. All incumbent officers were nominated by Gish for 1986-87. They were all re-elected unanimously by voice vote.

President Rusch announced that he desired to remain as President for only one more year and thanked all for their cooperation running the Society. It was passed that the next annual meeting would be on 24, 25 April, 1987 in Ann Arbor with 1, 2 May as an alternate date. Williams announced that 15 April, 1989 he will stop handling the sale of books. Authority was given to Meyer to proceed with the brochures and mail them with the fund appeal letter. It was passed that Wolfrom had the authority to buy a new typewriter not exceeding \$500. It was also suggested that we purchase a computer system for the Membership Secretary if funds are available. The meeting was adjourned at 1435.



David A. Kaufmann
Secretary

PANORAMA OF SCIENCE

Bishop Lightfoot and the Exact Hour of Creation

Did Bishop Lightfoot seek to improve on Ussher's chronology? Did he attempt with precision to determine the exact hour, day and year of Adam's creation?

Andrew D. White says that he did. He writes:

Though eminent chronologists of the 18th century like Jackson, Hales, and Drummond, gave forth multitudes of ponderous volumes pleading for a period somewhat longer than that generally allowed, and insisting that the received Hebrew text was grossly vitiated as regards chronology, even this poor favour was refused them; the mass of believers found it more comfortable to hold fast the faith committed to them by Usher (spelling sic) and it remained settled that man was created about four thousand years before our era.

To those who wished even greater precision, Dr. John Lightfoot, Vice Chancellor of the University of Cambridge, the great rabbinical scholar of his time, gave his famous demonstration from our sacred books that heaven and earth, centre and circumference, were created together, in the same instant, and clouds full of water, and that this work took place and man was created by the Trinity on the twenty-third of October, 4004 B.C. at nine o'clock in the morning. (White, p. 256)

White cites as evidence Lightfoot's *Works*, London, 1822, Volume iv, pp. 64, 112.

As Al Smith used to say, "Let's look at the record." Turning to page 64 in the edition of Lightfoot's *Works* quoted by White we read:

Satisfied am I with this, that the world and all things had their beginning from God, that, in the beginning, created heaven and earth. Some of the Jews do invert the word Bereshith' and make it Betisri, that is, in the month Tisri' was the world created. This month is about our September; and that the world was created in this month (to let other reasons alone) this satisfied me,—that the feast of tabernacles, which was in this month, is called the end of the year (Exodus 23:16); and this I take to be the reason why the Jews began to read the Bible in their synagogues, at the feast of tabernacles; viz. that they might begin the lecture of the creation, in Genesis 1, at the time of the year that the world was created.

What does Lightfoot say on page 112 which White quotes?

This is so plain in Daniel IX in the seventy weeks or seventy times seven years, there mentioned, from the commandment going forth from Cyrus, to restore and build Jerusalem, to the cutting off of the Messiah— that it needeth as little to confirm it,

as to tell, that seventy times seven is four hundred and ninety. For, if the angel speak not of a fixed and certain time in this sum, he nameth this sum to no purpose in the world; but he doth so clearly fix the time, two termini' of its extent, and some particular links of it, as it passed, that nothing can be more clear, evident, and perspicuous. Now, add these 490 years which reach to the death of Christ, to the age of the world, 3470, at the time when it began and it resulteth, that our Savior died in the year of the world 3960. Out of which subduct the two-and-thirty years of our Savior's life, and it appeareth that he was born in the year of the world 3928, that year being then but newly begun, stylo veteri' or according to the account used from the beginning of the world, from Tishri, or September; so that that year was his first year; and 3929 his second year,— at which, the wise men came to visit him; 3930 his third year; and so 3960, half passed, or at Easter, his two-and-thirtieth and a half, at which age he died.

And now, he that desireth to know the year of the world, which is now passing over us, this year, 1644— will find it to be 5572 years just now finished since the creation: and the year 5573 of the world's age, now newly begun, this September, at the equinox.

Did White have some unusual key to cryptic secrets hidden in Lightfoot's writings? Surely no person would claim that these passages as cited support White's statement regarding Lightfoot. There is nothing to suggest that Lightfoot held that the creation of man took place October 23, 4004 B.C. at nine o'clock in the morning. Either White depended on hearsay, or he totally fabricated the report. If he depended on hearsay, is it scholarly to cite references without checking them out?

It is true that elsewhere in sections not cited by White, Bishop Lightfoot expresses the "pious opinion" that our first parents were created about the time of the autumnal equinox (September 21 or September 22). He suggests this not because he is attempting to establish the day, month and hour of creation but rather because he believes that the trees of the garden were in full fruit and suggests that autumn is the time when fruit appears on trees. Lightfoot also suggests that Adam may have been created about nine o'clock in the morning. This "pious opinion" he has expressed because he believes that our first parents fell into sin on the very day of creation. Again he was not trying to determine the time of creation or the age of the earth.

A careful review of Bishop Lightfoot's writings demonstrates that in none of them does he suggest an exact hour, day and year for the creation. The indirect references he makes are made for an entirely different purpose than to establish precisely the date of creation. Moreover there is nothing in Lightfoot's writings that suggests creation in October. All of the references refer to the time around the autumnal equinox. It is apparent that either White or the individual from whom he got his information did not know when the autumnal equinox occurs. So much for the "science" of those who criticize the church and churchmen.

It is unfortunate that White is so often quoted as an authority on the relationship of science and religion.

He wrote his book in a pique. He was angry because of the opposition of some clergymen to his science university at Cornell and their unwillingness to support it from the public treasury. This type of scholarship, or rather example of lack of it, may well be typical of White's biased approach. He certainly misrepresents also Luther's attitude over against the astronomical theories of Copernicus (Klotz 1961 pp. 87-9; Klotz, 1985 pp. 26-8).

Rather than being an example of the warfare of science with theology in Christendom it is an example of an unfair and untruthful attack on a scholarly and respected divine.

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Contributed by John W. Klotz

International Conference on Creationism

The International Conference on Creationism was held in Pittsburg, Pennsylvania, August 4-9, 1986. The theme for this year was "the age of the earth." About 300 attended the daytime sessions. Most were men who were scientists and educators. Evening attendance rose to about 1200 to hear Dr. D. James Kennedy. It peaked at about 1500 to hear a debate between Dr. Duane Gish (for creation) and Dr. Vincent Sarich (for evolution).

Three dozen invited speakers presented the daytime lectures, each with a question period. The lectures were at three levels: technical, educational, and basic. The latter two levels were held only during the last three days of the conference. All speakers prepared preprints which were reviewed before the conference by both creationists and non-creationists. Questions from these reviewers were asked during the start of each discussion period. All preprints for the educational and basic sessions were bound in a paperback. A two volume hardbound proceedings for the entire conference, including many questions and answers, is being prepared for release in early 1987.

In some cases the oral presentations differed from the prepared texts. All lectures and question periods were recorded on audio tape. All technical sessions and four of the evening sessions were recorded on video tape as well. The plenary sessions were for an assortment of brief presentations by others who attended the conference and who were prepared to share their special interests with the group. Only one lecture was not presented when Dr. Clifford L. Burdick was unable to attend, but his preprint is available.

I was fortunate to be able to attend all technical and evening sessions. I will try to summarize their contents in a few sentences each, but I must leave it to another reviewer to summarize the educational and basic sessions. After a decade of my quietly studying of the creationist literature, this conference will probably be the catalyst that spurs me into original contributions to this field, as the Lord gives me insights. I am pleased to have finally met so many authors and to develop friendships with some of them and the other participants. I will be pleased to be more openly associated with this group in the future.

There were numerous comments during the conference about its high standard of scientific quality. I am in agreement with that assessment. The conference was at least as high in quality as the national and international conferences in weather research that I normally attend, and it was more interesting.

Summary of the Technical Sessions

Glenn R. Morton started the conference reminding us of numerous rock formations that are going to be difficult to explain in terms of a one-year Flood. We need to address these problems seriously and quantitatively.

Bernard E. Northrup suggested other catastrophic events apart from that in Genesis 6-8. He illustrated his talk with many slides of the Grand Canyon region.

Kurt P. Wise presented quantitative estimates for the rates of formation of some types of rocks. He showed that at the known cooling rates for large (1 to 100 km) bodies of igneous rock, some of which are intruded into sedimentary strata, the solidification times greatly exceed 10,000 years, yet the cores of actual bodies of those sizes are not liquid. Some other types of rock can be shown to form very rapidly, as when they encase modern objects.

The paper coauthored by Steven A. Austin and John D. Morris tied for best technical paper. They showed that the lowest sandstone layers, 3.5 miles deep, exhibited plastic flows as they adjusted to the movements of the Split Mountain fault in southern California. Similarly clastic sandstone dikes were injected downwards as plastic flows into fault cracks in the Precambrian granite when the Front Range was lifted near Colorado Springs.

D. Russell Humphries joined the tie for the best technical paper by showing how rapid reversals in the earth's magnetic field during the Flood interrupted the exponential decay of the field. Since then the field has recovered its strength and resumed its decay.

John R. Baumgardner reported on a three-dimensional global numerical model of mantle motions during the Flood. The color graphics output from the supercomputer showed the rapid sinking of the pre-Flood ocean crust into the hotter, less dense mantle. The simultaneous breakup of a hypothetical supercontinent was accomplished by a few randomly placed hot spots.

Robert H. Brown reviewed some of the uncertainties in radiometric dating, such as clocks not being set to zero, and mixing of isotopes from different sources.

Larry Vardiman reviewed the case for insufficient helium in the atmosphere to allow for long ages of radioactive decay. Sources and sinks of helium were quantitatively examined.

Robert V. Gentry, who spoke for two evening sessions as well as a technical session, talked at length over the three sessions about polonium halos in granites and coalified wood. The observation of pure polonium halos in the biotite of some granites gives evidence for cold creation of those granites, with the halos being recorded within a few minutes of creation. His talks also show the treatment he has personally received from those who do not like the implications of the findings. His proof of the superiority of encapsulating nuclear wastes in synthetic zircon crystals is apparently

being ignored by the DOE. Much of the time Gentry was summarizing from the galley proofs of his new book, *Creation's Tiny Mystery*.

William M. Overn and Russell T. Arndts discussed the problems with using radiometric dating by means of isochrons. Mixing can result in discordant dates. Whole rock isochrons and mineral isochrons can give different results.

Charles W. Lucas, Jr., could only skim over his lengthy derivations of electrodynamic laws based on a new theoretical structure of the atom. He can get relativistic answers directly from classical laws, avoiding some weaknesses in Maxwell's Equations which necessitated relativistic theory to correct them. Work is continuing to also eliminate the need for quantum mechanics.

John Woodmorappe showed quantitatively that there is no problem in finding enough carbon in the pre-Flood biosphere, enough carbonate-forming organisms, and enough bone-forming animals to account for the quantities of remains now found in the geological record.

Melvin A. Cook presented two brief papers. In one he drew from his experiences in explosive fracturing of rock to show in detail how the breakup of Pangaea started with a rupturing near Greenland and then propagated globally. (My notes on his radiocarbon paper are insufficient for summary.)

Michael J. Oard discussed a model of how warm ocean surface waters just after the Flood may have increased cloud and precipitation development, resulting in an ice age.

Francisco Ramirez ended the technical sessions with detailed derivations showing that the oblateness of the sun is sufficient to account for the precession of Mercury's perihelion, eliminating one of the supports for relativity.

Other Sessions

John D. Morris ended the basic sessions by showing how all Paluxy footprints thought to be human-like have changed in appearance and now seem to have been made by a three-toed dinosaur. Glen J. Kuban supported these findings in a special presentation a few hours later. Together, their two hours of slides carefully documented the present understanding and recommended against using Paluxy footprints as an important support for creationism.

D. James Kennedy showed how Darwinism has changed the world for the worse. He reviewed how evolution could not have occurred by any known natural process.

Duane Gish opened the debate summarizing how the abundance of available evidence keeps getting more unfavorable for those siding with evolution. Vincent Sarich responded by disowning Zuckerman and Oxnard for their research on primates. He suggested that evolutionary trees could be constructed by measuring the amount of variation in complex organic molecules between groups of animals. He showed how the bones of the lower half of Lucy matched those in humans while the upper bones matched those in apes, thus demonstrating a "transitional form." But he refused to respond to Gish's challenge to address the gaps between the major animal groups. Gish cited the failure of biochemical trees and the inadvisability

of untrained eyes to come to quick conclusions about fossil hominids.

Luther Sunderland showed how one can discuss, in public schools, the true scientific evidences on origins without resorting to faith in creation or faith in evolution. His book, *Darwin's Enigma*, is an excellent non-religious resource to counteract the censorship of data being forced on today's public school students.

Contributed by Edmond W. Holroyd, III

The Redshift Controversy

I recently came across two short articles that would be of considerable interest to creationists. The redshift is a foundational principle in astronomy and much research assumes it. The basis for the redshift is the doppler effect. However, a few well-known astronomers have been questioning it over the years, like Halton Arp of the Mt. Wilson Observatory. One alternate or additional explanation for the redshift is that it is caused by tired light, which has lost energy in its long trip through space due to interactions with matter. Arp has been a voice in the wilderness, but now a few other scientists are joining him. Emil Wolf has recently published an article in the March 31, 1986, *Physical Review Letters* in which he sketches the mathematical foundation for a non-doppler redshift. Since then he has added some flesh to his results that has been submitted to *Nature*. In addition, Arp and Sulentic published observational evidence in the October 15, 1986, *Astrophysical Journal* of galaxy pairs in which each member has a different redshift. This challenges the redshift-distance relationship and suggests a non-doppler mechanism must be included. One implication of all this is reported by Amato (1986, p. 166): "Thus, estimates of the size of the observable universe would shrink considerably—perhaps says Wolf, by a factor of 100 or more." William Corliss (1986, p. 2) reports that the tired light theory has been revived. He quotes from the August, 1986, issue of *Astronomy*: "P. LaViolette has '... compared the tired light cosmology to the standard model of an expanding universe on four different observational tests and has found that on each one the tired-light hypothesis was superior.'"

The revived redshift controversy at least informs us of the fragile nature of astronomical assumptions and that core ideas could be completely changed with new data. There will be much opposition from orthodox astronomers and it may well be a long bitter dispute. The non-doppler mechanism offers the potential to clear up several mysteries in astronomical observations, like the strange properties of quasars and objects that have been "found" to move faster than the speed of light. The controversy reminds me of the crisis before a paradigm shift as described by Thomas Kuhn (1970). Since I am not an astronomer, it would be interesting if one of our mathematicians or physicists would look into this new controversy in more depth.

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Contributed by Michael J. Oard

The "Crime" of Galileo

There is no doubt that the creation/evolution controversy has stirred up a great deal of emotion. Evolution has become the "party line"; evolutionary scientists are very defensive when attacks are made. Much of the emotion is traced to Andrew D. White's *A History of the Warfare of Science with Theology in Christendom*. It's a prejudiced account which presents the church as continually opposed to scientific research and scientific progress. One of the favored accounts is the Galileo episode. Galileo supported Copernicanism and the heliocentric theory. According to White he was obliged to recant on his knees because the theory was presumed to oppose the Scriptures.

But was Galileo condemned for his support of the heliocentric theory? An Italian historian of science, Pietro Redondi, speculates that he was not. He points out that the church had previously accepted Copernicanism and he believes that Galileo got into trouble because of his suggestion that matter was made of immutable atoms. Such a theory was believed to contradict the church's fundamental doctrine that the bread and wine became transformed in the mass into the body and blood of Christ. Redondi also speculates that Galileo was a victim of a power struggle within the church between Pope Urban VIII and the Jesuits. He contends that the Pope himself intervened to suggest that Galileo plead guilty to the lesser crime of Copernicanism so that he and the Pope would not be accused of heresy by the Jesuits. If Galileo had been convicted of an attack on the fundamental doctrine of the Church he might well have been burned at the stake.

Redondi refers to a hitherto unknown document which asks whether a passage in a document which Galileo had just published is compatible with the doctrine of the mass as it had recently been accepted by the Council of Trent. Galileo remains a martyr if Redondi's theories are proven to be correct. However, then the battle was not between the church and science but within the church itself. Earlier studies suggest this point of view.

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Contributed by John W. Klotz

Another Crypto-Ichnological Excursion

Glen Morton (1984) briefly reviewed the discoveries of anomalous hoofprints in formations belonging to the Permian and Triassic systems, in widely scattered regions of the globe. A further search through the geological literature revealed the existence of other anomalous ichnites of apparently mammalian origin.

The first report I encountered deals with two series of fossil footprints in sandstones of the Carboniferous of Northumberland, near Otterburn, N. Tyne, England (Figure 1). These were uncovered in a small quarry and first reported by Thomas Barkas (1873) in his *illustrated Guide to Fish, Amphibian, Reptilian and Supposed Mammalian Remains of the Northumberland Carboniferous Strata*. Details of the discovery

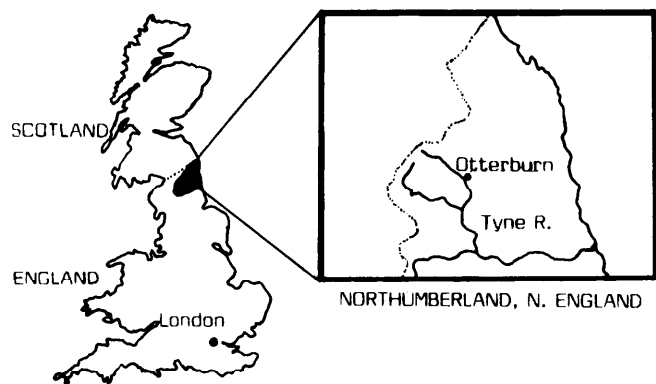


Figure 1. Location of fossil tracks shown in Figure 2.

were more recently published in Sarjeant's concise article (1974) on vertebrate trace fossils of the British Isles.

Two entirely different trackways are represented, both traveling in the same direction. The larger of the two appears to be those of a relatively small quadruped mammal (Figure 2). Strangely, Barkas, in his original report, considered the smaller set of prints to represent the remains of a "small", broad, four-legged mammal," while failing to comment on the larger tracks. The former were designated *Platytherium*, but the latter were imagined as those of a reptile and given the name: *Tridactylosaurus* [sic] *sandersoni*. The slabs of ripple-marked sandstone into which the tracks were impressed also bore traces of worms and crustaceans.

Another account of similar finds in the same area was presented by Barkas in 1889 at the British Association meeting. Not surprisingly, since Carboniferous mammals are much too early to fit into any current scenarios of mammalian evolution, ichnologists have been reluctant to instigate subsequent studies of these enigmatic footprint casts.

More mammal-like ichnites were exposed in arkosic sandstone among the footprints of early dinosaurian forms in the far-famed Connecticut Valley. Hitchcock (1858, pp. 54-5) published descriptions of several prints (Figure 3), which he believed were marsupial tracks, from the Upper Portland series (Triassic) around Turners Falls, MA and Portland, CT. The size, general morphology and the presence of dermal granulations in the forward depressions all suggest a mammalian origin.

Few professional paleontologists, however, are willing to concede to such an interpretation, for doing so would necessitate drastic revisions in the assumed evolutionary histories of the class mammalia. Even the

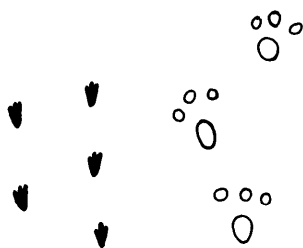


Figure 2. Trackways in Carboniferous sandstone, sandwiched between the Long Syke and Potts Durtree Limestones, Northumberland. No scale given.

larger "mammal-like reptiles" are generally believed to have perished at the close of the Permian, leaving only rat-sized, fur-bearing mammals surviving into the Mesozoic (Calder, 1983, pp. 120-1) when these footprints were left in unconsolidated sediments.

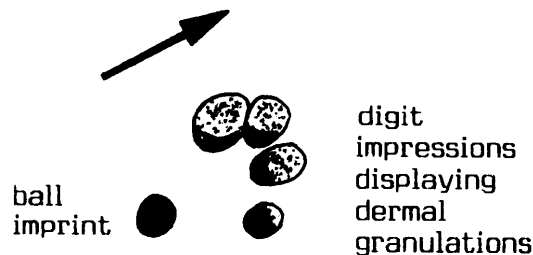


Figure 3. One of the curious impressions in red sandstone from Portland, CT. Hitchcock attached the generic name *Cunichnoidea* to the specimens because he considered the maker of the prints to be a dog-like marsupial. Scale: one-half natural size.

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Contributed by Ron C. Calais

The Snake's Spectacular Spectacle

Snakes comprise the order Ophidia in the class Reptilia and have been endowed with eyes differing in nearly every respect from those of any other reptile or vertebrate Dowling (1985, p. 96). Although such eyes are constructed on the same general vertebrate plan as that mentioned below, the details of the individual components vary widely. Especially striking is the mechanism of accommodation or focusing, and this is seen as well in a physical feature peculiar to the Ophidia, a structure termed the spectacle or brille.

The eyes of all vertebrates are designed on the plan of the simple camera, with a rounded front transparent layer, the cornea, through which light enters the eye. Passing through the pupil the light encounters the lens which, being actuated by several different methods, directs it through the transparent vitreous body to a focus on the retina, the light sensitive layer which lines the posterior 2/3 of the eyeball. The rods and cones in the retina, being nerve tissue, convert light energy to electrical impulses which pass via the optic nerves and radiations to the visual cortex of the brain where interpretation of the environment takes place.

The spectacle is a thin, tough, insensitive and transparent layer overlying the cornea, somewhat resembling a contact lens as worn under the lids in the human eye. Between them is a narrow space enabling the eyeball to move freely under the spectacle, but in spite of this, the eye retains a more or less fixed position most of the time. The cornea which contains many nerve endings is an extremely sensitive part of the eye.

Bereft of legs, and progressing over the ground, or, in many cases, burrowing into it, snakes would be especially vulnerable to corneal damage if they lacked

a protective aid. The spectacle provides an excellent and most appropriate solution to the problem, eliminating the need for eyelids which are almost universally present in terrestrial vertebrates. The spectacle, as it becomes scratched and abraded, in varying degrees loses its transparency. Although snakes in general do not depend primarily on vision, but have a highly developed olfactory sense mediated by a flicking tongue and Jacobson's organ in the roof of the mouth with which to assess their surroundings, the abraded spectacle, at times, could be somewhat of a visual disadvantage. Hence, when the healthy snake sheds its skin, which it does several times a year, it also relinquishes its hazy spectacle.

How did this unique visual apparatus of snakes originate? It is generally agreed by evolutionists that snakes descended from lizards which had gone underground and existed there for long ages. Under these circumstances their eyes, being unnecessary, lost not only their function but most of their substance as well, becoming almost vestigial in the process. When the snakes emerged from their underground environment their eyes had to be entirely reconstructed from what was left of the eyes of their lizard ancestors.

This reconstruction took a pathway divergent from all other vertebrate eyes including the lizards from which they are supposed to have originated. According to Duke-Elder (1958, p. 383) the impressive list of anatomical and physiological differences includes the following:

There is no scleral cartilage or ossicles; the iris musculature forms an indiscriminate network and its striated musculature, ectodermal in other reptiles is replaced by mesodermal fibres derived from the ciliary region; the ciliary venous sinus is corneal in location; the lens possesses sutures and an anterior annular pad and since it is divorced from the ciliary body, a new method of accommodation has been invented depending on pressure transferred to the vitreous; the retina has no *conus papillaris* but a *membrana vasculosa retinae*; the visual elements are distinctive and varied in their type; and the thick optic nerve is fascicular, each bundle being provided with an axial core of endymal cells.

The above blue print indicates the unique character of the make-up of the snake's eye apart altogether from its singular and remarkable spectacle. The lack of eyelids is accompanied by the absence of lachrymal glands.

Without fossil evidence of Ophidian evolution from lizards it seems almost ludicrous to imagine that the above reconstitution of the snake's eye supposedly took place by undirected chance processes. However, even if it did somehow occur, what was the source of the vast amount of genetic information necessary to direct, or in the words of Duke-Elder (1958, p. 383), invent, such a creative process culminating in such an innovative end result and beginning from remnants of a lizard's vestigial eye?

How much more rational and discerning to believe that an omniscient and omnipotent Intelligence designed the Ophidian eye along with its other senses to wonderfully satisfy its peculiar needs in its appointed environment!

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Contributed by H. S. Hamilton

The Genetics of Cheetahs

In a continued effort to improve the breeding success of cheetahs in captivity, reproductive physiologists from the U.S. ventured to a cheetah breeding and research center in South Africa to collect sperm from male cheetahs (OBrien *et al.*, 1985; Cohn, 1986). As Cohn noted in his review, the researchers were surprised when they learned that the samples were of very poor quality. Not only was the sperm concentration extremely low, but a large proportion of the sperm cells were abnormal. Subsequent studies of cheetah genetics have led to the amazing discovery that cheetahs lack the genetic diversity usually observed in wild animal populations. Such lack of genetic diversity is generally observed only in strains of highly inbred laboratory or domestic animals. The lines of evidence supporting this finding were as follows.

1) The proteins in blood samples collected concurrently with the aforementioned semen samples, together with blood samples from a number of cheetahs in zoos around the world, were examined by electrophoresis. In 250 other species similarly studied, differences in the amino acid sequence of blood proteins have indicated a genetic diversity of 10-50 percent. In the cheetahs, by comparison, no significant differences in amino acid sequence were found.

2) According to theory, genetic diversity prevents physiological extremes, while the lack of diversity, as in inbred animals, results in a greater degree of dissimilarity. The skulls of 33 cheetahs from various museums were carefully examined, revealing significantly more asymmetry than do the skulls of genetically diverse members of the cat family such as leopards, ocelots and margays.

3) Infant mortality among captive-born cheetahs is greater than that of the other large cats, and is similar between cubs born to either inbred or unrelated parents.

4) The cheetah's major histocompatibility complex was evaluated via the placement of reciprocal skin grafts on cheetahs in zoos in South Africa and in a U.S. game preserve. In unrelated animals with the usual degree of genetic diversity, such grafts would be rejected within 10-12 days. In the case of the cheetahs, all grafts were initially accepted. Those few rejections which eventually occurred did not take place until at least 50 days later.

Controversy has arisen over possible explanations for the virtual genetic identity of cheetahs, which vary from the occurrence of one or more population bottlenecks 10,000 years ago (comment: Noahian Flood?), to intense natural selection. Given the historical nature of such theories, we will probably never know for sure.

Other species have also been discovered which have a similar lack of genetic diversity: giant pandas, although only four individuals have been studied to

date; and elephant seals, which are reported to have suffered a population bottleneck about a century ago.

Of more importance perhaps is the paradox, noted by Cohn, which has arisen concerning the cheetah's survival as a species. It is thought that genetic variability is essential for a species' survival in the wild, and that a lack of diversity could cause a species to become extinct. How then has the cheetah survived the past 10,000 years after having lost its genetic variability?

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Contributed by Glen W. Wolfrom

Autumn Colors

The leaves of many plants have been designed to be discarded at the end of a growing season. During that season they were like factories manufacturing substances necessary for the sustenance of the plant. Like an evaporating body of impure water, leaf transpiration leaves behind the waste and byproducts of the manufacturing processes along with minerals carried up from the roots. At the same time many compounds useful to the plant are readsorbed during the same period so that there is a supreme efficiency of mineral recycling. By the time the leaf falls, the plant has readsorbed many useful atoms and molecules. The shedding of the leaves rids the plants of the unwanted wastes and is thus a helpful process for the plant.

The leaves of numerous plants just turn brown at the end of the season. Some, however, have brilliant colors of yellow, orange, red, and/or purple. Chemists can analyze the leaves to identify the chemicals that produce those specific colors and often find, as in the case

of the yellow carotenes, that they were there even during the growing season but were masked by the chlorophyll's green.

Other red pigments like anthocyanin are produced in high concentration during an autumn day when sugars manufactured in the leaf do not move out rapidly in the cool night which follows. Thus more intense red coloration occurs in those years when clear, warm days alternate with cool (but not freezing) nights. Excess sugar accumulating in the leaves somehow favors anthocyanin synthesis and shades of red, orange or purple result.

Yet one might ask for what purpose are there different colors in autumn leaves? Why are they not all brown? There would seem to be no selective advantage for plants to develop a brilliant color in the autumn because the reproductive season is then past. The colors would also seem to serve no purpose in seed dispersal. Neither would the colors be of benefit to any animal.

Perhaps there are physiological reasons why some species manufacture red pigment in conditions of sugar surplus. Possibly these anthocyanin molecules help carry out some final photosynthetic work or perhaps they protect the leaves for a few more days against advancing cold weather and thereby enhance food supplies. As creationists, we should search for such possible yet unknown functions.

It seems that only mankind notices and appreciates the brilliant autumn colors. In view of the apparent lack of any other purpose for those colors it would therefore seem that they are a gift and a signature of a loving Creator who designed the plants with a variety of autumn colors solely for the pleasure of mankind.

Contributed by Edmond W. Holroyd, III

ARTICLE REVIEW

The *Archaeopteryx* flap, by Stephen Jay Gould 1986, *Natural History* 95(9):16-25

Reviewed by J. Ricker Polsdorfer*

Fred Hoyle, "more recent supporter of uncommon causes," (p. 18) is the target for this detailed defense of *Archaeopteryx*, "a precious transition form." (p. 20) Professor Gould defends the authenticity of the fossil and castigates Hoyle for his theory justifying the alleged fakery.

According to Gould, the fossil contains fine sandstone detail (hairline cracks and manganese dioxide dendrites) on both the slab and counterslab that could not have been duplicated by subsequent overlay.

But his main concern is not the physical claim of forgery. Professor Gould is most bothered by what he calls "cardboard history" (p. 18)—the inventing of simplistic histories in an attempt to fabricate conspiracy. Hoyle's claim apparently was that Richard Owen, the alleged forger, was a creationist who sought to discredit evolutionism by inveigling them into accepting a fraud. Professor Gould thoroughly disagrees with Hoyle, maintaining that Owen, in the England of 1860, was one of "hundreds of evolution-ists, struggling with at least a dozen major theories for how evolution

worked." (p. 20). (My, how little things change.) From what Professor Gould writes, it seems that Owen was one of those unfortunate Christians so overwhelmed by the Darwinian flood that he occupied the only honorable ground still above water, that of theistic evolution.

He usually expressed his belief . . . with the standard argument of religious scientists in the Cartesian tradition: God made the world and then let it run without further interference according to laws of nature ("secondary causes" in Owen's terminology) . . . (p. 22)

There are several amusing comments in this article. T. H. "Huxley," it appears:

refused to view *Archaeopteryx* as a transitional form, interpreting it instead as "all bird," though the most primitive version of its class.⁹ This, to pile irony upon irony, is the position of modern creationists who must flatly deny the existence of all transitional forms . . . (p. 18)

Professor Gould honestly expresses his:

confidence in the fact of evolution, while acknowledging that we still struggle to understand how the process works—we are as confident that creatures evolved as we know that the earth goes round the sun . . . (p. 22)

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He then quotes Owen:

. . . the vast increase of knowledge-stores of biological phenomena makes it as impossible to comprehend them intelligibly in any degree, on the assumption of primary or direct creation of species, as it was impossible for Copernicus to understand and explain the vast accession of astronomical facts, on the belief of the subservient relation of sun to earth. (p. 22)

The impotence of an omnipotent God seems to have been an early article of faith in this new religion. Owen is also described as believing in "laws of form" (p. 22)

BOOK REVIEWS

It's a Young World After All: Exciting Evidences for a Recent Creation by Paul D. Ackerman. 1986. Baker Book House, Grand Rapids, MI. 131 pages. \$6.95.

Reviewed by Preson P. Phillips, Jr.*

Dr. Ackerman is a psychologist and professor at Wichita State University. He is also the founder and president of the Creation Social Science and Humanities Society. He is Editor of its journal, *Creation Science and Humanities Quarterly*.

This book will be of great help to the average Christian that is a non-scientist. It deals with important technical material in non-technical language. Important scientific principles are made understandable to the non-scientist. Dr. Ackerman is a good teacher. Each chapter is introduced with illustrations that make the technical material it contains more interesting and comprehensible.

After our conversion to Christ and His saving grace many of us had an experience similar to that which the author describes in the introductory section. We had, as scientists, been so thoroughly indoctrinated in the alleged billions of years of time that to challenge these vast ages "seemed arrogant, ignorant, even insane." This text, as the title indicates, is designed to help the thinking student across the gulf from seemingly unending time to measurable milleniums.

The author accomplished his purpose in an admirable manner throughout the first seven chapters. He discusses in clear, understandable language such technical matters as meteor dust and the problems posed by comets that should have disappeared long ago by evolutionists' time estimates. He has an excellent sense of humor and gives the reader a good laugh at such explanations as "Oort's Cloud" and "volcanoes in space."

It was a learning experience reading the chapter on "rock flows" and the age of the moon. There was also an excellent chapter on the shrinkage of the sun and possible mechanisms behind this shrinkage.

It would seem that, late in the book, the author abandoned the numerous SIMPLE evidences for a young earth and played around with the sensational and LESS understandable. I did not like his chapter on light and its relation to radioactive decay. In fact, his entire discussion of the speed of light is, from this reader's point of view, somewhat questionable. This material, in three chapters of the book, is taken from one man's largely unpublished work which Ackerman,

inherent in living organisms "that would channel evolution along predictable paths." (p. 22). Darwin and Lamarck, in contrast, held to a belief that all pressure toward change was external to the organism. These are called, respectively, the "structural and functional approaches." (p. 22).

Professor Gould concludes with a bemoaning of the necessity to carry on debate through a sensationalist press and a paean to the beauty of the Solnhofen limestone, complete with a picture of the fossilized *Archaeopteryx* feather, which is indistinguishable from one freshly plucked from a modern goose.

as a psychologist, is not qualified to appraise. It may have some merit but it is a pioneer work and not suitable for absorption by non-scientists.

The same criticism would apply to the chapter concerning the earth's axis. It is not the type of material you feed to non-scientists. He gives apparent evidence that Isaiah 24:20 is speaking of a shifting of the earth's axis, possibly because of an impact with asteroid. I have serious exegetical and scientific reservations about the whole idea.

One of the text's most useful chapters may be the one in which Robert Gentry's work on radioactive halos is discussed. This is done in a brilliant way in language the average layman can comprehend. The work ends with a very good discussion of time—from the scientific and the Scriptural points of view. There is an appendix dealing with "Scripture Evidence for a Young World."

Altogether, this book is easy reading, interesting, and should be highly enlightening to the average layman seeking further knowledge in the important field we call "The Bible and Science."

Living Fossils edited by Niles Eldredge and Steven M. Stanley. 1984. Springer Verlag, New York. 280 pages \$49.50.

Reviewed by Dennis Englin*

Living Fossils is a member of the Casebooks in Earth Science series developed by Robert Ginsburg. The format follows that of the case method developed for teaching law by Christopher Langdell at Harvard University in 1871.

Each volume in the series is to present case histories for reference and teaching; generate consistent terminology within the discipline; present a more consistent organization of data and classification; and identify new questions and approaches.

Eldredge and Stanley (editors) solicited 34 case histories of living fossils based upon the criteria that they "be anatomically very similar to a fossil species which occurs very early in the history of the lineage." For each case, the authors were asked to describe how similar the fossil forms were to living forms; how long the species remained unchanged; what were their relationships to other fossil forms; how diverse is the species now and in the fossil representations; what are the ecological niches of the living forms; how is the

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species distributed geographically now and in the past and how do the niches and geographical distributions of closely related species compare and contrast to the species under discussion. In the 34 case histories, 34 species or groups of species were analyzed and reported in separate chapters. A few were concluded not to meet the criteria of a living fossil.

The editors stated their main goal was to provide enough information through case histories for the readers to decide if living fossils were real or just a corner of a skewed pattern of evolutionary events. As shown in earlier publications (i.e., Stanley, Steven *The New Evolutionary Timetable*) the editors are both advocates of punctuated equilibrium. This is still evolution, but one which accepts extreme variations in the rate of evolution even within the same species.

A basic assumption underlying the discussion is that living fossils represent a question of the rate of evolution rather than a question of evolution's validity. In other words, evolution is a de facto assumption. They do not accept living fossils as an indicator of the falsification of evolution.

In the last chapter Niles Eldredge states that "somehow these hoary beasts have escaped the trap" of inevitable evolutionary change based upon adaptation through natural selection. They view taxa as individuals rather than as classes or groups. The taxa above the species rank are viewed as products of speciation which reflects the degree of similarity and difference between individuals. In other words, the natural variation within a gene pool at a given time represents the degree of variation of rates of change of individuals. They called these "taxa rates" of change versus the Darwinian "transformational rates." Instead of asking at what rate does a species evolve to another, they are asking how long does the identity (morphological character) of a form last. As well, in their view there is not always a correlation between the amount of morphologic change and speciation. Sibling species (morphologically similar or identical populations that are reproductively isolated) are cited as examples of speciation without morphological change. Being as fossils are evidence of morphological differences rather than reproductive isolation, living fossils do not, in their interpretation, negate speciation.

Stanley summarized the punctuational view in the last chapter and contrasted it to the gradualistic view as described by Simpson. In the punctuational model the distribution of longevities of genera is viewed as a rate of extinction rather than evolution. "Most evolution takes place within small populations in association with speciation events." Stanley claimed that the punctuational model of evolution would predict the existence of living fossils. The phyletic change in larger populations would be sluggish and have little impact upon evolution. He does not call living fossils "strange cases of arrested evolution" but rather "champions at warding off extinction."

Stanley and Eldredge saw the key purpose of this volume as providing a data base for the study of punctuated evolution that is consistent with the predictions of their model. Their model, however, still does not propose a mechanism for evolution but rather changes the expectations away from the traditional

gradualistic model to one that more closely matches already existing data.

The volume contains a wealth of comparative zoological information for advanced studies. The vocabulary, however, is quite specialized and requires a fair degree of maturity in zoology to handle. For those that would use it, the data is probably worth the cost of the book.

But like so many other volumes, the creationist alternative is by and large ignored.

The following are described along with their rationale as living fossils:

Tree squirrel (<i>Protosciurus</i>)	Oligocene
Tree squirrel (<i>Tupaia</i>)	Miocene
Old World Monkey (<i>Macques sylvanus</i>)	Late Miocene
Squirrel monkey (<i>Samiri</i>)	Middle Miocene
Owl monkey (<i>Aotus</i>)	Late Oligocene
Tapir (<i>Tapirus</i>)	Middle Oligocene
Mouse deer (<i>Tragulid</i>)	Late Eocene
Rhinoceros family (<i>Dicerorhinus</i>)	Late Oligocene
Musk deer (<i>Moschus maschiferous</i>)	Miocene
Broadnosed crocodiles Nile <i>Crocodylus porosus</i> <i>C. palustris</i> <i>Alligator mississippiensis</i>	Early Pleistocene Pliocene Pliocene Late Pleistocene
Narrow nosed crocodiles <i>Tomistominae</i> gharial	Late Cretaceous Late Cretaceous
Herring family <i>Denticeps clupeoides</i>	Oligocene
Lungfish (<i>Polypterus</i>)	Mid Cretaceous
Reed fish (<i>Erpetoichthyes</i>)	Mid Cretaceous
Bow fin (<i>Amia calva</i>)	Late Jurassic
Sturgeon (<i>Kindleia</i>)	Early Cretaceous
Garfish (<i>Lepidososteida</i>)	Cretaceous
Coelacanth	Devonian
Cow shark (Hexanchoids)	Early Jurassic
Order Leptostraca (Phylum Arthropods)	Early Paleozoic
Syncharida (Arthropoda)	Early Carboniferous
Horseshoe crabs (<i>Xiphosurida</i>)	Jurassic
Peripatus	Middle Pennsylvanian
Neopilinids (<i>Pilina unguis</i>)	Middle Silurian
Neopilinids (<i>Neritopsis radula</i>)	Middle Triassic
Neopilinids (<i>Neopolina galathea</i>)	Cambrian/Devonian
Conispiral gastropods (<i>Pleurotomaria</i>)	Mesozoic
Giant creeper shell (<i>Campanile symbolicum</i> <i>Tredale</i>)	Early Tertiary
Relict Shell <i>Diastoma melanioides</i> (Reeve)	Early Tertiary
Relict Shell <i>Gourmya gourmyi</i> (Crosse)	Early Tertiary
Bivalve mollusc (<i>Neotrigonia</i>)	Cretaceous
Bryozoan (<i>Nellia tenella</i>)	Early Ordovician
Coral (<i>Heliopora</i>)	Cretaceous

The hypothetical evolutionary age of the strata in which the "oldest" fossils were found is given by name because of the degree of disagreement in the age in years.

The Anthropic Cosmological Principle by John D. Barrow and Frank J. Tipler. 1986. Oxford University Press, New York. 706 pages \$29.95.

Reviewed by Don B. DeYoung*

Astronomer Barrow and physicist Tipler have written an encyclopedia on the Anthropic Principle. This principle concerns the fundamental fact that the universe is "user-friendly." If the basic properties of nature—as diverse as the shape of water molecules and the strength of gravity—were but slightly different, life as we know it would be utterly impossible. In 706 pages the authors touch on theology and history, cosmology and quantum mechanics. The book is a current summary of scores of recent publications on the anthropic topic. There are more than 1,500 references, many with detailed comments. Figures are limited to time-lines and technical graphs. The ten chapters are almost independent and no overall direction of thought is evident. The authors have purposely avoided any definite conclusion as to the meaning of design in nature. Certainly they display more reserve than paleontologist Stephen Jay Gould, who in the February, 1983 *Natural History* describes design in nature as nothing more than "raw hope gussied up as rationalized reality."

Some interesting anthropic tangents are explored, of which three will be mentioned. First, a strong case is

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LETTERS TO THE EDITOR

International Conference on Creationism

Between August 5th and August 9th of 1986 an important creation conference was held in Pittsburgh, Pennsylvania. As a scientist and participant I was very favorably impressed. Papers for the conference were selected and much effort went into their review. After the presentation of each paper 40 minutes were set aside for the speaker to answer both the comments of reviewers and those of conference participants. More than ever before, creation science was critically and honestly scrutinized by a large number of creation scientists.

And, lo and behold, creation science went through the fires of self-analysis and survived! And so much the stronger. The ICC Technical Conference allowed for iron to sharpen iron. Unencumbered by attempts to criticize evolutionary theory, dozens of creation scientists turned their expertise toward the revamping and rebuilding of their own formerly weak theory. A regular schedule of conferences of this sort is the most efficient method of advancing creation science.

The purpose of this letter is two-fold. One is advice to whomever sponsors a technical conference in the future. They would be well advised to pattern their conference after the 1986 ICC conference in Pittsburgh. Secondly a comment on the financial burden of such an endeavor. Unfortunately, the cost of technical conferences of this magnitude makes it impossible for

made that ours must be the only technological society in the Milky Way. The definition of life is thoroughly discussed. Second, entropy is recognized as the relaxing mainspring of universal history. The authors attempt to describe the consequent physics of future eras: 10^{66} - 10^{800} - 10^{1026} years from now! This is an opposite trend from that of most astrophysicists who give detailed analyses of the early moments of creation. (See Steven Weinberg. 1977. *The first three minutes*. Bantam Books. New York.) Third, James Jeans' little-known theory of the stellar red-shift is described. Jeans proposed in 1931 that instead of universal expansion, all physical objects in space are uniformly shrinking!

Parts of the book are deeply technical: wave functions, topology and black hole theory. However there is also much "easy" reading. For example the fascinating physical properties of water are outlined. Then the authors continue in the same way for hydrogen, oxygen, carbon dioxide, and nitrogen. It is shown that if the oxygen content of Earth's atmosphere were just slightly higher, lightning would quickly burn all vegetation, wet or dry (p. 544). Between the lines one reads "Praise the Lord for His handiwork!" Modern terminology in cosmology at times becomes misleading. The "ex nihilo" origin discussion (p. 440) is not in agreement with Creation. Instead the reference is to the whole universe arising from a giant quantum mechanical fluctuation of a vacuum. In a future instant we might all disappear once again! Secular origin theories offer a distinct lack of security.

The book is a good buy; quotes and references alone are worth the price. *The Anthropic Principle* should become a standard work on the vast subject of design which is of special interest to creationists.

small creationist organizations to sponsor them. The Creation Research Society may well be one of the very few organizations which is capable of sponsoring a technical conference both in finances and expertise. With that thought I would like to strongly encourage the CRS to consider sponsoring a technical conference such as was seen at Pittsburgh.

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Editor's Note: Unfortunately, CRS has neither the manpower nor the finances to support such a conference. Please see editorial comments on p. 141.

CRS Should Sponsor Conferences

This letter comes to urge the CRS leadership to start having creation science conferences every year or two. These would help to produce enthusiasm for creation science as well as stimulate interest in the Society.

The International Conference on Creationism (ICC), Pittsburgh Pennsylvania August 5-9, 1986, was a tremendous success for creation science. The immediate exchange of ideas and data will undoubtedly accelerate the advancement of the creation model. Fellowship and enthusiasm grew during the ICC week as hames'that are on Quarterly articles became friends.

Such benefits could only be achieved through some gathering like this.

We all know how important the technical foundation is to creation science. I suspect that if quality conferences continue to occur the cause for creation will greatly benefit.

Presently the CRS constitution and by-laws do not say anything about such conferences, so presumably conferences could be held. CRS technical conferences could become major events with tremendous impact in advancing the creation cause. To see younger and smaller organizations surpass the Society because they are the only ones willing to organize and lead important technical creation conferences is sad indeed!

I hope other members will write to the Quarterly's editor and to the Society's officers so that CRS conferences will become a reality.

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Editor's Note: Please read editorial comments on p. 141.

The Seven-Day Week

Introduction

The earth's motion provides two natural divisions of time. One rotation of the polar axis defines the 24-hour day; one orbital revolution about the sun defines the year. The week is a third, intermediate time segment that is not as readily derived from observation. There is no obvious seven-day rhythm in the solar system. What then is the basis of the week? Genesis 2:2-3 states that the weekly cycle was ordained by the Creator Himself. The very word for week, occurring 19 times in the Old Testament, comes from *sheba*, "seven-period." From time to time cultures have established other arrangements of days. However, all alternatives are temporary and the seven-day week always reappears in the end.

Of what interest is the length of the week to the creationist? Two particular points are emphasized in this study. First, the present calendar of weeks is a strong testimony to the pattern of the Creation activity. Liberal scholarship has attempted to turn this around, suggesting instead that the week is presupposed by the Creation narrative and is not derived from it. That is, the Genesis week is only a literary device based on man's own developed calendar—Abrahams (p. 766), Van Till (p. 84). This false idea needs to be refuted. Second, there appears to be a conscious effort in current literature to ignore the Biblical basis for the week. Many imaginative sources are suggested for the number seven but Genesis is seldom mentioned. Such bias should be exposed.

Calendar Systems

Any description of historical calendars is sketchy at best. Complications and uncertainties are numerous. Parise lists more than 40 distinct calendars, many of which were altered during their lifetimes, and even this list is not comprehensive. Since there is not an exact number of earth rotations in one solar revolution, our Gregorian calendar today remains inexact. Leap year provides only a crude solution to the problem of fitting an exact number of days into the average year.

All annual calendars have needed days dropped or added (intercalation) after a period of time. Added to all this, many societies follow dual religious and civil calendars. Table I lists several representative calendars, emphasizing the variable length of weeks. People have tried many ways to cluster days together in bunches of 5-10 days. Two of the recent calendars illustrate the temporary nature of any time reckoning that diverges from the seven-day week. In 1792 the French decided to institute a decimal calendar with a ten-day week. The day was further divided into decimal parts instead of hours and minutes. It failed to satisfy the people and quickly fell into disuse. The 1929 Russian entry was an attempt to dissociate time-keeping from any religious bias. Therefore, Saturday and Sunday were simply eliminated from the week! Soviet people enjoy week-ends like everyone and this calendar also was short-lived.

Abrahams (p. 766) suggests evidence for an ancient Hebrew ten-day week in Scripture. He cites Genesis 24:55 and Exodus 12:3, however, these verses have nothing to do with the definition of the week. Abrahams could as well have used Genesis 7:4 and 8:10 in favor of the seven-day week. In truth, the normal week is recognized throughout Scripture. A seven-day period is explicitly named in the days of such men as Joseph (Genesis 50:10), Moses (Numbers 19:11), and Samson (Judges 14:12).

Table I. A Representative List of Calendar Systems*

Calendar	Length of Week (days)	Period of Use	Source
Hebrew	7	14th century B.C.	P
Macedonian	none	9th century B.C.	P
Chaldeans	7	747-734 B.C.	P
Egypt	10, none		R
Babylon	10	625-316 B.C.	P
Assyria	6		R
Zoroastrian	none	389 B.C.	P
Greek	10		P
Rome	8, 10		P
Islamic	7	622 A.D.-Present	P
West Africa	4		R
Central Asia	5		R
French Republican	10	1792-1806 A.D.	P
Russia	5	1929-30 A.D.	P
Gregorian	7	1582-Present	

*The source is either Parke (p. 5, 8):P or Robson (p. 596):R. The sources were in conflict for some items.

Literature

It is understandable that the original seven-day week was abandoned by many countries. After all, God's commands and promises were likewise neglected in the sad history of mankind. However, why has the Genesis heritage of the calendar been forgotten today? Several contemporary comments on the length of the week illustrate the avoidance of any mention of Scriptural authority.

The seven-day week is firmly entrenched and no one knows for certain where it came from . . . Perhaps the week was originally used to mark the phases of the moon and we have forgotten the connection. — Brown (p. 2-3).

A 7-day week of uncertain origin (perhaps traceable to the approximate phases of the moon or to the popularity of the number 7) was observed with the entirely Israelite feature of a sacred day of rest on the 7th day. — MacRae (p. 1068).

Our own Western 7-day week, one of the most arbitrary of our institutions, came into being from popular need and spontaneous agreement, not from a law or the order of any government . . . The number seven almost everywhere has had special charm. The Japanese found seven gods of happiness, Rome was set on seven hills, the ancients counted seven wonders of the world, and medieval Christians enumerated seven deadly sins. — Boorstin (p. 13).

Astronomical bodies are frequently mentioned for the origin of the seven-day week: Sun (Sunday), Moon (Monday), Mars (Tuesday), Mercury (Wednesday), Jupiter (Thursday), Venus (Friday), Saturn (Saturday). It is true that the days are presently named after these celestial lights, which are themselves named for Greek deities. This simply fits man's usual pattern of naming discoveries and inventions after his own gods. However, the idea that the week's length *originated* from these bright lights must be challenged. Consider the case of the planet Venus. It was seen in antiquity as two separate objects and was given two names: the morning star (Phosphorus) and the evening star (Hesperus). It is unknown whether the ancients realized that both of these lights were in reality a single object. It would seem that Venus could easily have been named for two separate days of the week, and the same is true for Mercury. If the week was first defined by wandering lights in the sky, there should be at least nine weekdays! Instead, it is more likely that the already-existing pattern of seven days was later superimposed with planetary names.

Old Testament Israel used a lunisolar calendar that is still followed today for Hebrew religious days. The Islamic nations also use a lunar calendar and carefully observe the phases of the moon. It is to be expected then that the moon is often appealed to for the definition of the week. After all, the quarter phases of the moon are "about" a week apart. Actually the moon's synodic period is 29.53 days. This natural cycle comes close to an integral number of sevens, but is certainly not an exact 28 days. If used in establishing a lunar week, it would have been more precise to insert three weeks into a lunar cycle, each being 10 days in length! Also, lunar phases do not really provide a convenient visual calendar. The first quarter moon is overhead at sunset, the full moon rises at sunset, the third quarter is not seen until midnight, and the new moon (or waxing crescent) is barely seen at all. As with the planets, the cycle of moon phases most likely as a framework which was assigned to an already-existing seven-day pattern.

Conclusion

It is with hesitation that one attempts a discussion of calendar systems with their inherent complexity. However, their study shows that the enduring seven-day week is a strong testimony to the reliability of Scripture and the work of Creation. The final word has not been written on calendars; new proposals have arisen

on reform. The seven-day week and the variable lengths of months are unsatisfactory to some people. Merchants in particular would like holidays on the same week day each year. One popular suggestion is called the International Fixed Calendar. Each year would be 364 days long, or 52 weeks exactly. One's birthday would then always fall on the same day of the week. Each of the 13 months would also contain a Friday the 13th! There would be an extra 365th day (two during leap year) that did not belong to any week. This added day would bear no month or weekday designation. History predicts that such a system, even though diverging from the seven-day week by just one or two days a year, would be doomed to failure.

Several suggestions arise for further study on the subject of weekly time reckoning. Can the seven-day week be traced back through early extra-Biblical literature just as Flood traditions have been? In what ways is the seven-day week an optimum time interval for our physical and mental well-being? Who is promoting calendar reform in our day and what are the real motives? What upper limit does the seven-day week and the tidal-frictional slowing of the earth's rotation place on the age of the earth?

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QUOTE

Why isn't secular psychology enough? It offers plausible explanations, good insights, good techniques. It offers very good pills. But it doesn't offer the one thing that people require most: a sense of meaning. Quite the contrary, we can even say that the psychological sciences tend to reduce meaning. One comes away from the psychology textbooks with the feeling that though life now seems more explainable, it somehow seems less meaningful. Everything we thought was of value gets explained away. Symphonies and paintings turn out to be sublimations of the sex drive or productions of the right brain hemisphere. Love turns out to be a matter of stimulus and response or a series of transactions conditioned by family patterns.

Kilpatrick, W. K. 1986. Why secular psychology is not enough. *Imprimis* 15(4):2 Hillsdale College.

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The subscription year for the Creation Research Society Quarterly begins with issue Number 1 in June and continues through publication of the other three Quarterlies which appear in September, December, and March.

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