

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

VOLUME 17

DECEMBER, 1980

NUMBER 3



CREATION RESEARCH SOCIETY QUARTERLY

Copyright 1980 © by Creation Research Society

VOLUME 17

DECEMBER, 1980

NUMBER 3

EDITORIAL BOARD

Harold L. Armstrong, Editor
4 Couper Street
Kingston, Ontario, Canada

Walter E. Lammerts, Research Editor

- Thomas G. Barnes University of Texas at El Paso, Texas
Duane T. Gish Institute for Creation Research,
San Diego, Calif.
George F. Howe Los Angeles Baptist College,
Newhall, Calif.
John W. Klotz Concordia Seminary, St. Louis, MO.
John N. Moore Michigan State University
East Lansing, Michigan
Henry M. Morris Institute for Creation Research,
San Diego, Calif.
William J. Tinkle Anderson College (retired)
North Manchester, Indiana
John C. Whitcomb Grace Theological Seminary,
Winona Lake, Ind.
Emmett Williams Continental Telephone Laboratories,
Norcross, Georgia

Notices of change of address, and failure to receive this publication should be sent to Wilbert H. Rusch, Sr. 2717 Cranbrook Road, Ann Arbor, Michigan 48104.

Creation Research Society Quarterly is published by the Creation Research Society, 2717 Cranbrook Road, Ann Arbor, Michigan 48104. © by Creation Research Society.

Creation Research Society Quarterly is indexed in the *Christian Periodical Index*.

COVER ILLUSTRATION

The picture on the front cover of this issue of the *Quarterly* is of a beetle *Golofa porteri*. This is one of the horned beetles, of the kind discussed in an item by Lammerts in an item in *Panorama of Science*, elsewhere in this issue of the *Quarterly*. The insect comes from Columbia. The one shown is a male, and the horns can be clearly seen.

As Lammerts points out, such extraordinary appendages as these horns are an embarrassment to evolutionary theory. For while the insects do use them, the use is not at all vital; hence it should have nothing to do with survival. The Creationist view, that God likes variety, and created these insects as He saw fit, is much more reasonable.

Mr. Robert E. Jensen, of Encino, California, who has an M.S. in entomology, is presently working on tarantulas and scorpions, and has prepared a key to the scorpions of California, took this picture. Dr. G. Howe helped in arranging for it.

TABLE OF CONTENTS

	Page
The Inconsistent Sun: How Has it Been Behaving, and What Might it do Next? Hilton Hinderliter	143
Cosmology and Einstein's Postulate of Relativity Harold S. Slusher	146
Significant Fossil Discoveries Since 1958: Creationism Confirmed Marvin L. Lubenow	148
Notes on the Use of Statistics in the Debate of Creation versus Evolution John M. Andresen	160
Prolegomena to the Study of the Sediments Robert Morton	162
Thoughts on the Structure of the Ark P. H. van der Werff	167
Death and Niche Limits Mark W. Tippets	168
On the Star of Bethlehem Gerardus D. Bouw	174
Asa Gray and Theistic Evolution Randall R. Hedtke	181
Panorama of Science	185
Book Review (1)	188
Letters to the Editor (8)	189

NEWSLETTER STILL AVAILABLE

We hear that back issues of our newsletter, *Creation Reflections and Selections*, are still available. It will be recalled that the newsletter is being produced this year on a trial basis. The issue of June, 1980, circulated widely; and three other issues have been or are to be prepared: in September, December, and in March 1981. Among other things, it contains items which are not suitable for the *Quarterly*, because of the long time which its preparation takes.

The four issues, including back issues if necessary, are available to members and subscribers only. To receive them, send \$1.00 to C.R.S. Books, 5093 Williamsport Drive, Norcross, Georgia 30071.

THE INCONSISTENT SUN: HOW HAS IT BEEN BEHAVING, AND WHAT MIGHT IT DO NEXT?

HILTON HINDERLITER*

Received 6 November, 1979

Various observations showing the sun's behavior to be non-steady over time spans much less than millions of years are cited. The contraction, — which, in the author's opinion, is gravitational, is just one of these. The problem of missing solar neutrinos is well known; some of these observations further contradict the model of solar density distribution derived from the nuclear-fusion model. Suggestions for further research are offered. Also, this latest evidence is correlated with Scriptural prophecies concerning the sun.

Introduction

A previous article¹ dealt with the history of theories explaining the source of the sun's radiant energy, the shortcomings of the nuclear-fusion model, and the recent discovery of solar contraction. In reading that article, one who is familiar with Dr. Eddy's publications² may wonder if I am totally ignorant of the interpretation which he gives to the contraction—one which is quite different from my own. Well, I am neither ignorant of it, nor wishing to suppress it. In fact, it serves as a good starting point for the present analysis.

Eddy (as well as other authorities with whom I have communicated) has avoided the direct clash between contraction on the one hand, and the billion-year myth (BYM) on the other, by believing that: (1) The contraction has not been going on indefinitely, but is only one phase of expand-contract cycles; and (2) Only the outer layers of the sun are involved in the decrease in visual size of the solar disk. The question which immediately arises is, "Why does he so believe?" Well, for one thing, he does say that he believes the sun to be between 4.5 and 5 billion years old³; this, for the sake of consistency, can leave him no choice but such restricted interpretations. On the other hand, I will credit him with great honesty in his admission, "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"⁴. This attitude toward Bishop Ussher's chronology is truly remarkable, considering that Ussher's name has been mentioned in scientific circles (at least since I've been on the scene) only as an object of ridicule.

The only justification for Eddy's acceptance of billion year ages appears in his allusion to paleontology. Now, personally, I find it disappointing (but not uncommon) to hear experts admitting that evidence in their field fails to support evolution and/or vast ages—yet adding that they rely on the conclusions of spokesmen from other fields. The pressing question is whether or not arguments derived from those other fields are any more valid. I remember an evolutionary biologist with whom I was one day discussing radiometric dating. He seemed to know little of the theory of how dating is done; and, when I explained that errors in any of several major assumptions could render the results completely meaningless, he shrugged it off with the statement that he had

read a book on the subject—wherein it was claimed that results are accurate within 10%—so there was no use in my disputing it. Just how much of our so-called science amounts only to faith in someone's (possibly-biased) opinion?

To briefly scrutinize Eddy's "outer-layer only" approach, I would question whether this is anything but ad-hoc speculation. In light of the neutrino dilemma, it is certain that none of the theorists has any knowledge of what's going on inside the sun (except that not many neutrinos are being produced). To trust another's interpretation whose only basis is a *belief* in vast ages—this is unwise, to say the least. Maybe the outer layers *are* contracting more than the core, but maybe the core is contracting faster still—no one knows!

As for the contraction's being cyclic, I looked over Dr. Eddy's published data,² but found no hint of a turnaround at either end of the range (years 1836 to 1953). There may be a slight buckle in the graph from 1875 to 1885, but nothing is evident detracting from a steady lessening trend in size. It might be well to mention that some have disputed Eddy's contraction data; but he has shown that measurements of the solar diameter along different axes (referred to as horizontal and vertical) all show a steady decrease, as do also the observations recorded at different locations. In being careful to avoid systematic errors, Eddy has done a thorough job of making sure that such things as changes in atmospheric conditions could not be making a constant-size sun only *appear* smaller.²

Much, Much Too Fast!

In his reports, Eddy has given only one data-related reason for his belief in cycles (I asked him specifically about this in a private communication, but have as yet learned of no others): the magnitude of the contraction rate. And just how great is it? Approximately 0.1% per century. That may not sound like much (It certainly won't make the sun visibly smaller in our lifetimes), but it is *170 times* the rate of contraction which Helmholtz calculated as sufficient for generating *all* of the sun's radiant energy! So if all of the sun is shrinking together, then there are orders of magnitude more energy being generated inside it, than is being emitted from it. From the BYM viewpoint, I would have to agree that this condition must not have persisted for billions of years (long ago something would have had to give). But since there is really no hint of cycles in the data, and since the myth is running into more and more contradictions from the hard sciences, anyway, why doesn't someone consider

*Hilton Hinderliter, Ph.D., is Assistant Professor of Physics at The Pennsylvania State University, New Kensington campus.

the possibility that the contraction might be steady (i.e. non-cyclic)—perhaps even accelerating—but characteristic of a sun only tens of thousands of years old? Such a view might even relate to further idiosyncrasies of the sun—such as its non-uniform, and possibly variable,^{4,5} rate of rotation. For a collapsing sun, wouldn't one expect constituents of greater angular momentum to show up at the equator?

Along a totally different line of reasoning, if the changes in dimensions *were* cyclic, on what grounds could we assume that, at certain points in the cycle, the behavior of the sun does not become catastrophic (relative to earth)? It appears that a primary motivation for the uniformitarian assumption (besides the obvious one of trying to explain how the creation could have originated without the Creator) is the one so well described by Immanuel Velikovsky as “cultural amnesia”. The psychological makeup of mankind is such that one feels much safer in *assuming* (hoping) that catastrophic happenings are not the natural (and frequent) course of events. And this desire to believe in a “friendly neighbor” I judge to be a major motivator toward theories which characterize the sun's behavior as steady through vast ages.

A quote from Isaac Asimov is appropriate here, as it also lays bare the evolutionary ties to the steady-sun assumption: “It is just our good fortune that our sun is well balanced. (Actually, that's putting the cart before the horse. If the sun were not well balanced, life would not have developed on earth, or if it had, it would relatively quickly have been destroyed. The mere fact that we are here, then, shows that the Sun is well balanced and there is no need to perspire thankfully over the inevitable.)”⁶

But what of the evidence? Has the sun in fact proved itself to be as reliable as a Swiss watch?

Stuttering Sunspots, and Other Jitters

Since Galileo had the gall to suggest flaws in the celestial realm, solar blotches have captured the imaginations of many. In recent decades it has been noticed that the abundance of these blotches varies with a period of eleven years. But, besides this variation, Dr. Eddy has called renewed attention to the virtual absence of sunspots altogether from 1645 to 1715 (Maunder minimum). He has further remarked that moon rock analysis “indicates that about 10,000 years ago solar activity was much higher than anything experienced since that time”.³

Some years ago I made a practice of noting reports of observations of erratic solar behavior. Consider these examples:

a) Unexpected solar activity which threatened premature termination of the Soviet Salyut 3 space station.⁷

b) A flare of a type never seen before.⁸

c) A noticeable change (1 or 2 per cent in the visible spectrum) in solar brightness over a 25-year period.⁹

d) Flares and explosions of enormous magnitude that defied all previous theories, and which occurred during times when the sun should have been “quiet”.^{10,11,12}

To bring the subject of solar variability up to date, I will point out that one now commonly finds the sun

referred to as a variable star,^{13,14} along with such statements as: “Either the solar constant is slightly (up to 2% since 1972) variable or else solar activity causes correlated changes in the albedos of planetary bodies”.¹⁵ “Actually there are four or five independent lines of evidence consistent with the idea of solar variability . . . the incidence of sunspots and (on earth) auroras, the structure of the solar corona, the concentration of ¹⁴C in the earth's atmosphere, and the temperature at the earth's surface . . . Evidently the seemingly regular behavior of the sun over the past 150 years is not, as solar physicists have long assumed, necessarily typical.”¹⁶ “Its behavior is not constant. Even worse, it's not regular. In fact, only within the past year or two have we begun to realize how truly complex and *capricious* (emphasis added) our sun's behavior is . . . and the implications for life on earth are profound . . . (and, a quotation from Dr. Eddy:) I don't think that such irregularity is a mark of health. I think it's the mark of a shaky, rickety machine.”¹⁷

The Density Distribution is What?

Perhaps the most shocking discovery of all (from the viewpoint of “accepted” solar models) derives from the work of two separate research teams (one Soviet,¹⁸ the other British¹⁹) who, by means of different techniques, have detected radial pulsations of the sun (of amplitude about 10 kilometers). Whereas accepted models of the solar interior predict a period of such vibrations as one hour in duration, both groups of observers have found the period to be 2 hrs 40 min; and both have noted that this value implies that the sun's interior is nearly *homogeneous*!!

Now what billion-year model of the sun could possibly be consistent with homogeneity? The density distribution inherent in the nuclear-fusion model is irreconcilably at odds with these discoveries. So, if the missing neutrinos²⁰ don't demolish all solar models built on the BYM, then surely this 160-minute tremor will!

Before proceeding to the “wind-up”, I should like to list here a few avenues of further research suggested by these recently-discovered solar enigmas—ones which relate crucially to the age of the solar system, and to theories of origins:

a) What would near-homogeneity imply about the sun's age, and about its past history?

b) What rotational characteristics would derive from a rapidly-collapsing star?

c) What might likely happen to a star which is internally generating many, many times the amount of energy it is radiating away?

Thought About the Future—Correlations With Scripture

The last item on the list above stirs up questions of the most important kind: How is the sun likely to behave in the future? In crossing the astrophysical bridge to this issue, let me toss a stone in the direction of the sprawling lake known as “theories of stellar evolution.” Even before the nuclear-fusion model began to falter in the face of scientific observations, it was apparent to any thinking person that the billions-of-years scenario of

stars evolving from this type to that type—that this could amount to nothing but wishful thinking. Surely no one has been around long enough to see a star progress even a small step through any such slow sequence. As for myself, besides possessing the heretical tendency to question things that have merely been assumed (upon posing this challenge to an astrophysical authority, I was told that I shouldn't be so sceptical!²¹), I can now delightfully point to Stephen Maran's conclusion (based on observations, rather than BYM speculations) that a red giant star has become a white dwarf in one thousand years, or less!²²

So, with the realization that vast-age stellar evolution retains no substance worthy of further refutation (some of the latest "imaginative" attempts to fit the observations suggest that the sun contains a black hole at its center, or that the exterior half of the sun's mass was added, with an entirely different composition from the interior half, about 5 billion years ago!²³), let's consider what the really-reliable source—the Bible—has to say. It should first be explained that this assessment of the Bible is not based on mere indoctrination, but is supported by a quarter-century of experience. To be sure, the study of the Scriptural predictions of future events could be labelled as quite scientific—at least as far as their being verifiable by observations. Putting Biblical prophecy to the test, I have found world events to confirm it to the letter.

As just one of many specific examples, I would quote Zechariah 12:3, "And in that day will I make Jerusalem a burdensome stone for all people: all that burden themselves with it shall be cut in pieces though all the people of the earth be gathered together against it." Who could argue that this was anything but divine foreknowledge—as we witness the present world-wide turmoil over the fate of Jerusalem?

The Bible repeatedly mentions the sun, in prophecies of the future. Some of these may well be symbolic; but others are direct, and strike me as relevant to the scientific findings reported in this (and the previous solar-contraction) article. Of these I shall mention only a few (keeping most of my thoughts and interpretations to myself):

(1) Joel 2:31 bluntly states, "The sun shall be turned into darkness, and the moon into blood, before the great and the terrible day of the Lord come."

(2) Jesus is quoted in Luke 21:25-26 as saying, "And there shall be signs in the sun and in the moon, and in the stars; and upon the earth distress of nations, with perplexity; the sea and the waves roaring; men's hearts failing them for fear, and for looking after those things which are coming on the earth: for the powers of heaven shall be shaken."

(3) Finally, as an indirect reference to the sun, but perhaps even more thought-provoking than these former, note Zechariah 14:6-7: "And it shall come to pass in that day, that the light shall not be clear, nor dark: but it shall be one day which shall be known to the Lord, not day, nor night: but it shall come to pass, that at evening time it shall be light."

Consider what might happen (remembering that no man can say what *would* happen—all contemporary solar models have proven themselves bankrupt) as a

result of the sun's internally generating many times the amount of energy now escaping from it. What would occur if the sun were to "blow its stack"?²⁴ Might material from the sun be hurled into space in such a way as to make the remaining core appear darker, the moon glow red, and the sky light up around the clock? Even charged particles and electro-magnetic effects could give rise to a continually-glowing sky—could they not? Who is to say? Certainly not the "experts," many of whom will undoubtedly revamp their BYM models, which the data have so thoroughly discredited. They'll refurbish them, and before long claim that they "predicted" the recent shocking discoveries which I have mentioned above.

No, only time will tell—and most likely not billions of years of it, either!

References

- ¹Hinderliter, Hilton, 1980. The shrinking sun: a creationist's prediction, its verification, and the resulting implications for theories of origins. *Creation Research Society Quarterly* 17(1):57-59.
- ²Eddy, John A., and Aram A. Boornazian, 1979. Secular decrease in the solar diameter, 1836-1953. *Bulletin of the American Astronomical Society* 11, 437. Also GBL, 1979. Analysis of historical data suggest Sun is shrinking. *Physics Today* 32(9):17-19.
- ³Kazmann, Raphael G., 1978. It's about time: 4.5 billion years. *Geotimes* 23(9):18-20.
- ⁴Herr, Richard B., 1978. Solar rotation determined from Thomas Harriot's sunspot observations of 1611 to 1613. *Science* 202(4372):1079-1081.
- ⁵Fath, E.A., 1955. *Elements of astronomy*. McGraw-Hill. P. 153. The remark is made: "No satisfactory reason has been found to explain the peculiar law of solar rotation." (i.e., different latitudes rotate at different rates.)
- ⁶Asimov, Isaac, 1974. *Asimov on astronomy*. Doubleday. P. 199.
- ⁷1974. Salyut 3: busy and comfortable. *Science News* 106(3):37.
- ⁸1974. Flare on the Sun: a whole new class. *Science News* 105(17):270.
- ⁹1975. Something new under the Sun: a flicker. *Science News* 108(3):37.
- ¹⁰Driscoll, Everly, 1973. A massive explosion in the Sun's corona. *Science News* 104(7):123.
- ¹¹1973. Sun dances for Skylab: scientists elated, puzzled. *Science News* 104(11):166.
- ¹²1975. Helios makes closest pass to Sun. *Science News* 107(12):188-189.
- ¹³1975. Variable star. *Scientific American* 232(3):49.
- ¹⁴1978. Solar activity linked with luminosity drop. *Astronomy* 6, 65.
- ¹⁵Lockwood, G. W., 1975. Planetary brightness changes: evidence for solar variability. *Science* 190(4214):560-561.
- ¹⁶Hammond, Allen L., 1976. Solar variability: is the sun an inconsistent star? *Science* 191(4232):1159-1160.
- ¹⁷Bell, T. E., 1978. The shaky machine. *Astronomy* 6, 6-17.
- ¹⁸Severny, A.B., V.A. Kotov, and T.T. Tsap, 1976. Observations of solar pulsations. *Nature* 259(5539):87-89.
- ¹⁹Brookes, J.R., G.R. Isaak, and H.B. van der Raay, 1976. Observations of free oscillations of the sun. *Nature* 259(5539):92-95.
- ²⁰Steidl, Paul M., 1980. Solar neutrinos and a young sun. *Creation Research Society Quarterly* 17(1): 60-64.
- ²¹Private communication from Prof. J.M. Rees, Institute of Astronomy, University of Cambridge.
- ²²Reference 3, p. 19.
- ²³Bahcall, John N., and Raymond Davis, Jr., 1976. Solar neutrinos: a scientific puzzle. *Science* 191(4224):264-267.
- ²⁴Frazier, Kendrick, 1978. The sun our star. *Science News* 113(16):252-266. It is remarked that: "The orb we had once thought so regular turns out to be more and more variable and unpredictable. Perhaps it was inevitable that this should come to pass. Our impression of solar regularity may have depended more on our inner need for a dependable celestial parent—living in the neighborhood of a variable star is a bit of a nervous strain—than it did on the facts . . . In the end we may be discovering that we do not live in as quiet a corner of the universe as we may have wished."

COSMOLOGY AND EINSTEIN'S POSTULATE OF RELATIVITY

HAROLD S. SLUSHER*

Received 2 April, 1980

Introduction

Some years ago, the late professor Herbert Dingle¹ pointed out a most profound effect that the acceptance of Einstein's postulate of relativity would have on current ideas in cosmology and cosmogony. This effect is seen in the interpretation of the Doppler shift. The Doppler effect is a relation between the relative motion of a source of light and an observer or receiver along the line connecting them and the spectrum of that light as recorded for instance on a spectrometer. If a source and an observer are approaching each other, the spectrum is shifted to shorter wavelengths; but the shift is to longer wavelengths if they are receding from each other. These shifts are measured relative to position of the spectrum of the light when the source of light and the observer have no relative motion. This paper is a discussion of Dingle's examination of the meaning of the Doppler shift in the light of the postulate of relativity. Dingle's examination is little known but of tremendous significance and therefore the subject of this paper.

Dingle's Proposed Problem

Dingle proceeded in the following manner in proposing a simple but far-reaching problem regarding Doppler shift. Suppose that initially the source and observer are stationary with no motion toward or away from each other and are separated, being a distance s apart (Fig. 1 (a)). Then suppose the source begins to move with speed V toward the observer (Fig. 1 (b)). The light-waves will be compressed and, thus, shifted toward the blue side of the spectrum that existed before this motion began. However, this Doppler shift should not begin to be detected until a time s/c after the motion began, since it would take this long for the effect caused by the motion of the source to reach to observer at a distance s away; c is the speed of light.

But now suppose that the source is stationary and the observer (say a spectrometer on Earth) begins to move with a speed V toward the source (Fig. 1 (c)). The spectrum will be shifted to the blue side an identical amount as before; but the shift will be detected immediately, since the Doppler shift is caused by the observer encountering the waves with a greater frequency. The amount of shift is the same in both cases. The only observable difference between a Doppler shift caused by a speed of the source towards the observer and an equal speed of the observer towards the source is that in the first case, there is a delay in detection of the Doppler shift, while in the second case its detection is instantaneous. Synchronized clocks placed at the source and observer should show which has moved since the time of movement of the source or the observer and the detection of the Doppler-shifted light can be determined.

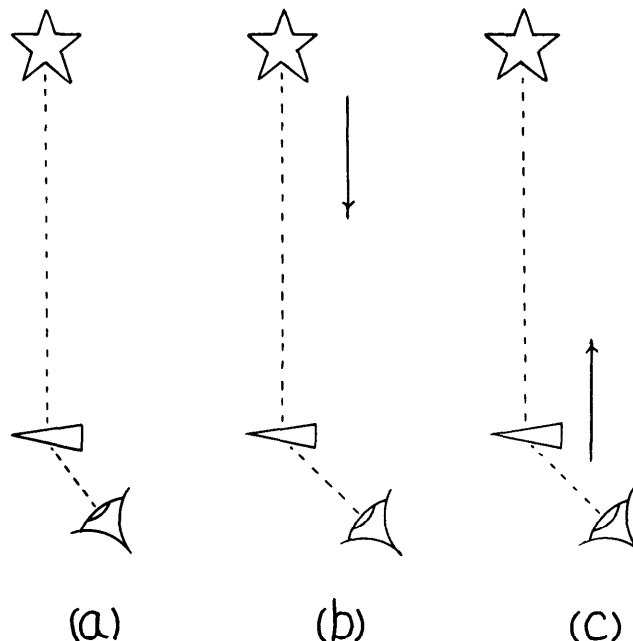


Figure 1. This shows an observer (shown in the stylized way of optics, by an eye) observing a star, and in particular its spectrum (suggested by a prism). In (a), the observer and star are stationary the one with respect to the other, i.e., the distance between them is not changing. In (b) the star is moving toward the observer, while in (c) the observer is moving toward the star.

Einstein's Relativity Postulate and this Problem

In Einstein's hypothesis, the relativity postulate maintains that there can be no observable difference between the motion of the source towards the observer and that of the motion of the observer towards the source. Only relative motion can be detected. So either observation of the motion causing the Doppler shift is instantaneous in both cases or there is a time delay in both cases. There cannot be two answers. Common experience should tell us which of these answers we must take.

Consider the orbital motion of Earth about the Sun and observations of a distant star. There will be an oscillation of the spectral lines of that distant star as the Earth revolves in its orbit. Superimposed on this oscillation of the spectrum due to Earth's orbital motion will be a shift due to the relative motion of the solar system and the distant star. This however does not affect the oscillation of the spectral lines. The Doppler effect corresponding to this orbital motion is synchronized with the orbital position of the earth. The Doppler shift of the light from the distant star caused by Earth's orbital motion is instantaneous in its detection. As shown in Fig. 2, the Doppler effect is a maximum (in opposite senses) at positions (2) and (4) and a minimum at positions (1) and (3). The expected Doppler shift synchronizes immediate-

*Harold S. Slusher, D.Sc., is Assistant Professor of Physics at the University of Texas, El Paso.

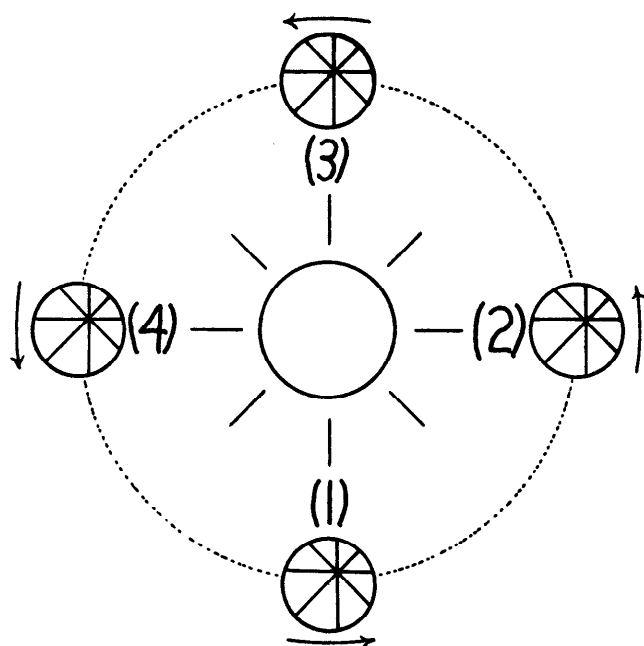


Figure 2. This shows how the Earth, and hence an observer on it, is in different states of motion with respect to a distant star at different times of the year, as the Earth goes around its orbit. Hence the Doppler effect observed is different at different times of the year. It will be understood that this illustration is nothing like to scale.

ly with the positions of the Earth. According to the relativity postulate, the Doppler effect of the motion of the star then must likewise show up immediately; otherwise there would be an observable difference between the two cases. The relativity postulate says that phrases "when the star moves" and "when the observer moves" are meaningless phrases and only a phrase like "when the relative motion occurs" is proper. Two answers are not possible according to the relativity postulate. We know that for the observer moving the Doppler shift is instantaneous. Therefore, this answer must apply regardless of which body moves if the postulate of relativity is to stand. Thus, the Doppler shifts of stars and galaxies must give the speeds which exist when the observations are made, no matter how far away the sources of the light are.

Implications for Cosmology

Dingle's singling out of this problem regarding the postulate of relativity and/or modern cosmology is little known but obviously of tremendous significance. For it would seem to imply that the red-shifts of the spectra of distant galaxies give velocities existing now, not millions or billions of years ago as generally accepted. So, if the relativity postulate is accepted, then a radically different interpretation must be placed on the Hubble law. The Hubble law ($V=Hr$), a prediction of relativistic cosmology, says the distance of an object is proportional to its velocity which is found from its red shift. This velocity presumably was that of the object years into the past. Of course, today, there is a great deal of question as to whether red-shifts are truly Doppler effects at all. If the postulate of relativity is not accepted so as to eliminate this problem, a vast reconstruction must be made of modern cosmology and cosmogony since they are laid down on the assumption of the validity of the hypotheses of special and general relativity. Both the hypotheses of special and general relativity and their child, modern cosmogony, have several distinct failures when attempting to represent the real Universe.

References

- ¹Dingle, Herbert. 1960. The Doppler effect and the foundations of physics, (I) and (II). *British Journal for the Philosophy of Science* XI (41):11-31 and (42):113-129. In this article Dingle remarked: "It is doubtful if there is a serious rival to the Doppler effect as the department of modern science in which the experimental basis is slightest in comparison with the structure raised on it."
- ²Dingle, H., 1972. *Science at the crossroads*. Martin Brian and O'Keefe, Ltd., London. Pp. 215-217.

CREATIONIST ACADEMIC POSITION AVAILABLE

It has come to our attention that College of the Southwest, Hobbs, New Mexico, is seeking to fill a full-time position in Math and Chemistry, beginning either in January or in August. The successful candidate should have teaching competence in both fields, with preferably a doctorate in one. Applicants should be

compatible with a small, private, accredited college stressing Christian principles and the Free Enterprise System. The salary is competitive. A curriculum vitae and transcripts should be sent to: The Search Committee, College of the Southwest, Lovington Highway, Hobbs, New Mexico 88240.

SIGNIFICANT FOSSIL DISCOVERIES SINCE 1958: CREATIONISM CONFIRMED†

MARVIN L. LUBENOW*

Received 13 August, 1979.

Creationists have often pointed out that the fossil record, although claimed by some to be evidence for evolution, is in fact more indicative of special Creation. A well known book on geology, published in 1958, corroborated, in a remarkable chart, the Creationist position, although the book was not written from a Creationistic viewpoint.¹ It showed that many distinct kinds of creature, both plant and animal, appeared suddenly and separately in the fossil record, and remained separate, without any evidence of evolution into something else, until the present or until they became extinct. In this article some of this evidence is reviewed. Also, it is shown that in the years since 1958 the beginning of various kinds has been found to be earlier in the fossil record, but there is still no evidence that some evolved from others.

Although many different kinds of evidence are cited to support evolutionary theory, all of these evidences are circumstantial with the exception of the historical evidence, the fossils. Many evolutionists recognize that the theory of evolution stands or falls ultimately on the quality of the fossil evidence. Yet, there is something of a paradox in the almost universal acceptance of evolution on the one hand and the universal absence in the fossil record of the transitional forms which the theory of evolution demands.

For generations, we have been exposed to diagrams of the so-called tree of life implying that all life is genetically related and began with one or a few simple cells. Seldom in evolutionary writings are we shown diagrams setting forth the true condition of the fossil record. Perhaps the most complete and most remarkable statement of the actual condition of the fossil record is the chart, reproduced in the paper, from the inside front cover of *Introduction to Historical Geology*, Second Edition, by Raymond C. Moore,¹ published in 1958. Moore, before his death in 1974, was professor of Geology at the University of Kansas. He was the editor of the definitive six-volume work, *Treatise on Invertebrate Paleontology*, and was one of the most distinguished of twentieth-century paleontologists.

Even a cursory examination of Moore's chart reveals the following facts regarding the fossil record: first, the separateness or distinctiveness of all eighty-six categories of plants and animals from the time of their first appearance in the fossil record to the present day (or to the time of their extinction); second, the complete and total absence of transitional forms between the various categories listed in the chart; and third, the alleged evolutionary relationships inserted in dotted lines which reveals that these relationships are a faith construct or a philosophical concept rather than a deduction from the fossil evidence.

Since Moore's chart represents the evidence for the condition of the fossil record in 1958, it is the purpose of this paper to set forth the most significant fossil discoveries in the twenty-two years since 1958, as

reported in the relevant literature, to determine whether this separateness of the categories of plant and animal life persists—thus strengthening the evidence for special creation—or if convergence through the discovery of transitional forms has been demonstrated—thus furnishing a degree of rigorous historical evidence for evolution. The material will be considered under four categories: Precambrian Microfossils, Land Plants, Invertebrates, and Vertebrates.

I. The Precambrian Microfossils

Although the study of the Precambrian microfossils is less than fifteen years old, it has already given rise to an extensive literature. Rather than deal with this literature here, I want merely to state some of the questions Creationists have regarding the interpretation of these microfossils and the reasons why we challenge this interpretation.

Several years ago, I attended a seminar on the Precambrian microfossils at the University of Michigan, Ann Arbor. The speaker was Dr. J. William Schopf (Professor of Geology, U.C.L.A.), who is recognized as perhaps the world's leading authority on the Precambrian biota. Questioned why people haven't looked much for fossils in the Precambrian (which evolutionists feel represents seven-eighths of earth history), Schopf replied that they had looked but had looked for the wrong things. They made the mistake of looking for large (megascopic) organisms. He continued:

Of course, the Precambrian really is the age of microscopic life. Many of us working in this field figure that you can look as long and as hard as you want in rocks perhaps older than 700 million years and you never will find any megascopic records of life. Many of us think that there were no such things as megascopic organisms prior to that time.²

Schopf thus rules out, by definition or by belief, any possibility of discovering anything but microscopic life in the bulk of the Precambrian. However, after commenting on some of the spurious Nineteenth Century claims of macroscopic fossils in the Precambrian, he remarks:

In a philosophical sense, folks find what they want to find. You go out looking for something . . . and some folks will make it be whatever their model says it should be. That type of thing, unfortunately, runs through science.²

In the question period following his lecture, I asked

*Marvin L. Lubenow, M.S., Th.M., is Pastor of the First Baptist Church, 901 East Lake Street, Fort Collins, Colorado 80524.

†This article was presented as a paper at the meeting of the American Scientific Affiliation, Stanford University, 10-13 August, 1979; and at the Fifteenth Anniversary Creation Convention, Anaheim, California, 12-15 August, 1979; and is included in *Repossess the Land*, the Proceedings of the latter conference. It is used here by permission.

Schopf two questions. I first asked him what criteria were used to determine whether a given object in the Precambrian was indeed a microfossil as opposed to something of inorganic origin. Calling it "an interesting problem," he said that one had to determine that a particular object was indigenous to the rocks involved, and then determine whether it was indeed a fossil. His criteria were, first, "Was it of organic composition?" and second, "Does it have biologic morphology?" His criteria worked quite well, he felt, for something relatively complex. However, "the spheroids become a mess." For these are smaller, and in the earlier assemblages, most of them are very poorly preserved. He thus cited two additional criteria: first, "Are such spheroids a part of an evolutionary continuum? Do they fit in?" He stated that some do but most do not. Second, an examination of population structure is useful. When compared to the organic matter in meteorites—which is non-biological—most of the spheroids compare with them rather than with biological systems.

My second question dealt with two articles published in the journal, *Evolution*, by Daniel Axelrod (1959) and S. Leclercq (1956). Both cited numerous fossil discoveries of vascular (land) plants in the Cambrian. Reference will be made to both of these articles later. I asked Schopf if he were familiar with those papers—knowing that he was an associate of Axelrod at U.C.L.A. He replied:

Oh yes, and I think that even Dan (Axelrod) would say these days that that is an error . . . If you find a tracheid in there (Precambrian shale on which one is doing macerations), you say "I have a Precambrian tracheid," particularly if that happens to fit your model that there ought to be vascular plants in the Precambrian . . . The nice thing now is that you have a tree, a tree of some sort (based on the evolutionary sequence of Precambrian microfossils that he and others have worked out). You know what is reasonable and what isn't reasonable. There is some base data. You have some idea of what we've found in these sections, demonstrably indigenous to the Precambrian. Now we can go look (at other rocks) and if somebody finds pine pollen, as has been reported in the Precambrian (much laughter by the audience) they are not going to interpret it, one hopes, unless they are anti-evolutionists, as evidence for pine in the Precambrian. So now we have some sort of base line. That base line is not fixed. We have many questions to solve. We don't know all the answers. There's an awful lot more to learn than we already know now, but I think we are making some progress.²

I have no doubt, based upon the evidence Schopf presented, that he has indeed found legitimate microfossils—including fossils of multicellular organisms—in the Precambrian. The reason I am convinced he has found multicellular fossils in the Precambrian is itself interesting—they are virtually identical with present-day organisms. His work in this case is with blue-green algae preserved in stromatolite sediments. Blue-green algae from stromatolite material said to be 900 million years old were easily identified by

their present-day morphological counterparts. Schopf spoke of "... their apparent lack of morphological evolution. To evolutionists this presents a rather interesting problem." Further this lack of change in both the unicellular and multicellular fossils was "... characteristic of these primitive microorganisms."

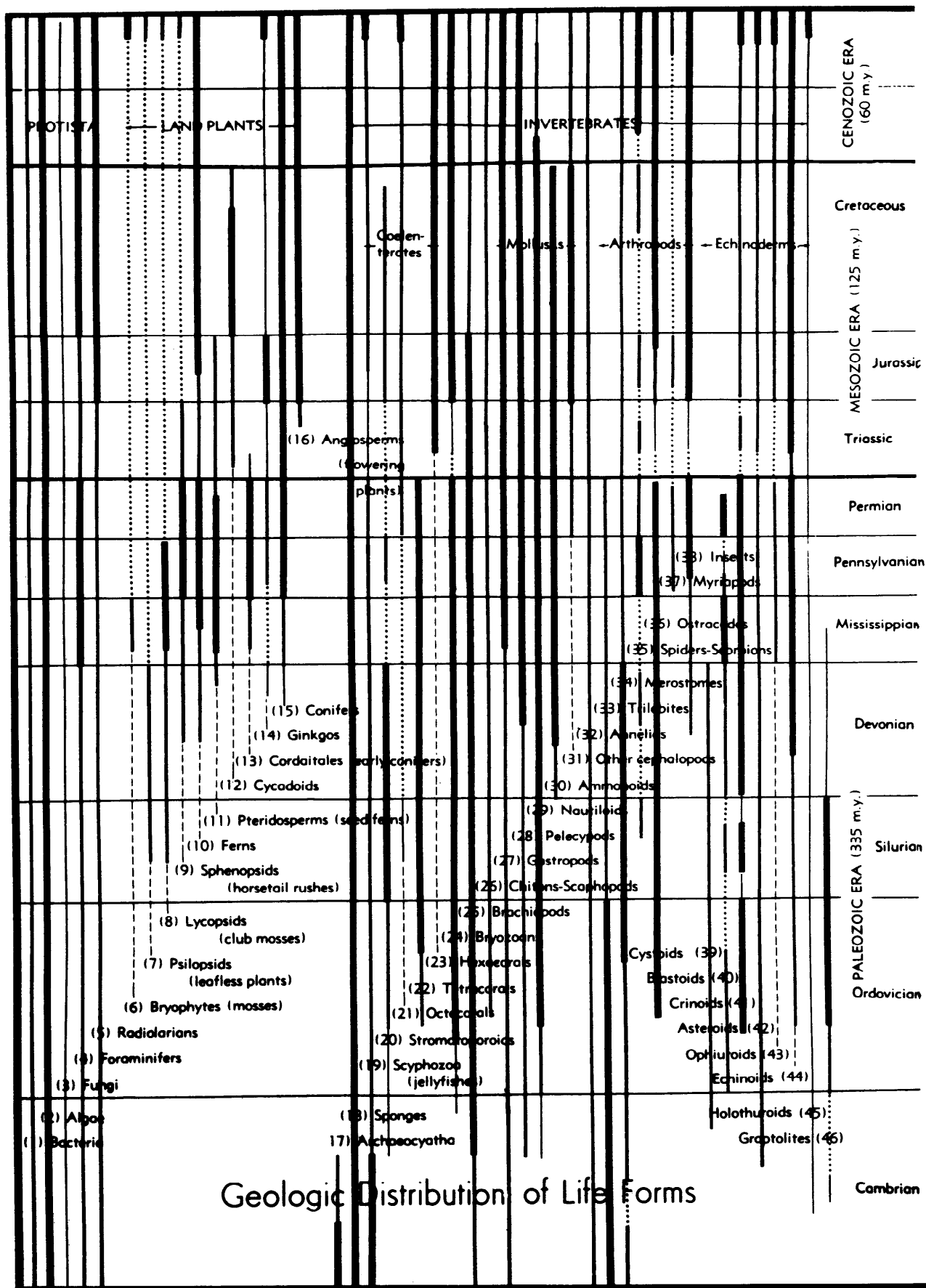
Creationists have no difficulty accepting the legitimacy of these Precambrian fossils. We do have immense difficulty in accepting the age which evolutionists assign to them. (The dating methods are beyond the scope of this paper but have been handled very well in other creationist writings.) "Change" and "evolution" are used almost synonymously. The evolutionist's

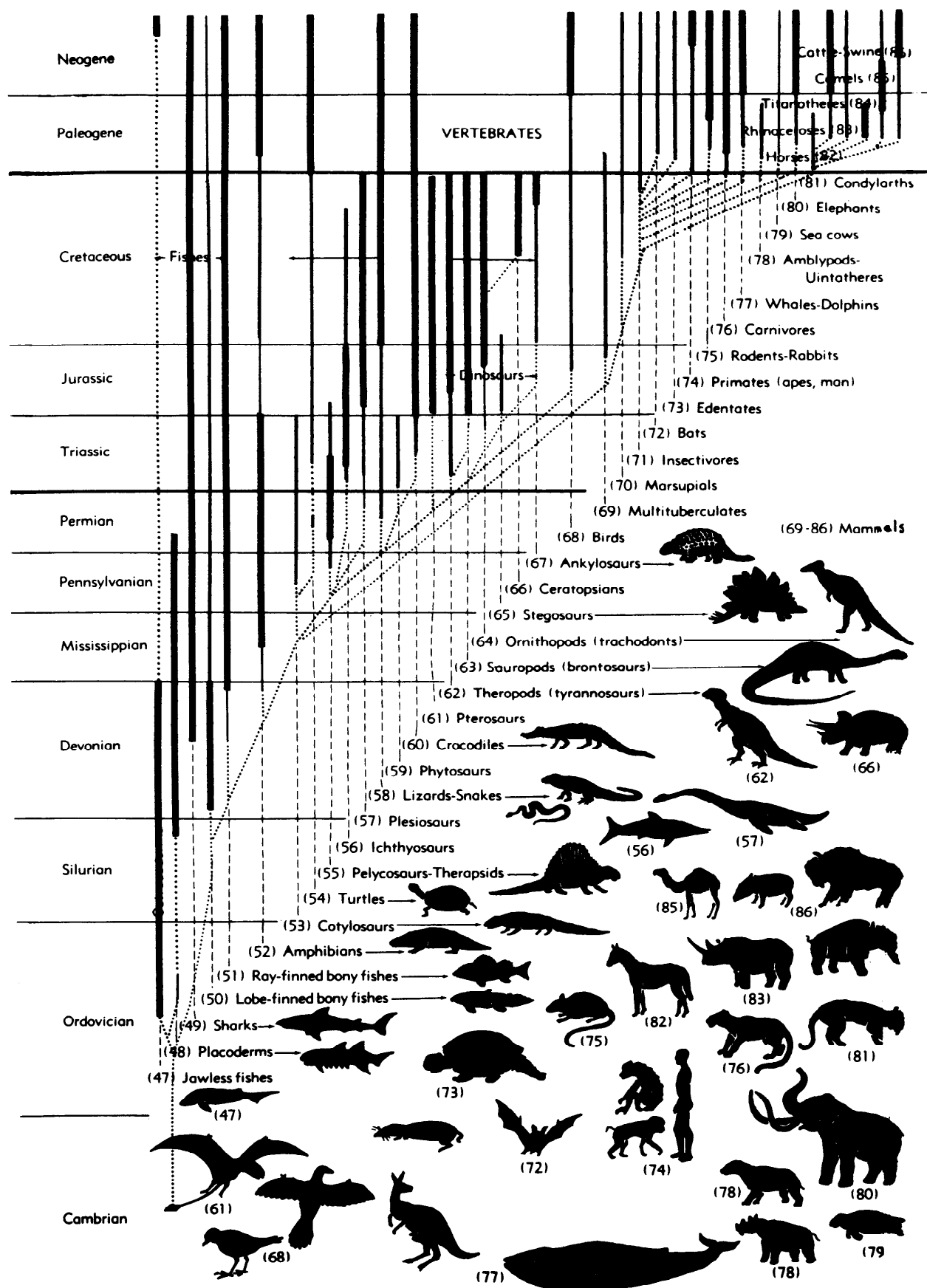
Table 1. This shows extensions which should be made to many of the lines in the chart, on the basis of discoveries of fossils since the chart was first prepared.

Line no.	Fossil	Extended to
6	Bryophytes	Lower Cambrian
7	Psilopsids	Lower Cambrian
8	Lycopods	Middle Cambrian
9	Sphenopsids	Lower Cambrian
10	Ferns	Lower Cambrian
11	Pteridosperms	Middle Cambrian
12	Conifers	Bottom of Cambrian
16	Angiosperms	Bottom of Cambrian
22	Tetracorals	Middle Cambrian
24	Bryozoans	Bottom of Ordovician
26	Chitons- Scophopods	Bottom of Cambrian
28	Pelecypods	Lower Cambrian
31	Other Cephalopods	Bottom of Cambrian
36	Ostracodes	Bottom of Cambrian
37	Myriopods	Middle Silurian
38	Insects	Lower Cambrian
41	Crinoids	Middle Cambrian
43	Ophiuroids	Lower Ordovician
44	Echinoids	Lower Cambrian
47	Jawless fishes	Middle Cambrian
49	Sharks	Upper Ordovician
58	Lizards, Snakes	Upper Pennsylvanian
69	Multi- tuberculates	Upper Triassic
74	Primates	Middle Cambrian
81	Condylarths	Upper Cretaceous

The Chart, on the next two pages (the two parts may be imagined pushed together to form one chart) shows the state of the fossil record in 1958, when the chart was published. Some later discoveries, listed in Table 1, serve to extend a number of the lines. It will be noticed that there is no recorded branching of lines or evolution of one kind into another; if anything of the sort is suggested it is hypothetical.

This chart is from *Introduction to Historical Geology*, by Raymond C. Moore. Copyright 1958, McGraw-Hill. Used with the permission of McGraw-Hill Book Company.





favorite, although sadly deficient and misleading, definition of evolution is "change through time." To state that these Precambrian microorganisms have persisted through 900 million years of evolutionary history with no change whatsoever stretches credulity. Many creationists believe that evolutionists are in error in their dating system by a factor of 10^5 .

I have referred as extensively as I have to Schopf's work with the Precambrian microfossils because that same lack of objectivity so clearly seen in his evaluation of the Precambrian fossils is also seen in the failure of evolutionists to accept the extensive evidence found in the literature for land plants in the Cambrian. It will be noted in Schopf's criteria that there is first of all the assumption that evolution is a fact. Hence, Precambrian fossils are accepted as valid only when they fit into an evolutionary continuum. Any evidence for creation is automatically discarded as contamination, no matter how valid that evidence might be. Only evidence that fits the evolutionary scenario is valid. It is not at all surprising, then, that Schopf and others are able to point to their research as supportive of evolution. One can only wonder at the amount of contrary evidence that has gone unreported. The theory of evolution thus determines which evidence will be accepted and which evidence will be discarded. This same prejudice obtains when we consider the evidence for vascular plants in the Cambrian.

II Discoveries of Fossils of Land Plants

It is the almost universal evolutionary position that vascular (land) plants evolved from marine plants called algae. These algae are thought to have evolved in the Precambrian. Later, in the Cambrian, some of the modern algae groups were established, and in the Ordovician the marine algae were the dominant plant types. One could document literally thousands of statements in evolutionary literature stating that land plants did not evolve until the late Silurian and early Devonian, and that this is where the first direct fossil evidence for land plants is found. The time span from the first appearance of multicellular blue-green algae in the Precambrian to the appearance of land plants in the late Silurian is, according to evolutionists, approximately 500 million years.

Few people, other than botanists, appreciate the radical differences between marine and land plants, and the tremendous changes that had to take place before plants could survive on land—assuming that they evolved. Only when we understand the radical transformations that had to take place can we understand why the theory of evolution demands a vast period of time for the emergence of the land plants and why evolutionists resist accepting any evidence for land plants before the Silurian.

Aquatic plants do not need to support themselves nor have a deep root system, for the water itself gives them support and buoyancy. Their immediate environment provides them both with water for photosynthesis and the various mineral salts required. Further, they do not need a vascular system to conduct the water and minerals from the roots to the leaves because the necessary water and minerals can be absorbed directly

from the environment. The water also provides the vehicle whereby the zoospores are dispersed and the sperm reaches the egg. Nor is there any danger of the plants drying out, for they are bathed in water.

For plants to survive on land, they had to "solve" all of these problems in the course of their evolution. One of the first and immediate necessities was the evolving of the cuticle, the wax-like layer which prevents a plant from drying out. Since a plant could dry out in just hours, this had to be a very rapid development. Yet, we are told that evolution is such a slow process that it is not subject to direct human observation. While a plant is in water, this cuticle would have been a disadvantage. Yet, a land plant needs it immediately. One looks in vain in evolutionary literature for an explanation as to how this transformation might have been accomplished.

Aquatic plants are quite fragile. The transformation to land involved an adequate root system for underground support as well as the evolution of the xylem, the tissue which gives above-ground support and rigidity to the plant.

This xylem also serves as the conducting or vascular system for the transport of water and mineral salts from the roots to the area of photosynthesis—the leaves. This vascular system is so basic to land plants that land plants are called vascular plants. This system is also diagnostic in determining whether a plant fossil is indeed a land plant. Chaloner writes:³

The one criterion by which a fossil may be indisputably recognized as a vascular plant is by the occurrence of xylem elements in the form of tracheids, with the characteristic thickening of the walls of this type of cell.

The land plants also had to develop a dispersal system for disseminating their reproductive cells. Since water was originally required for the sperm to swim to the egg, it is difficult to comprehend how a pollen system allowing transport by wind, insects, or animals could evolve rapidly enough to allow land plants to survive.

Further, the roots, once needed only to secure the plant to the bottom of its aqueous environment, not only had to be considerably extended for the support of the plant on land, but also had to take up a whole new function—that of mining or extracting mineral salts from the soil as well as transporting them to the above-ground portions of the plant.

When the radical nature of the changes is comprehended, it is easy to understand why evolution, with its belief that all of these changes came about naturalistically, demands vast periods of time. Yet, logic alone would seem to dictate that if land plants came from marine plants, each of these changes had to come about very rapidly and that most of them had to happen simultaneously for the land plants to survive.

Let us now consider some of the fossils.

A. *Division Bryophyta* (Line 6 on Moore's chart).

The bryophytes are the liverworts, the hornworts, and the mosses. After the Protista, they come first in the fossil chart by Moore because they are considered the most "primitive" green land plants and are thought to be something of a bridge or transition between the marine algae and the more "advanced" land plants.

Although they are extant today, Moore (1958) shows them as fossils only in the Mississippian. Scagel et al. 1969 (Ref. 4, pp. 250-51) show them in the Upper Devonian, Permian, and Triassic as well.

However, in 1959, Axelrod (Ref. 5, p. 264) cites the discovery by Naumova, in 1949, of Bryophyte spores in the Lower Cambrian Pre-Baltic clays of the U.S.S.R.

It should be pointed out that although this paper deals basically with fossil discoveries since 1958, we are going to include significant fossil discoveries made before that time and reported in the relevant literature but which have been ignored by Moore and others because they do not fit the accepted evolutionary scenario. One of the very few references in current botany textbooks to some of the discoveries we shall mention is found in Scagel et al. (Ref. 4, p. 25) who writes:

Spores attributed to terrestrial plants have been found in Precambrian and Cambrian rocks in the Baltic. Whether some of these are from bryophytes is uncertain.

In the original report by Naumova, she stated that the spores represented both Bryophyta and Pteridophyta (Ref. 5, p. 264). Scagel et al. do not seem to challenge the fact that spores of land plants have been found in the Precambrian and the Cambrian. They only question whether they include bryophytes. Yet, this discovery of early terrestrial plants does not influence them in their concept of evolution or in their concept of the origin of land plants. They continue to state in their text that land plants first evolved in the Early Devonian.

B. *Division Psilophyta* (Line 7).

The psilopsids are the leafless plants. Besides being extant, they are shown by Moore to be found as fossils in the Silurian and the Devonian. Recent textbooks convey basically the same information.

However, Axelrod (1959, Ref. 5, p. 273) shows spores of *Rhyniaceae* (Division Psilophyta) having been discovered in the Lower Cambrian. He writes (p. 274): "The Psilophyte Paleoflora was already in existence in Precambrian time."

C. *Division Lycophyta* (Line 8).

The lycopsids are the club mosses. Some are extant; also many of the coal beds of the world are made up of extinct members of this group. Moore shows them as fossils from the Silurian to the Pennsylvanian. Recent texts date them no earlier.

In 1972, Fleming and Rigby⁶ make reference to the discovery, in 1968, by J. Obrhel, of lycopod-like plant remains in the Ordovician of Bohemia. It should be understood that the discovery of fossil plant remains is even more significant than is the discovery of fossil pollen and spores as far as diagnosis and confirmation of land plants is concerned.

In 1956, Leclercq⁷ records the discovery, by the Soviet investigator, A. N. Kryschtofovitch, in 1953, of lycopodiaceous plant material in the Middle Cambrian of East Siberia. The find included four impressions of shoots, one of which is 8.5 cm. long with spirally arranged microphyllous leaves. The 1959 article by Axelrod⁵ refers to the article by Leclercq.

D. *Division Arthrophyta* (Line 9).

This division includes the sphenopsides and the Equisetales, the horsetail rushes. All in this division are

marsh plants, and Moore dates them from the Middle Devonian through the Triassic as well as the Recent. Newer texts place their beginnings, as far as the fossils are concerned, in the Early Devonian.

As early as 1953, however, K. Jacob, C. Jacob, and R. N. Shrivastava report their own findings of spores of Equisetales (horsetails) in the Cambrian Suket Shales, Vindhyan System, Central India.⁸ Besides their own work they cite the work of two other researchers to the same effect: the discovery of horsetail spores by Naumova from the Lower Cambrian Pre-Baltic clays in the U.S.S.R.; and the discovery of horsetail spores by Reissinger from Lower Cambrian sediments of Kunda in Esthonia. Review articles by Axelrod⁵ and Leclercq⁷ cite all of the above research. This represents three reports by five investigators of horsetails in the Cambrian.

E. *Division Pterophyta* (Line 10).

This division involves the ferns, and is the largest group of vascular plants that do not form seeds. Moore lists them as extending from the Middle Devonian to the present. Recent texts give the same time span. Yet, the reports of fern fossils from the Cambrian are many, and are quite impressive.

William Darrah of Harvard, in 1937, reports pteridophyte spores in the Upper Cambrian "Kolm", a Swedish oil shale formation.⁹

Ghosh and Bose¹⁰ report their 1947 findings of pteridophyte tracheids from the Dandot overfold and the Salt Pseudomorph Beds, Salt Range, Punjab, India. Both of these formations are of Cambrian or Precambrian age. In a later report (1952, Ref. 11), they confirm their original findings with further investigations in the Salt Range of Punjab, the Cambrian Vindhyan System, and the Cambrian of Kashmir. They state that some have suggested an Eocene dating for the Salt Range because of the vascular plant fossils they contain but that a field party of geologists in 1944 unanimously rejected that as being incompatible with the field evidence. Further, the Cambrian of Kashmir has several types of trilobites in it.

In 1953, Jacob, Jacob, and Shrivastava⁸ confirm the above reports by Ghosh and Bose regarding spores and tracheids of ferns in the Cambrian of the Salt Range and Spiti. They also report fern spores from the Cambrian Suket Shales, Vindhyan System, Central India.

The review articles by Axelrod⁵ and Leclercq⁷ refer to all of the above research. Axelrod then goes on to mention the discovery of fern spores in the Lower Cambrian Pre-Baltic clays of the U.S.S.R. by Naumova in 1949. This makes a total of ten different findings by seven investigators of ferns in the Cambrian.

F. *Division Pteridospermophyta* (Line 11).

The seed ferns are represented in this division and are now extinct. Moore, together with recent writers, places them from the Upper Devonian through the Cretaceous. Individual authors vary somewhat. None of the recent authorities refer to the report by Jacob, Jacob, and Shrivastava⁸ regarding their discovery of spores and tracheids of seed ferns in the Cambrian Salt Range of Punjab, the Cambrian of Kashmir, the Cambrian of Spiti and the Cambrian Suket Shales, Vindhyan System, Central India. The review articles of Axelrod⁵ and

Leclercq⁷ mention all of this research. This represents four locations by three researchers of seed-ferns in the Cambrian.

G. *Division Cycadophyta* (Line 12).

Of the eleven major categories of land plants on Moore's chart, eight have been found in the Cambrian or the late Precambrian. One of the remaining three categories, the cycads, seed plants, was found only down to the Triassic. In 1976, Sergius H. Mamay of the United States Geological Survey reported the extension of the cycads down into the Late Pennsylvanian.¹²

H. *Division Coniferophyta* (Line 15).

The well-known conifers represent this division, and Moore and recent texts list the conifers as extending from the Middle Devonian to the Present. Some authorities split this division and make the earlier conifers (Devonian and Carboniferous) a separate division, the Progymnospermophyta, or primitive gymnosperms. The neglected evidence that conifers actually go back to the Cambrian is quite compelling.

In 1947, Ghosh and Bose¹⁰ reported bordered pitted tracheids of conifers from the Cambrian Dandot overfold and the Salt Pseudomorph Beds, Salt Range, Punjab, India. In the Dandot overfold, they also discovered wood parenchyma (tissue of cortex or pith) from conifers. A second report by Ghosh and Bose (1952, Ref. 11) confirms their original findings and tells of further investigation in the Salt Range of Punjab, the Cambrian Vindhyan System, and the Cambrian of Kashmir with similar results regarding conifer fossils in the Cambrian. The review articles by Axelrod⁵ and Leclercq⁷ include all of the above findings.

The discovery, in 1964 and 1965, by Clifford L. Burdick, of gymnosperm pollen in the Hakati Shale, Upper Precambrian of the Grand Canyon,¹³ is well known to many creationists. His work has been highly criticized by evolutionists—as one would expect—but this work has been justified by subsequent creationist investigators¹⁴ as well as by findings of evolutionists themselves (Ref. 5, 7, 10, 11).

In the light of the research presented thus far, it is very difficult to reconcile recent articles in *Nature* describing an Upper Carboniferous conifer fossil as "the earliest conifer"¹⁵ and Silurian tracheids as the "oldest recorded *in situ* Tracheids".¹⁶ There are at least six different locations reported by three different workers where conifers have been reported in the Cambrian and Late Precambrian.

J. *Division Anthophyta* (Line 16).

The anthophyta are the flowering plants (angiosperms). They are the largest single division of the plant kingdom and are the best known to man. Because they are the most complex, evolutionists believe that they were the last category to evolve. Moore places their beginnings in the Upper Middle Triassic. Some recent authorities place the beginnings of the flowering plants in the Jurassic or even later in the Cretaceous. Darwin called the origin of the flowering plants "an abominable mystery," and modern evolutionists admit that that is still the case.

Just as fossils of most of the other land plants have been discovered in Cambrian deposits, so it is with the flowering plants. In 1947, Ghosh and Bose¹⁰ reported

discovering angiosperm vessels with alternate pitting and libriform fibres of higher dicotyledons from the Salt Pseudomorph Beds and the Dandot overfold, Salt Range, Punjab, India. These are Cambrian deposits. They later report (1952, Ref. 11) that further investigation confirmed their original report, and the same results were obtained from the Cambrian Vindhyan System, and the Cambrian of Kashmir—these Kashmir beds also containing several types of trilobites. The review articles of Axelrod⁵ and Leclercq⁷ acknowledge these findings.

Clifford Burdick^{13,14} reports finding angiosperm pollen grains in the Upper Precambrian Hakati Shale of the Grand Canyon in 1964 and 1965 while working with the University of Arizona. Because these results were totally incompatible with the evolutionary theory, his findings were challenged and the claim was made that what he thought were Precambrian angiosperm pollen grains were actually contamination by modern plants. Burdick's refutation of this charge seems to be beyond reproach. He states that not only were elaborate precautions taken against contamination, but that the pollen and spores were dyed a deep red because of being imbedded in the iron-rich red Hakati Shale. Further, an examination of slides of extant pollen and spore grains at the University of Arizona (one of the largest and most complete slide libraries of that type in the world) revealed none quite like these. These were extinct species or genera. Hence, contamination from present-day plants could not possibly be the explanation for these pollen grains. Thus, at least three workers have reported six separate discoveries of angiosperms in the Cambrian and Late Precambrian. In total, this paper has documented thirty-two individual localities where discoveries of land plant fossils have been made in the Cambrian or below. Writing in 1959, Axelrod (Ref. 5, p. 264) stated that at that time approximately 60 Cambrian spore-genera had been reported. This evidence should not be ignored.

K. *Land Plant Fossils of Unknown Taxa.*

A number of fossils have been discovered which are not capable of being diagnosed in terms of their proper division, but give every indication of being legitimate fossils of land plants found in strata older than the commonly accepted time for the evolution of vascular plants.

Jane Gray and A. J. Boucot¹⁷ reported in 1974 the discovery of probable land plant trilete spores and spore tetrads from Silurian deposits on the island of Gotland in the Baltic Sea. They also reported, in 1971, the discovery of several taxa of abundant cutinized trilete spores from the earliest Silurian shale at Niagara Falls, New York. These, they say, predate by almost the entire Silurian Period vascular land plant megafossils.¹⁸ In a 1977 article, Gray and Boucot tell of two areas in North America where spores and spore tetrads of land plants have been found in the uppermost Ordovician (Ref. 19, p. 170). They also lament the problems which attend land plant evolution and strongly defend as legitimate the evidence of palynology. In the absence of megafossils, they feel that if any new light will be shed on the origin of land plants, the evidence will come from microfossils.

Pratt, Phillips, and Dennison²⁰ claimed discovery, in 1978, of the earliest land plants. The remains were from earliest Silurian age deposits in Virginia and include cuticularized scraps, banded and unbanded tubes, and trilete, cutinized spores. They also found erect plant structures.

Fleming and Rigby, in 1972, reported the finding of two fossil fragments that are probably stems of land plants in the Middle Cambrian of Queensland, Australia.⁶

Melvin A. Cook²¹ states that while he was serving as a consultant at the Schefferville mine of the Iron Ore Company of Canada he was shown and given samples of several fossil wood specimens that had been recovered from the iron ore deposits several hundred feet below the surface. It was a Precambrian deposit, and there were no overturns or fissures that would have allowed the material to be introduced at a later time. Two independent radiocarbon dates gave consistent ages of about 4,000 years. Attempts by some evolutionists to make this material "Late Cretaceous rubble" do not satisfy the field evidence.

No one has summed up the full significance of the evidence of the very early appearance of the vascular plants better than has Leclercq—himself an evolutionist (Ref. 7, p. 111 and 113).

The conclusion to be drawn from these facts was that varied types of vascular plants existed in Early Palaeozoic . . . In a wider sense palynology and plant impressions of Cambrian raise the major question of the polyphyletism of the vascular plants.

A Special Creationist couldn't have said it better.

III. Discoveries of Fossils of Invertebrates

A. *Phylum Bryozoa* (Line 24).

Fossils from the Black Rock limestone of northeastern Arkansas discovered as early as 1911 were thought to be bryozoans, but they were so poorly preserved that no definite determination could be made. Very recent discovery of fossils in very good state of preservation from the same formation now allows a positive identification to be made. The fossils are dianulitid bryozoans from the very early Ordovician. It is believed to be the oldest occurrence of an unquestioned bryozoan.²² The fossil record of bryozoans is thus extended from the Middle Ordovician to the Lower Ordovician, very close to the Cambrian/Ordovician boundary. There is no question but that their ancestors had to extend down into the Cambrian.

B. *Phylum Mollusca*.

1. *Class Calyptoptomatida* (Might be assigned line 26½).

In 1962, J. Wyatt Durham and Roland A. Gangloff (University of California, Berkeley), collected mollusk-like fossils from the White-Inyo Mountain area, Inyo County, California.²³ They consist of small orthoconic shells with relatively large bilaterally symmetrical protoconch-like initial termini. Some similarities exist between these fossils and members of the Cephalopods, but not enough to include them in that class. Since these fossils were found at least 900 meters below the strata containing the earliest known olenellid trilobites, it is

considered Precambrian although the Precambrian/Cambrian boundary is indistinct in that area. The classification is also somewhat tentative. They were not on the original chart.

2. *Class Bivalvia* (Line 28).

This category includes the oysters, mussels, and clams. Fossils of disputed taxon from many early Cambrian localities have been identified, in 1973, as a result of specimens from the Lower Cambrian rocks of New York State.²⁴ Fordilla troyensis *Barrande* has been identified as the oldest known pelecypod mollusk. This finding extends the range of the Class Bivalvia backwards in time from the early Ordovician to the very early Cambrian—a step of about 100 million years according to evolutionists. It also places the animal very close to the base of the known fossil record of animals with hard parts.

3. *Class Cephalopoda* (Line 31).

One of the most remarkable fossil discoveries²⁵ in recent years was made by Jean B. Firby and J. Wyatt Durham in 1974. Their discovery was that of a large squid-like mollusk with tiny cone-shaped denticles (teeth) in the very early Cambrian rocks of the White Mountains near Bishop, California. The denticles appear most like those of living members of the predatory Class Cephalopoda, especially the cuttlefish (*Sepia*). These fossils were found in the lowest trilobite-bearing formation, and it is speculated that trilobites may have been the major prey of this predator.

This discovery, found at the very Cambrian/Precambrian boundary, is of major significance for a number of reasons. First, it extends the range of the Cephalopoda from the late to the very early Cambrian. Second, the cuttlefish, which are very complex invertebrate predators, had not been reported previously from strata earlier than the Jurassic, 400 million years younger according to evolutionary geologists. Third, these fossils represent predators 100 million years older than any that had been found previously.

This predatory feature has special significance because evolutionists believe that rapid and far-reaching evolutionary changes took place in the Late Precambrian and the Early Cambrian. Since all of the major animal phyla are found in the Cambrian, it means that the bulk of evolutionary diversity had to take place before that time. The reason so much evolution could take place at that time, evolutionists explain, is due to the *absence of predators*. During times of rapid evolutionary change it is assumed that animals would be more susceptible to predation because they would be in a transitional phase from one type of organism to another or from one ecological niche to another. The finding of very capable predators at the base of the Cambrian is thus a major blow to evolutionary theory.

C. *Phylum Priapulida* (Might be assigned line 31½).

The priapulids, worm-like invertebrates, had not been considered of major importance. There are only a few living members of this group and they had never been found in the fossil record. They are not on Moore's chart.

In 1978, Simon C. Morris, working in the Middle Cambrian Burgess Shale of British Columbia, found fossil priapulids. Gut contents show that these worms

were carnivorous-eating mainly hyoliths and brachiopods. In the words of Richard Cowen: "... here are some of the long-lost predators of the Cambrian sea-floor".²⁶

In a more recent article, "The Animals of the Burgess Shale," Simon C. Morris and H.B. Whittington describe four more predators of the Middle Cambrian.²⁷

They are: (1) *Opabinia*, a worm-like creature, representing a new phyla, which swam close to the sea-floor; (2) *Olenoides*, a trilobite able to feed on small worms; (3) *Sidneyia*, an arthropod, with limbs similar to the horseshoe crab, which was able to crush the shells of hard-bodied prey such as brachiopods; and (4) *Nectocaris*, another representative of a new phyla, a fast swimming predator with enormous eyes, prominent dorsal and ventral fins, and numerous fin rays. Thus, at least six predators have recently been discovered in the Lower and Middle Cambrian, in which there were formerly thought to be none.

D. Phylum Arthropoda.

1. Class Crustacea (Line 36).

The ostracodes are small, bivalved members of the crustaceans. Although they are living today, they are also quite important in Paleozoic rocks because they abound in many strata and differ from layer to layer. Hence, they are often used for correlation of rock strata. Moore, in 1958, has them terminating in the Middle Ordovician. However, a newer chart by Norman Newell, 1967, shows them extending to the base of the Cambrian.²⁸

2. Class Myriapoda (Line 37).

This class involves the familiar centipedes and millipedes—the millipedes having the older fossil record. Moore's chart shows them extending down to the Lower Pennsylvanian. Beerbower states that they are now found in the Silurian (Ref. 30, p. 328).

3. Class Insecta (Line 38.).

In 1970, a Melbourne University student discovered the oldest fossil flea.³¹

It is thought to be 120 million years old, putting it in the Lower Cretaceous. Since insects are known all the way back to the Middle Devonian, a 120 million year old flea should not even raise an eyebrow. However, it does pose a very interesting question. Since fleas are hosted by fur-bearing animals, and since the fur-bearing animals are the mammals, and since the mammals having fur are said to have evolved only about 30 million years ago, one could ask the question: Does that flea know something we don't know?"

E. Phylum Echinodermata.

1. Class Eocrinoidea (Might be assigned line 38½).

Moore does not have these early echinoderms on his chart. Beerbower (Ref. 30, p. 387) describes them as becoming extinct in the Ordovician. J. Wyatt Durham reports the discovery of the oldest eocrinoid in the Early Cambrian Marble Mountains of California.³² James Sprinkle also records eocrinoids from the Early Cambrian.³³

2. Class Crinoidea (Line 41).

The crinoids are the sea lilies. In 1958 they were known as far down as the lower Middle Ordovician. However, the Stephen Formation of the Burgess Shale in the Rocky Mountains of British Columbia has pro-

duced a Middle Cambrian crinoid. Morris and Whittington write: "... the sea lily *Echmatocrinus*, is the earliest crinoid in the fossil record..." (Ref. 27, p. 129). Sprinkle also confirms this discovery.³³

3. Class Ophiocystioidea (Line 43).

These slender-armed star-shaped echinoderms were known in 1958 only from the Lower Mississippian and above. Beerbower states that they have been extended all the way down to the Early Ordovician (Ref. 30, p. 410).

4. Class Echinozoa (Line 44).

The echinoids are the sea urchins and the sand dollars. While in 1958 Moore shows them extended only to the Middle Ordovician, in 1978 Bruce Bell and James Sprinkle describe an edrioasteroid (echinoid) from the Middle Cambrian.³⁴ Further, both J. Wyatt Durham³² and James Sprinkle³³ state that two types of echinoids (helicoplacoids and edrioasteroids) have been found in the Lower Cambrian near the California-Nevada border and in the Rocky Mountains of British Columbia.

F. Phylum Coelenterata.

Tetracorals (Line 22).

The tetracorals are corals with four-fold symmetry. Whereas in 1958 they were found only as far down as the Middle Ordovician, a review article by John Pojeta, Jr.³⁵ tells of a discovery in New South Wales, Australia, of Orders Rugosa and Tabulata from the Cambrian, making these the oldest known corals.

IV. Discoveries of Fossils of Vertebrates

A. Sybphylum Cephalochordata (Might be assigned line 46½).

A tiny animal, two inches long, with a general shape like that of a slender minnow, is known as lancet or *amphioxus*. It is not actually a vertebrate. It has, instead of a vertebral column, a hollow dorsal nerve cord running the length of its body. Below that and extending to the tip of the head is a Notochord. This latter structure consists of a tough cover and a gelatinous-like interior. It functions as a stiff but flexible beam on which the body muscles can pull. Lancet's general morphology, though relatively simple, is much like the vertebrates.

Amphioxus, although hardly a household word to most people, is of tremendous importance in the evolutionary scenario. In the words of zoologist Alfred M. Elliott (University of Michigan): "... it possesses body structures that force us to believe that some such form might have given rise to the vertebrates".³⁶

Although capable of swimming, this animal often buries itself in bottom sediments. It is found, among other places, off the coast of California and off the coast of China—where it reaches such numbers that it is utilized as a source of food.

Amphioxus has had a very poor fossil record, and was not in the original chart. Until now it was known only from the Recent Stage. (The Recent Stage is a rather vaguely defined geologic period that generally refers to the interval between the end of the Wisconsinan glaciation and the present. This is considered to be a time period of approximately 10,000 years.)

Now a form very much like *Amphioxus*, known as *Pikaia*, has been found in the Middle Cambrian Burgess

Shale of British Columbia. At first this form was considered to be a polychaete worm. However, about thirty well-preserved specimens show a prominent rod along the animal's back that resembles a notochord. Morris and Whittington write (Ref. 27, p. 131):

In addition to this key anatomical feature the blocks of muscle in *Pikaia* form a zigzag pattern that is comparable to the musculature of the primitive living chordate *Amphioxus* and of fishes. Although *Pikaia* differs from *Amphioxus* in several important respects, the conclusion that it is not a worm but a chordate appears inescapable. The superb preservation of this Middle Cambrian organism makes it a landmark in the history of the phylum to which all vertebrates, including man, belong. There are possible instances of even earlier chordates from Lower Cambrian formations in California and Vermont but none is as rich in detail.

B. Subphylum Vertebrata.

1. Class Agnatha—Jawless Fishes (Line 47).

Until recently, the oldest fish fossils known were from the Middle Ordovician Harding Sandstone of Colorado. These were of "primitive" heterostracan fishes (Class Agnatha) which are jawless. The Vertebrates were the only major animal group not found as fossils in Cambrian rocks.

In 1976, Bockelie and Fortey³⁷ reported the discovery of heterostracan fish fossils, consisting of minute scales and spine fragments, from the very early Ordovician Valhallfonna Formation on the island of Spitsbergen. They have proposed for their find the new genus *Anatolepis*. These specimens predated the Colorado fish fossils by about 20 million years. Concluding their article, they state the belief that pre-Ordovician vertebrates may exist and express hope that their discovery might stimulate such a search.

In 1977, Ritchie and Gilbert-Tomlinson reported the occurrence of two new genus of heterostracan fishes from the earliest Middle Ordovician of Australia (Ref. 38, p. 529). These specimens would be slightly younger than those reported by Bockelie and Fortey from Spitsbergen. However, they are significant in that they are well-preserved molds of articulated individuals.

The anticipation of Bockelie and Fortey was rewarded in 1978 when John E. Repetski, paleontologist with the U.S. Geological Survey branch at the National Museum, Washington, D.C., reported fish fossils from the Upper Cambrian Deadwood Formation in northeastern Wyoming.³⁸ These fossils have been assigned to the genus *Anatolepis* because of their great similarity to the Spitsbergen fossils. They extend the fish fossil record 40 million years beyond the Spitsbergen and 60 million years beyond the Colorado fossils according to standard geologic dating.

For Creationists, this discovery of fishes (vertebrates) in the Cambrian is without question the most significant fossil discovery in the period 1958-1979. The evidence is now complete that all of the major categories of animal and plant life are found in the Cambrian. While Creationists should remember that evolutionists claim the Cambrian extends over a period of 100 million years and that would allow for a signifi-

cant amount of evolution, there is no question but that this discovery lends credibility to the Creationist position and presents problems for evolutionists.

Anatolepis was a tiny heterostracan fish of from one to three inches in length. The original discovery³⁸ consisted of four bony plate fragments and about two dozen individual tubercles. Since then, Repetski reports finding hundreds of plate fragments in rocks at the same Wyoming locality.³⁹ X-ray analysis of the scales shows that they are of bony composition. *Anatolepis* apparently had a protective armor or shield to which the scales were attached.

Repetski reports that he has also recovered *Anatolepis* fossils from Upper Cambrian rocks in Idaho, eastern Alaska, from the Upper Cambrian basil Fort Sill Limestone in southwestern Oklahoma, and from the Middle Cambrian Metaline Formation in northeastern Washington. He has also found additional Lower Ordovician occurrences in the El Paso Group of westernmost Texas, the Baldwin Corner Formation of eastern New York, the Wahwah Limestone of western Utah, and in the Black Rock Limestone of northern Arkansas. Reports tell of additional occurrences in the Lower Ordovician of eastern Greenland.

From the geographical occurrences of *Anatolepis*, it is obvious that it had an extensive range. It is also obvious that we are not dealing with an insignificant Cambrian phenomenon. Furthermore, all of the occurrences are in what Repetski states are of "undoubted marine origin". It deals a serious blow to the long-standing evolutionary teaching that the earliest vertebrates originated in fresh-water habitats.

2. Class Chondrichthyes—Sharks (Line 49).

Raymond Moore, in his 1958 chart, shows the fossil record of sharks extending down to the Upper Middle Devonian. In 1979, D.A.T. Harper reports spines of the spiny shark in the Upper Ordovician Lady Burn Starfish Beds at Girvan, southwest Scotland.⁴⁰ This represents an extension of approximately 80 million years in the fossil history of sharks.

Two fish spines were found, the better preserved one being 13 cm. long. Harper refers to the unusually early appearance of this type of vertebrate material in the fossil record and states: "Most probably the spines are those of an acanthodian (spiny shark)" (Ref. 40, p. 634).

3. Class Reptilia.

a. Order Squamata—Lizards and Snakes (Line 58).

In 1958, Moore shows the lizards and snakes extending to the Upper Middle Permian. In a 1977 article in *Science*,⁴¹ Robert Reisz tells about fossils known as *Petrolacosaurus kansensis* ("rock lizard") extending down into the Upper Pennsylvanian. This form was a slender, delicately limbed lizard about the size of an average iguana. Many of these fossils have been found in the Rock Lake deposits near Garnett, Kansas.

What is especially interesting about this article is that what gives every evidence of being just an ancestral lizard is made into a major transitional form by this evolutionary writer. He claims that this fossil lizard, which he calls the oldest known diapsid reptile, is an evolutionary link relating the ancestral stem reptiles and the dawn of diapsids. Diapsids include the over-

whelming majority of living reptiles (three of the four orders) and such extinct groups as eosuchians, thecodonts, dinosaurs, the flying pterosaurs, and one that eventually gave rise to birds (Ref. 41, p. 1091). yet, a careful study of the article gives compelling reasons for saying that it represents an extension in the fossil history of lizards. Nothing more. Beerbower (Ref. 30, p. 464) writes:

The lizards and snakes (order Squamata, suborder lacertilia and Ophidia) have been the true heirs of the primitive diapsids. Most retain the pineal eye and the primitive palate and resemble the late Permian form in size and adaptations.

b. *Order Pterosauria—Flying Reptiles* (Line 61).

The largest known flying creature ever to inhabit the earth describes a series of fossil discoveries made by Douglas Lawson beginning in 1971. In a remote section of Big Bend National Park in southwest Texas, Lawson has unearthed the fossil remains of three pterosaurs—one of them having an estimated wingspan of 51 feet, twice as large as any flying reptile previously discovered. By way of contrast, the bird with the largest wingspan, the wandering albatross, measures 11 feet, and the McDonnell Douglas F-15A jet fighter has a wingspan of 43 feet.

Pterosaurs had bat-like leathery wings, long, powerful necks, and pelican-like jaws. Although they were originally thought to be fish eaters, the remains were found in Late Cretaceous nonmarine sediments far from the ancient coast. The fossil discovery includes vertebra, humerus, and wing bone material of the larger specimen. An almost complete skeleton of a smaller specimen was found, as well as remains of a third one of intermediate size.⁴²

c. *Order Saurischia—Lizard-Hipped Dinosaurs* (Line 63).

James A. Jensen, Director of the Earth Science Museum, Brigham Young University, is one of the most remarkable paleontologists of our day. Not only was he responsible for discovering some of the crucial fossils that provided evidence to the geological world that the continents were once linked together, but in the Summer of 1972 he discovered the world's largest dinosaur.

This dinosaur is significant not because of its dating but because of its size. Two shoulder blades, a pelvis, and five vertebrae were discovered by Jensen in western Colorado's Uncompahgre National Forest, near the town of Delta. Although it has a superficial resemblance to the huge herbivorous Brachiosaurus, Jensen feels that it is different enough to be an entirely new species. Estimates are that the dinosaur was 50 feet tall, 100 feet in length, and weighed 80 tons. That would make it approximately three times as large as the largest dinosaur now known, and place it in the range of size of the blue whale—called the largest creature on earth. A land creature the size of the blue whale staggers the imagination, and causes one to stand in awe at the engineering ability of the Creator.

Reports of Jensen's discovery first appeared in *Time*, August 21, 1972, and later in its 1973 *Nature/Science Annual*.⁴³ The absence of any report in the scientific journals caused me to contact Jensen personally about these fossils. He reports that he has found two entirely

different faunas—neither one of which has been known before. Very seldom has this ever happened in paleontology. The first new fauna is at the site of the dinosaur discovery. It is Dry Mesa Quarry in the Morrison Formation, western Colorado, and is a very Late Jurassic to Early Cretaceous sequence. The second new fauna is in an area of eastern Utah and is higher in the Morrison Formation. The area is so productive, the work so slow and so costly, that he does not know when he will have the material complete enough to report it. He has been working it steadily each Summer since 1972. *Science News*, August 4, 1979, reports an even larger dinosaur find by Jensen at the same place.

4. *Class Aves—Birds* (Line 68).

Although *Archaeopteryx* continues to be the oldest fossil bird discovery, dating from the Upper Jurassic of Bavaria and elsewhere, it must now share antiquity with another more modern type bird fossil discovery. Since most evolutionists felt that *Archaeopteryx* was a transitional form in the evolution of birds from reptiles, the discovery of a more modern type of bird that was contemporary with *Archaeopteryx* seems both to indicate a greater antiquity for birds and to effectively remove *Archaeopteryx* from the role of a transitional form. The result is a strengthening of the creationist position and a further eroding of the alleged evidence for evolution.

The new bird discovery, also made by James A. Jensen of Brigham Young University, has thus far been reported only in *Science News*, September 24, 1977.⁴⁴ The original report was of a bird femur and two articulated shoulder bones. This discovery was made in Dry Mesa Quarry, in western Colorado, where Jensen had also discovered the world's largest dinosaur. The finding of birds and dinosaurs together also makes more questionable the evolutionary concept that birds evolved from dinosaurs.

Jensen states that his fossil bird is 60 million years older than any previously found oldest bird. However, he takes the position, as do many other evolutionists⁴⁵ that *Archaeopteryx* is just a feathered dinosaur and should not be classed as a bird at all.

Because nothing had appeared in the scientific literature about this discovery, I personally contacted both Jensen and John H. Ostrom (Professor of Geology and Curator of Vertebrate Paleontology, Peabody Museum, Yale University), also quoted in the original *Science News* article as having verified the discovery. Jensen now feels that the original articulated shoulder bones are actually the scapula and coracoid of a flying reptile (order Pterosauria). However, he recently has found a second bird femur and two articulated tibia—metatarsals (lower leg and foot bones). He states that they are quite different from the comparable bones of reptiles and quite different also from *Archaeopteryx* in that they are more modern. He also stated that he had found the remains of *Hesperornis*, which Alfred Romer describes as both primitive and specialized: "... much like the modern loon in habits..." (Ref. 46, p. 167).

Jensen feels that he needs much more material before he can report these discoveries with any specifics. He gave no date as to when this would be, but said he would probably publish it in the *B.Y.U. Geology*

Studies or in the *Journal of Paleontology*.

5. Class Mammalia—Mammals.

a. Mesozoic Mammals (Line 69).

In 1958, the Mesozoic mammals, the Multituberculates and related orders, were extended down into the very late Jurassic. Freeman⁴⁷ states that by 1976 they had extended down into the very late Triassic. Their first occurrence was about 190 million years ago, according to evolutionary geology.

b. Order Chiroptera—Bats (Line 72).

In 1966, in the journal, *Science*, Glenn L. Jepsen (Princeton University) gave a study he had just completed on a fossil bat found 33 years before.⁴⁸ He remarks that it is one of the most remarkable vertebrate fossils ever discovered both in its state of completeness and the preservation of the soft tissue structures. Other than having a clawed index finger, this microbat is virtually identical with bats of today and is included in the same sub-order, Microchiroptera, as are living bats. It is of special interest that the bat had the same highly developed echolocator equipment as do modern bats. The bat was found in the Green River Formation, early Eocene deposits, at famous Fossil Butte in southwestern Wyoming.

Perhaps the most important thing is not what Jepsen's article said but what it didn't say. Jepsen gave a report on this bat at the annual meeting of the American Association for the Advancement of Science before the article was published in their journal. Dr. Wilbert C. Rusch, Sr., Prof. of Science, Concordia College, Ann Arbor, Michigan, was in attendance at that lecture. He reports that Jepsen set forth a problem for evolution that he did not mention in the article. The problem is that if one has a fully developed, modern, specialized bat in the early Eocene, 60 million years old, at a time when the Class Mammalia was in the relatively early stages of its evolutionary development, then the evolutionary antecedents of that bat would have had to extend down into the Paleozoic Era, which from the standpoint of evolution is out of the question. Jepsen was not quite bold enough to put that dilemma into print, but it is a problem which evolutionists must squarely face.

c. Order Primates, Genus Homo (Line 74).

Although the human fossils are beyond the scope of this paper, a listing of the most significant fossil discoveries since 1958 should at least make mention of two extraordinary ones about which many Creationists are already aware. The first is the discovery of human footprints *in situ* with dinosaur footprints in the Cretaceous strata of the Paluxy River, Glen Rose, Texas. The most recent report of these tracks is by Wilbur Fields.⁴⁹

A burned branch, about 2.25 m. long, was found buried in a limestone layer which contained many dinosaur tracks (Ref. 49, p. 23). A sample of the charcoal from this branch was submitted to the radiometric dating laboratory at the University of California, Los Angeles, by Mr. Fredrick Beierle. The reply, by Dr. Berger of the U.C.L.A. laboratory, was that the sample, labeled UCLA-2088 and dated Nov. 6, 1978, was 12,800 plus or minus 200 years old.⁵⁰

The second remarkable discovery deals with the mat-

ter of human footprints *in situ* with trilobites, discovered by William Meister, Sr., in 1968 in the Cambrian "trilobite beds" of Antelope Springs, in western Utah.⁵¹ These discoveries have tremendous implications for evolutionists and Creationists and deserve full, impartial study.

d. Order Carnivora (Line 76).

Although dogs have not been discovered at the base of the Cretaceous, fossil fleas have been.⁵¹ Is it possible to have fleas without host animals? This is speculation, perhaps, but we wait with interest the fossil record in this area.

e. Order Condylarthra (Line 81).

The condylarths, now extinct, were herbivorous sheep-size animals that were known, according to Moore, only from the lower half of the Cenozoic. However, Sloan and Van Valen, in their research in 1963 and 1964 at the Fort Peck Reservoir area of northeast Montana reveal that the Condylarths extended down into the Upper Cretaceous.⁵²

Conclusion

A review of the developments in the fossil record since Raymond Moore prepared his chart in 1958 reveals that the 86 categories are as distinct now as ever; that there is a general trend toward polyphyletic origins in the Cambrian; and that the transitional forms demanded by the theory of evolution are as absent as they were in 1958. The result of 21 years of paleontological discovery is further confirmation of the concept of Special Creation and a lessening of the credibility for the concept of organic evolution. The fossil record continues to provide a rigorous, objective, historical, and scientific foundation for the concept of Special Creation.

References

- ¹Moore, Raymond C., 1958. Introduction to historical geology. McGraw-Hill.
- ²Lecture by J. William Schopf, University of Michigan, November 20, 1975. Quotations taken from personal tapes of the proceedings, made with the consent of Prof. Schopf.
- ³Chaloner, W.G. 1970. The rise of the first land plants. Cambridge Philosophical Society: Biological Review. (3):353-377. See especially p. 355.
- ⁴Scagel, Robert F., Bandoni, Robert J., Rouse, Glenn E., Schofield, W.B., Stein, Janet R., and Taylor, T.M.C. 1969. Plant diversity: an evolutionary approach. Belmont, Calif. Wadsworth Publishing Co., Inc.
- ⁵Axelrod, Daniel I. 1959. Evolution of the Psilophyte paleoflora. *Evolution*. 13(2):264-275.
- ⁶Fleming, P.J.B. and J.F. Rigby, 1972. Possible land plants from the Middle Cambrian, Queensland. *Nature* (5362):266.
- ⁷Leclercq, S. 1956. Evidence of vascular plants in the Cambrian. *Evolution* 10(2):109-114.
- ⁸Jacob, K., Chinna, Jacob, and R.N. Shrivastava, 1953. Spores and tracheids of vascular plants from the Vindhyan System, India: the advent of vascular plants. *Nature* 172 (4369):166-167.
- ⁹Darrah, William C. 1937. Spores of Cambrian plants. *Science* 86 (2224):154-155.
- ¹⁰Ghosh, A. K., and A. Bose, 1947. Occurrence of microflora in the Salt Pseudomorph Beds, Salt Range, Punjab. *Nature* 160 (4075):796-797.
- ¹¹Ghosh, A.K. and A. Bose, 1952. Spores and tracheids from the Cambrian of Kashmir. *Nature* 169 (4312):1056-1057.
- ¹²Mamay, Sergius H. 1976. Paleozoic origin of the Cycads (Geological Survey Professional Paper 934). Washington, D.C.: United States Government Printing Office.

- ¹⁰Burdick, Clifford L. 1966. Microflora of the Grand Canyon. *Creation Research Society Annual (Quarterly)* 3(1):38-50.
- ¹¹———. 1972. Progress report on Grand Canyon palynology. *Creation Research Society Quarterly* 9(1):25-30.
- ¹²Scott, Andrew. 1974. The earliest conifer. *Nature* 251 (5477):707-708.
- ¹³Edwards, D. and E.C.W. Davies, 1976. Oldest recorded *in situ* tracheids. *Nature* 263 (5577):494-495.
- ¹⁴Gray, Jane, and A.J. Boucot, 1974. Silurian trilete spores and spore tetrads from Gotland: their implications for land plant evolution. *Science* 185 (4147):260-263.
- ¹⁵Gray, Jane, and A.J. Boucot, 1971. Early Silurian spore tetrads from New York: earliest New World evidence for vascular plants? *Science* 173(4000):918-921.
- ¹⁶Gray, Jane, and A.J. Boucot, 1977. Early vascular land plants: proof and conjecture. *Lethaia* 10:145-174.
- ¹⁷Pratt, Lisa M., Tom L. Phillips, and John M. Dennison, 1978. Evidence of non-vascular land plants from the early Silurian (Llandoveryan) of Virginia, U.S.A. *Review of Palaeobotany and Palynology* 25:121-149.
- ¹⁸Cook, Melvin A. 1966. Prehistory and earth models, pp. 332-333. London: Max Parrish.
- ¹⁹McLeod, John D. 1978. The oldest bryozoans: new evidence from the early Ordovician. *Science* 100 (4343):771-773.
- ²⁰Taylor, Michael E. 1966. Precambrian mollusc-like fossils from Inyo County, California. *Science* 153 (3732):198-201.
- ²¹Pojeta, John, Bruce Runnegar, and Jiri Kriz. 1973. Fordilla Troyensis *Barrande*, the oldest known pelecypod. *Science* 180 (4088):866-868.
- ²²Firby, Jean B., and J. Wyatt Durham. 1974. Molluscan radula from earliest Cambrian. *Journal of Paleontology* 48 (6):1109-1119.
- ²³Cowen, Richard. 1979. Invertebrate fossils. *Geotimes* 24 (1):34-35.
- ²⁴Morris, Simon Conway, and H.B. Whittington. 1979. The animals of the Burgess Shale. *Scientific American* 241(1):122-133.
- ²⁵Rusk, M.J. 1973. Silurian echiuroids: possible feeding traces in the Thorold Sandstone. *Science* 180 (4092):1285-1287.
- ²⁶Ager, Derek V. 1973. The nature of the stratigraphical record, p. 22. London: Macmillan.
- ²⁷Beerbower, James R. 1968. Search for the past, second edition. Englewood Cliffs, N.J.: Prentice-Hall.
- ²⁸Osborn, Charles, ed. 1970. 1971 Nature/Science Annual, p. 179. New York: Time-Life Books.
- ²⁹Durham, J. Wyatt. 1978. A Lower Cambrian eocrinoid. *Journal of Paleontology* 52(1):195-199.
- ³⁰Sprinkle, James. 1976. Biostratigraphy and paleoecology of Cambrian echinoderms from the Rocky Mountains. *Brigham Young University Geology Studies* 23(2):61-73.
- ³¹Bell, Bruce M., and James Sprinkle. 1978. *Totiglobus*, an unusual new edrioasteroid from the Middle Cambrian of Nevada. *Journal of Paleontology* 52(2):243-266.
- ³²Pojeta, John, Jr. 1977. Invertebrate paleontology. *Geotimes* 22(1):35.
- ³³Elliott, Alfred M. 1963. Zoology, third edition, p. 349. New York: Appleton-Century-Crofts.
- ³⁴Bockelie, T. and R.A. Fortey. 1976. An early Ordovician vertebrate. *Nature* 260 (5546):36-38.
- ³⁵Repetski, John E. 1978. A fish from the Upper Cambrian of North American. *Science* 200 (4341):529-531.
- ³⁶———. 1978. Oldest vertebrates found. *Geotimes* 23(9):27.
- ³⁷Harper, D.A.T. 1979. Ordovician fish spines from Girvan, Scotland. *Nature* 278 (5705):634-635.
- ³⁸Reisz, Robert R. 1977. *Petrolacosaurus*, the oldest known Diapsid reptile. *Science* 196 (4294):1091-1093.
- ³⁹Lawson, Douglas A. 1975. Pterosaur from the latest Cretaceous of West Texas: discovery of the largest flying creature. *Science* 187 (4180):947-948.
- ⁴⁰Alexander, Jane D., ed. 1972. 1973 Nature/Science Annual, p. 181. New York: Time-Life Books.
- ⁴¹Bone bonanza: early bird and mastodon. 1977 *Science News* 112 (13):198.
- ⁴²Ostrom, John H. 1979. Bird flight: how did it begin? *American Scientist* 67 (1):46-56.
- ⁴³Romer, Alfred Sherwood. 1966. *Vertebrate paleontology*, third edition. Chicago: University of Chicago Press.
- ⁴⁴Freeman, Eric F. 1976. Mammal teeth from the Forest Marble (Middle Jurassic) of Oxfordshire, England. *Science* 194 (4269):1053-1055.
- ⁴⁵Jepsen, Glenn L. 1966. Early Eocene bat from Wyoming. *Science* 154 (3754):1333-1339.
- ⁴⁶Fields, Wilbur, Lyman Hemby, and Ralph Mehrens. 1978. Paluxy River explorations. (Published by Wilbur Fields, 2313 East 20th Street, Joplin, MO 64801. \$2.00 plus .75 postage.)
- ⁴⁷Personal communication from Fredrick Beierle, Box 748, Lyons, Kansas 67554.
- ⁴⁸Cook, Melvin A. 1979. William J. Meister discovery of human footprint with trilobites in a Cambrian formation of western Utah, p. 185, in *Why not Creation?* Walter E. Lammerts, ed. Nutley, N.J.: Presbyterian and Reformed Publishing Company. Also (with Meister) 1968. *Creation Research Society Quarterly* 5(3):97-102.
- ⁴⁹Sloan, Robert E., and Leigh Van Valen, 1965. Cretaceous mammals from Montana. *Science* 148 (3667):220-227.

NOTES ON THE USE OF STATISTICS IN THE DEBATE OF CREATION VERSUS EVOLUTION

JOHN M. ANDRESEN*

Received 15 April, 1980

A statistical argument commonly used by Creationists and in Creation Research is reviewed and examined. Suggestions are put forward for some ways to refine the handling of statistics. It is urged that Creationist research in statistics and probability be continued and improved, but a modification in future emphasis is suggested.

Statistics today are research tools commonly used by many in physical and social sciences, the media, business, government, and even gambling. While "statistics" is a very broad term, there is a simple, recurring use of statistics, especially in probability form, in various Creation-oriented writings. The level of statistical calculation used in the Creation-evolution

debate is such that people with no specialized background in mathematics and probability theory can grasp the argument. In this paper I try to show some problem areas in the argument in hopes that doing so will stimulate discussion and possibly a shift in research emphasis.

Briefly, this argument states one has reason to believe that a sequence of events has been planned if that sequence of events has an incomprehensibly low probability of occurring purely by chance. Sometimes this

*Mr. John M. Andresen's address is P.O. Box 43082, Tucson, Arizona 85733.

argument appears in prose¹, i.e. in a qualitative way; but lately more and more scholars are calculating actual mathematical probabilities for such events as the origin of the solar system, and the genetic mutation sequences presumed necessary by evolutionists for the chance development of the Earth and Life. For example, in this journal Trop and Shaki² calculate that there is a 1 in 10^{157} chance of obtaining a protein with a chain of 100 amino acids as a random product of carboxyl acids, aldehydes, amino acids, and simple aminos. Using estimates actually favorable to the evolutionist position, John Clayton³ calculates that the probability of our solar system and Earth existing by chance as a suitable place for life is fantastically small, using only a few of the many possible variables. Lammerts⁴ estimates that there is a 1 in 100 million probability of certain birds developing wings and strong muscles by the chance recombination of rare recessive mutations. Golay⁵ shows that there is a 1 in 10^{450} chance of a living system organizing itself randomly.

These examples are but a few of the many similar calculations appearing in current anti-evolution arguments. Although the focus ranges from solar systems to molecules, there is a common argument and conclusion. This argument can be broken down into three parts:

- (1) Demonstrate or observe that a particular sequence of events has occurred: (Seq. X [$X_1 X_2 X_3 \dots X_n$])
- (2) Calculate the probability of that sequence occurring by chance: $pX_1 (pX_2) (pX_3) \dots (pX_n)$ where pX_i is the probability of event X_i occurring by chance. The result will be an incomprehensibly low probability.
- (3) Because the probability of Sequence X occurring by chance is so low, a person has good reason to believe that something other than chance was at work. There is design, plan, or intention behind the sequence.

Some problems require careful handling of (1) and (2). However, I draw attention to (3) in this paper in order to make a clear distinction between statistical calculation and statistical interpretation. In spite of elaborate calculations, many scholars treat (3) briefly or not at all, and so leave their arguments open to criticism by evolutionists. It is necessary to review all sides of the problem to evoke discussion and full treatment of the problem. The summary below is offered as constructive criticism.

In order to see that more discussion is needed, it is necessary to review briefly the basics of calculation. Any introductory probability or statistics text book will outline the procedure, but I have chosen examples from the works of Blalock⁶ and Roscoe⁷.

The probability of getting five heads in a row in five tosses of a fair coin is calculated by multiplying the probability of getting one head in one toss by itself five times:

$$p(H \ H \ H \ H \ H) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{32}$$

Dice rolls are treated in the same way. Because there are thirty-six possible combinations for a fair pair of six-sided dice, the probability of any particular roll is $1/36$.

The situation is complicated by the fact that a 5 and 2 will look like a 2 and 5, so we use different colored dice (R = red, W = white). The probability of the following sequence is low ($p = 1/46,626$):

$$\begin{array}{ccccccc} R-1, W-5 & & R-3, W-2 & & R-4, W-4 & & \\ 1/36 & \times & 1/36 & \times & 1/36 & & = (1/36)^3 \end{array}$$

Using the same method of calculation for a vastly more complex sequence, Morris⁸ calculates that there is 1 chance in 10^{280} that living organisms would occur through random processes.

Some evolutionists would waste their time quibbling over individual probabilities or selection of events. So what if an evolutionist can take a 1 in a trillion probability for an essential process and narrow it down to a mere 1 in 500 million! Actually, the calculation of statistics does not raise many objections, even from some evolutionists. A problem arises in the interpretation, however.

One can examine the problem at home by a simple experiment and with the help of a companion. Take a normal, unmarked 52-card playing deck and shuffle. Spread the cards face down on a table and ask your companion to choose a card. Record the value and suit of the card, replace it in the deck, shuffle, and repeat the procedure until you have made and recorded 10 selections. When I tried this, the sequence was: 3-S, 10-D, 5-D, Q-H, 2-H, 7-S, K-C, J-S, 4-D, 10-H.

Handling parts (1) and (2) of the argument above is quite simple. A given sequence, for 10 cards chosen randomly, with replacement, has a probability of $(1/52)^{10}$ or 1 in 144,555,105,949,109,024. Draw a few more cards and the probability of the sequence will rapidly diminish. But we would not conclude (3) that something other than chance is at work.

Lest the reader feel that this example is contrived or otherwise irrelevant, I should point out that this aspect of modern statistics is a direct outgrowth of attempts to understand coin tossing, dice rolling, and card playing. The calculations are identical to those used in Creation theses. Emphasis here is on the distinction between calculation and interpretation.

The implication is that while the computational procedures used in cards and life are the same, the conclusions drawn are quite different. This disparity should not be overlooked. If one is willing to apply simple statistical procedures to a problem, they should be applied consistently and thoroughly, including interpretation. Of course, this does not end the matter. It has been necessary to include here an exposition of conflicting views and interpretation standards so that we, as Creationists, can become more familiar with these basic principles and become better equipped to deal with them in research.

Morris⁸ briefly addresses the problem brought out above. He points out that while many sequences in the development of life are equally likely (or unlikely), only 1 works and 10^{280} do not work. This is an important point, but it needs further development and examination.

I have found in talks with evolutionists that the matter is not as simple as it seems, and simple unilinear

statistical calculations may not be enough in coming years to deal effectively with evolutionist arguments. Many evolutionists and others turn to General System Theory to show that there are many paths that a system, living or non-living, may take to reach a particular outcome. Biologist L. von Bertalanffy⁹ calls this process "equifinality". Even when controlling for a few of the many possible variables, the number of paths a system may take gets quite large through a multiplicative process not unlike that used in calculating probabilities. I hope that the readers of this journal will pick up where this admittedly brief discussion leaves off so that together we may further Creation research.

The ultimate resolution of this situation through Creation research will add to our partial understanding of what day by day becomes more incomprehensible to human beings. I can offer no special insights here. Rather, I present the details of a common argument to the readers in order to encourage the combination of elaborate calculation of statistics with more complete interpretation.

In closing, it is tempting to repeat an often quoted and more often misunderstood observation made by

Albert Einstein concerning his struggle with chance versus order.

"God does not play dice with the world."¹⁰

References

- ¹Reno, Cora A. 1972. *Evolution and the Bible*, Moody Press Chicago. Pp. 63-4, 99-103.
- ²Trop, M. and A. Shaki, 1974. Is molecular evolution of proteins possible? *Creation Research Society Quarterly* 11(1):28-29.
- ³Clayton, John. 1976. *The source: eternal design or infinite accident?* Superior Printing, Mentone, Indiana.
- ⁴Lammerts, Walter E. 1977. On the recombination of rare recessive mutations. *Creation Research Society Quarterly* 14(2):99-100.
- ⁵Golay, Marcel E. 1961. Reflections of a communications engineer. *Analytical Chemistry* 33:23. (June).
- ⁶Blalock, Hubert M. 1972. *Social statistics*. 2nd ed. McGraw-Hill, New York. Pp. 119-150.
- ⁷Roscoe, John T. 1975. *Fundamental research statistics for the behavioral sciences*. Holt, Rinehart and Winston, New York. Pp. 139-154.
- ⁸Morris, Henry M. 1977. *The scientific case for creation*. Creation-Life Publishers, Inc., San Diego. Pp. 54-64.
- ⁹Bertalanffy, Ludwig von. 1968. *General system theory*. George Braziller, Inc., New York. Pp. 140ff.
- ¹⁰Whitrow, G.J. (editor). 1967. *Einstein: the man and his achievement*. Dover Publications, New York. P. 67.

PROLEGOMENA TO THE STUDY OF THE SEDIMENTS

ROBERT MORTON*

Received 19 April, 1980

An analysis of the distribution of the sediments seems to indicate that the earth at the time of the flood was considerably smaller. Assuming that the flood occurred on an earth of the present radius, the sediment distribution can not be explained and appears to violate the second law of thermodynamics.

This paper intends to raise an issue about the distribution of the sediments which form sedimentary rocks which at first glance is rather disturbing to the creationist position. An analysis of the distribution of the sediments reveals that a world-wide flood, at least as it is presently envisioned, would not be able to account for that distribution. In order to properly introduce this problem we must first examine how the sediments were formed, where the source of the sediments was, and in what manner the depositional mechanism operated. Following the philosophical analysis, a mathematical analysis of the distribution of the sediments will be presented.

Basically there seem to be two methods which could account for the depositing of the huge layers of sedimentary material observed on the earth. Uniform forces acting over millions of years would seem to account for the sediments (but not the fossils) every bit as effectively as non-uniform forces acting over a short time span. Therefore the first question to be answered is this one: fast or slow sedimentation?

This author does not intend to repeat the massive

evidence collected from the fossils which indicate that the sediments were the result of non-uniform forces acting over a short time since most readers will already be familiar with it. However, even if the above conclusion is true it does not necessarily follow that the sediments were deposited during Noah's flood. Obviously either the majority of the sediments were deposited by Noah's flood or they were deposited by some other mechanism. There appear to be only three choices: a previous flood, Noah's flood or uniformitarian processes. Belief in a merely local Noah's flood forces one to accept one of the other two ideas to explain the sediments. To believe that the sediments were the result of a previous deluge for which there is only the shakiest Biblical evidence seems to be a repeat of Cuvier's theory. To accept the uniformitarian formation of the sediments clearly raises the fundamental question, "Why should we believe in a worldwide flood which left no evidence of itself?" For if the sediments were formed by uniformitarian methods then there is no geological evidence for the flood and we should all accept uniformitarianism. Therefore, it must be concluded that the sediments with their fossils were deposited by Noah's flood. At least this must be concluded if we are to be logically consistent.

*Mr. Robert Morton's address is 3313 Claymore, Plano, Texas 75075.

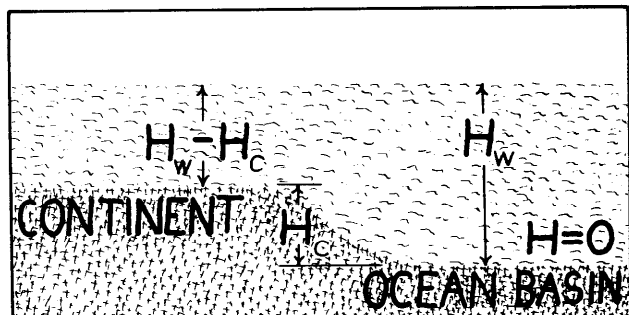


Figure 1. Structure of the continents. The meanings of the symbols are explained in the text.

The Source of the Sediments

Figure 1 shows an idealized view of the continents and the ocean basins. With this structure there are only two possible sources for the sediments which were deposited during the flood: the top of the continental platform and the ocean bottom. Primeval material had to be eroded from either the platform, the ocean bottom or from both and redeposited elsewhere as the sedimentary rocks.

As we will see, the greatest thicknesses of sediment presently reside on top of the continental platform. The source of the sediment on top of the platform could not be solely from the ocean basin for basically two reasons. First and foremost, the initial state of any natural process always contains more useful energy than the final state. This is the second law of thermodynamics in action. Consider a tank of water in which the bottom of the tank varies in depth. (See Fig. 2) No matter how the water is stirred up there is just no way for all of the sediment on the bottom to be deposited on top of the elevated portion of the tank bottom. When very little energy is expended stirring up the water, very little of the sediment on the tank bottom will be deposited on the upper level. As more energy is input to this system, more will be deposited there—up to a point. When a certain amount of energy is input in stirring up the sedi-

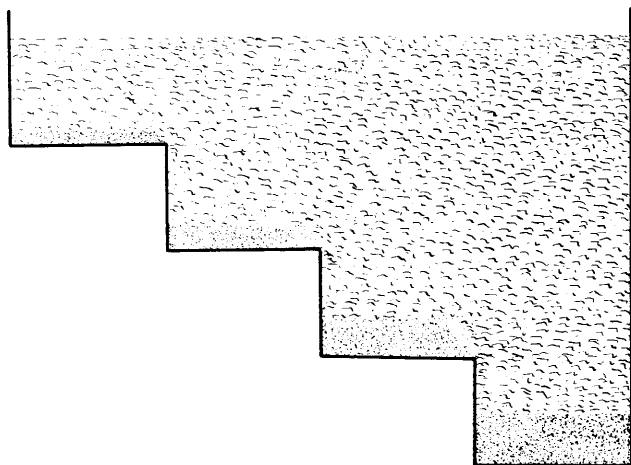


Figure 2. This shows how the thickness of settled sediment would vary with depth in a water-filled tank, in the experiment discussed in the text.

ment, the sediment will be uniformly mixed in the water. As we shall see later under these conditions the maximum sediment thickness on the upraised portion of the tank will always be less than the thickness on the bottom of the tank. In fact, this condition will represent the maximum amount of energy which can be saved out of the energy which was input to the system to stir up the water. Inputting more energy into stirring up the water will not result in storing any more of the input energy.

Secondly, the erosion due to water can only occur down to the base of the waves. Sedimentation occurs below this level. In order for the ocean bottom to be the source of the sediments, the base of the waves must be at the ocean bottom. If this were the case then the top of the platform would also be subject to erosion and thus the source of the sediments could not be *solely* from the ocean basins; it would be from both. In fact, under these conditions the top of the platform would be subjected to more severe erosion than the ocean bottom.

When the effects of gravity are included it is realized that the source of the net sediments on top of the platform cannot be both from the top of the platform and the ocean bottom. It is easier for a particle to drift from the higher level to the lower than for the reverse to occur. Because of this it is to be expected that more of the sediment from the top of the platform will end up on the ocean bottom than the sediment which started on the ocean bottom and ended up on top. Thus the net effect is that the primary source of the sediments on top of the platforms *must* be from the top.

If the top of the platform was the source of the sediments then obviously for any given area the basement had to be eroded to its final depth before any permanent deposition could occur. Thus the sediments had to be eroded and temporarily stored somewhere else before permanent deposition commenced.

There are only three possible places that the sediments could be stored: on the ocean bottom, the top of the platform, or in the water itself. If the sediments were stored temporarily on the ocean floor, then there would be no way to pick up the sediments and retransport them to the platform top for the same reason outlined earlier. Thus either the sediments were stored on top of the platforms or in the water at or above the level of the platform.

Figure 3 shows the gross relationship of the Cambrian deposits as they were laid down.¹ Very little of the continent remains exposed for erosion, and even that small area was permanently covered by the Pennsylvanian, halfway through the geologic column. By the time these sediments were laid down the vast majority of erosion on the platform had ceased. Bearing this fact in mind, one realizes that the sediments could not have been temporarily deposited all over the platform or no permanent sedimentation could have occurred. It is also unlikely that the sediments could have been piled up on one place on the platforms. A mound of unconsolidated sedimentary material would easily be attacked by the waves and could not exist long. Furthermore it is inconceivable how water action could produce such a feature in the first place. The erosive action of water tends to level higher points of elevation, not build them.

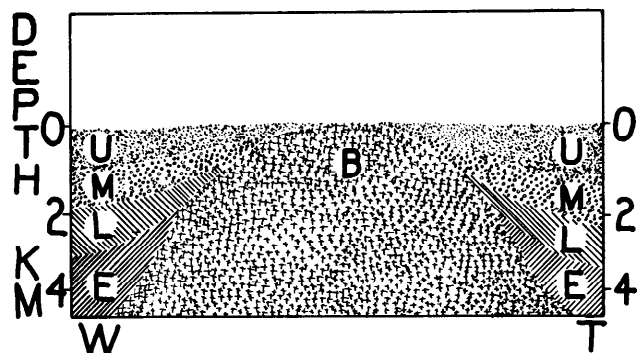


Figure 3. A cross-section showing the relationship of the Cambrian deposits to the continental basement at the time of deposition. (After Dott and Batten, Reference 1.) The meaning of the letters is as follows: W: Washington State; T: Tennessee; U: Upper Cambrian; M: Middle Cambrian; L: Lower Cambrian; E: Eocambrian; B: continental basement.

Even sedimentation, temporary or permanent, also fills up the lower elevations more quickly than the higher ones, producing a level surface, not one with a huge mound of temporary deposits. Neither is it possible for the sediments to have been washed from place to place solely on top of the platform. Since it takes longer for the clay particles to come out of suspension than the sand, most likely the clay would not be deposited until the current carrying it was over the ocean basin. Thus we would expect to find more sand on the platforms and more shale on the ocean bottom. Therefore the sediments must have been temporarily stored in suspension. This is especially true of all sediments deposited after Pennsylvanian time.

Thus there had to be sufficient water to support the sediment load in suspension as well as enough turbidity.

Thus we have reached five conclusions. First the sediments are the result of Noah's flood. Secondly, the sediment's source was the top of the platform. Third, the continents were eroded to their permanent basement depths before permanent deposition occurred. Fourth, the sediments were stored in suspension in the water. Finally, there was enough water in the flood to accomplish this.

It is realized that many will not relish the idea that the majority of the sediments were in suspension at one time before permanent deposition occurred. However there is one important fact which must be considered. There is a tremendous lack of clay in Cambrian deposits. Dott and Batten remark of the Cambrian deposits,

"Upper Cambrian sandstones, the dominant cratonic sediment, rank among the most mature in the world. They are unrivaled for perfection of rounding and sorting of grains, and contain 90 to 99 per cent quartz . . ."²

The problem is that the source rocks for these huge deposits contain less than 40 per cent quartz. They further state,

"Where is all of the clay that must have formed by decay of the immense volumes of igneous and metamorphic rocks indicated by the pure quartz sand concentrate? Possible ultimate source rocks contain less than 40 per cent quartz, whereas most

of the remaining minerals tend to weather to clays. Certainly there is too little shale found in Cambrian deposits of the craton to correspond with the phenomenal amount of quartz."³

Assuming that the Cambrian deposits are the earliest deposits of the deluge, the lack of clay is not surprising at all. As the Flood waters began to still, there would be a time when the turbulence would keep the clay particles suspended while allowing the sand to be deposited. However for a uniformitarianist this lack of clay presents a nearly insoluble problem. The worldwide turbulence must have been maintained at this precise level for millions of years if the problem is to be explained. Obviously the flood model is better at this point.

The Problem of Distribution

There is a problem in the distribution of the sediments which has generally been overlooked by creationists. That is that there is too much sediment on top of the continental platforms. Poldervaart has estimated the sedimentary thicknesses over several geologic regions of the earth's surface.⁴ He divided the earth into four regions: the deep-sea region, the suboceanic region, the continental shield region and the young folded belt region. Table 1 gives Poldervaart's estimates for the thickness of the sediments, the average elevation of the surface and the area each of these regions covers. Table 1 also shows what would be the average basement for each region.

As noted earlier, since many would not like the idea of all of the sediments being stirred up in the flood waters at one time, the following analysis of the sediment distribution will not make that assumption. We will assume that only a small per cent of the total sediments seen on the earth were stirred up at any given time. Mathematically these two views led to the same conclusion.

Consider a small amount of sediment stirred up in the flood waters. The average sediment load density will be simply this amount of mass divided by the volume of the ocean. The volume of the sediments themselves may be considered small compared to the oceanic volume. In mathematical terms $\rho_w = m_i/V$ where m_i is the increment of mass of the sediments and V is the volume of the oceans.

Table 1. Physical Data for the Four Geologic Regions (meters)

Region	Thickness of Sediment	Average Surface Elevation	Average Basement Elevation	Area
Deep Sea	300	-4500	-4800	268×10^{12}
Sub-oceanic	4000	-1750	-5750	93×10^{12}
Continental Shield	500	750	250	105×10^{12}
Young Folded Belt	3000	1250	-3750	42×10^{12}

Table 2. Potential Energy of Sediments Datum – 4800 m (i.e., below sea level.)

Region	Elev. of Base	Elev. of Surface	Density	Potential Energy (Joules)
Deep Sea	0	300	2.7	3.19×10^{23}
Suboceanic	– 950	3050	2.7	1.033×10^{25}
Continental Shelf	5050	5550	2.7	7.36×10^{24}
Young Folded Belt	1050	6050	1.62	1.18×10^{25}
Total				2.985×10^{25}

The amount of sediment suspended in the water above any given point is $SL_i = m_i(H_w - H_c)/V$, where H_w is the height of the flood, and H_c is the height of the platform.

Dividing SL_i by the average density of the deposited sediments (ρ_s) we have the average thickness of the sediment deposited by the small increment of mass stirred up at any given time: $\Theta_i = m_i(H_w - H_c)/V\rho_s$. Summing on i yields the average total thickness of the sediments after all increments have been stirred up. It is the same as if all of the sediments were stirred up at one time. Therefore, $\Theta = m(H_w - H_c)/V\rho_s$, where ρ_s is the density of the solid sediment. This will be assumed to be 2.7 gm/cc.

Using the basement of the deepsea region as the zero potential energy line (all elevations will henceforth be measured from this level), we find that the potential energy of an element of mass is $dU = dm gh$ where dm is the element of mass, g is the acceleration due to gravity, and h is the height above the datum (the deep-sea basement).

Now, since $dm = \rho_s dh A$ where A is the area, then $dU = \rho_s Agh dh$. Integrating gives $U = \frac{1}{2} \rho_s Agh^2$.

Table 2 shows the potential energy of sediments as they exist on the earth. The total potential energy for all of the sediments is also given in Table 2.

The sediment thicknesses cited in Tables 1 and 2 are the solid sediment thicknesses. This means that the sediments will be treated as if there were no porosity. It will be noticed that the density of the sediments in the young folded region is less than that of the others. The

Table 3. Potential Energy of Sediments From a Flood of Infinite Depth.

Region	Potential Energy (Joules)
Deep Sea	5.42×10^{24}
Suboceanic	-1.01×10^{24}
Continental Shelf	1.948×10^{25}
Young Folded Belt	2.86×10^{24}
Total	2.675×10^{25}

reason for this is that it is estimated that about 40% of their thickness is made up of volcanics. Since we are only interested in the sedimentary thickness and not in the volcanics, the total thickness of 5 km in these regions must be reduced by 40% to 3 km. However, this lesser thickness of sediment is spread out over the 5 km distance. Therefore, the effective density of the sediments in this region is also reduced by 40%.

Table 3 gives the expected distribution (thickness and potential energy) of sediments for a flood of an infinite depth. In a flood of an infinite depth, the structures of the earth would have no effect on the sediment thickness. It would be the same everywhere. One can see that even in this situation the potential energy predicted is considerably smaller than what is actually observed. This indicates that the flood, at least on the earth of the present radius could not possibly account for the distribution of the sediments.

Table 4 shows the potential energy and thicknesses of the sediments for floods of various depths (measured from the oceanic basement). Current sea level would be 4800 m in this system of elevations. Thus a flood in which the depth of the water was 5500 m actually covered all elevations below 700 m above sea level. Thus, the flood in table 4 with a listed depth of 15,000 m would be deep enough to have covered the current elevation of Mount Everest (29,000 feet) by nearly 1400 m.

As can be seen, none of these cases can explain the current distribution of the sediments. Figure 4 shows graphically how the potential energy of the sediments

Table 4. Potential Energy and Sediment Thicknesses for Floods of Various Depths.

Region	Depth of the Flood (meters)								
	5500	6000	7000	8000	9000	10000	15000	20000	
Deep Sea	1503	1477	1438	1410	1389	1373	1326	1304	Thickness
Suboceanic	1736	1711	1633	1578	1536	1503	1410	1366	
Continental Shelf	123	233	400	520	609	679	880	974	
Young Folded Belt	2027	2031	2037	2042	2045	2048	2056	2059	
Total Potential Energy of Sediments $\times 10^{25}$	1.22	1.34	1.54	1.69	1.80	1.89	2.16	2.29	Joules

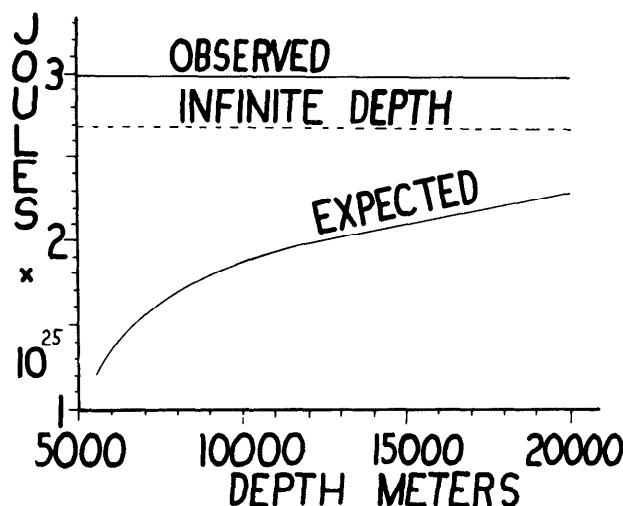


Figure 4. Potential energy of the Flood sediments vs. depth of the Flood.

varies with the depth of the flood waters. It can be seen that the curve becomes asymptotic to the value for a flood of an infinite depth. Since the actual value of the potential energy is higher than the infinite-depth value, it must be concluded that the flood on an earth of the present radius can not account for the sediment distribution.

We are therefore presented with a dilemma. We are fond of accusing evolutionists of violating the second law while we ourselves seem to violate it with a flood. We chide the uniformitarianist position because they can not explain why more sedimentary material is not in the ocean basin, assuming that the earth is as old as they say, while we can not explain it either!⁵ If there were a flood, there should be more sediments on the ocean basin. This situation must be resolved if the idea of a world wide-flood is to retain any credibility in terms of science as well as faith.

One explanation which has been suggested to the author is that somehow during the flood the continental platforms were lower than the ocean basins. Even though the sediment distribution could be explained in this manner, it should be rejected. Since the sialic continental platforms are floating in the underlying sima one would need to explain how the continents were pushed down against the natural forces of bouyancy. In order for this to have occurred, some rather uniform force must have been operative, pushing *only* the continents down. Thinking of a cause for this force is very difficult. The problems associated with sinking the continents are similar to those of submerging a balloon in a swimming pool. It is very difficult.

The sediment distribution becomes explainable if one assumes that the earth at the time of the flood were considerably smaller. Creer⁶ showed that if the earth were shrunk to approximately 55% of its present radius the continental platforms would fit together very nicely. This would imply that the deep-ocean region was formed after the continental platforms. If the ocean basins were formed by an expansion of the earth both during and immediately after the flood, and if the sediments

Table 5. Physical Data for Sub-Oceanic Subregions

Region	Surface Area	Average Thickness
Shelf Region	30×10^6 KM	4 KM
Hemipelagic Region	63×10^6 KM	4 KM

currently residing on the ocean bottoms are assumed to have come from the other three regions by stripping off a layer of sediment from each of them, then the sediment distribution can be explained.

In shrinking the earth, one must consider which regions will be left. Obviously the deep sea region would be eliminated. Part of the sub-oceanic region would also be eliminated. Poldervaart divides the sub-oceanic region into two subregions: the shelf region and the hemipelagic region. With the shrinking of the earth, the hemipelagic region would also be eliminated. Table 5 gives the pertinent data concerning these two subregions.

It can easily be verified that the total surface area which is left after the shrinking is that equal to a sphere with a radius of 58% of the present radius. This is very close to Creer's radius.

Table 6 shows the comparison between Poldervaart's estimates and values calculated assuming that H_w is 6000 m and that the basement in the shelf subregion is 500 m. It can be seen that there is fair agreement. The discrepancies can most likely be explained by the inappropriateness of the assumption that no erosion took place during the draining of the flood waters.

Thus it can be concluded that the sediment distribution can be better explained if the flood occurred when the earth's radius was smaller.

Postscript

Allusion was made to the problem of trying to explain the sediments by just pushing them around from place to place on top of the continental platforms. There is another point. An oceanic current approaching a continent would have to speed up while passing over the continent. The reason for this is that the depth of the waters over the continent is shallower than the oceanic depth and therefore the depth of current would be constricted. According to Resnick and Halliday,⁷ "The equation of continuity requires that the speed of the fluid at a con-

Table 6. Sediment Thickness Predicted for a Flood on a Smaller Earth.

Region	Thickness on Smaller Earth	Poldervaart's Estimate
Suboceanic (shelf only)	3475 M	4000 M
Continental Shield	599 M	500 M
Young Folded Belt	3126 M	3000 M

striction increase . . .” This physical constraint is the basis for the old cliché “Still waters run deep.”

It is a known fact in sedimentology that the faster a body of water is moving, the more sediment load it can carry. Verhoogen et al.⁸ show a chart which gives a depositional velocity for silt and clay of .4 cm/sec. This is how slow the current must be moving before these tiny particles (.05 mm⁹) will be deposited. Due to the shallowness of waters over the continents and the deepness in the ocean, the depositional velocity for silt and clay will be reached over the ocean far sooner than it will on top of the platforms. What this implies is that the silt and clay will be preferentially deposited in the ocean basins. We don't see this in the sediments as we have observed them. Thus, if the flood occurred on an earth of the present radius, why is there so much shale on the platforms?

References

- ¹Dott, Robert H., Jr., and Roger L. Batten, 1971. Evolution of the Earth. McGraw-Hill. See especially Figure 9.18, p. 205.
²*Ibid.*, p. 207.
³*Ibid.*, p. 211.
⁴Poldervaart, Arie, 1955. Chemistry of the Earth's crust. (in) the crust of the Earth. The Geological Society of America. Washington. Pp. 119-144.
⁵Nevins, Stuart E., 1974. Evolution: the oceans say no! (in) Creation, ed. H.M. Morris, D.T. Gish, and G.M. Hillestad. Creation-Life Publishers, San Diego. P. 169.
⁶Creer, K.M., 1965. An expanding Earth? *Nature* 205 (4971):539-544. See especially p. 540.
⁷Resnick, Robert, and David Halliday, 1960. Physics, part I. John Wiley and Sons, Inc., New York. P. 379.
⁸Verhoogen, John, Francis J., Turner, Lionel E. Weiss, and Clyde Wahrhaftig, 1970. The Earth. Holt, Rinehart, and Winston, Inc., Dallas. P. 337.
⁹*Ibid.*, p. 405.

THOUGHTS ON THE STRUCTURE OF THE ARK

P.H. VAN DER WERFF*

Received 20 May, 1980

Several authors have written on the all-over plan of the Ark, as it is recorded in Genesis.¹⁻³ They have shown that the Ark was an exceedingly stable vessel, and the shape in accord with good shipbuilding practice. Such findings can strengthen one's belief in the account. For were it fiction, the design given would likely have been wildly impracticable and unseaworthy.

Authors writing on the subject have shown also that the capacity of the Ark was sufficient for the job which it had to do.

Most of these authors seem, however, not to have considered much the finer details of construction. It may be that my background has made me wonder more about such matters. I come from a Dutch family of shipbuilders, and, when young, have seen wooden ships built. While most authors seem to envisage the Ark as just a very large wooden ship, I can see difficulties which would arise. The bending, which, it seems to me, would be inevitable in so long a ship would, I believe, have caused the joints at the ends of planks to open, no matter how well they were protected with pitch.

It occurs to me, then, that it may be that Noah used a completely different construction. What that might have been has been shown to us by Heyerdahl. For he built a raft of balsa logs, and sailed it across the Pacific.⁴ In so doing, as he himself reported, he was following the ancient people of the Pacific coast of South America, who built such rafts and made long ocean voyages on them.⁵

The gopher wood, which Noah was told to use, seems to be mentioned nowhere else. I suggest that it may have been balsa, or something similar.

One can visualize, then, how the Ark might have been built with the huge logs which were no doubt available in antediluvian times. There could have been, say, 25 balsa logs side by side to give the width. Ten such groups of logs, one behind the other, could have formed the length. The logs could all have been lashed together with rope. Four such layers of logs, one above the other, would have given the required buoyancy.

This colossal balsa raft, then, was the lower layer: the foundation for the two upper stories. The first floor would be well above the water line. On this floor was the superstructure. Heyerdahl used wickerwork of split bamboo for this purpose, when he built his raft. Ten cubits, about five metres, higher came the second floor. In this way the three sections were built.

The lowest section, the raft proper, would have been mostly under water and inaccessible, once the Ark was afloat. The logs would have been pitched on all sides against the pole-worm, which ruins wood which is under water.

The top of the Ark, I suggest, was a slanted roof with an overhang, against the torrential rain. The door was in the second section, well above the water line.

Heyerdahl's raft was ten by nine metres, about twenty by eighteen cubits. It was built in a few weeks, with one layer of logs. His expedition took three months. Noah's expedition, on the much larger Ark, took only about twice as long—six months—in actual sailing time. But, of course, the passenger list was much greater.

*While this item was being edited we received word of Mr. van der Werff's death, at age 82.

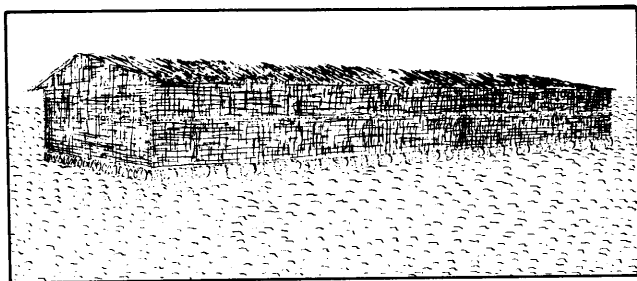


Figure 1. This shows what, it is suggested, the Ark may have looked like.

Figure 1 shows what, it is suggested, the Ark looked like. The appearance, it should be remarked, is something like that which Ben Uri suggested a few years ago.⁶

Figure 2 shows one corner, and some of the detail of the construction.

If the logs were ideally cylindrical and ideally packed, they would have filled $\pi/4 = 78\%$ of the space. The specific gravity of balsa is about 0.15. Thus, the buoyant force would have been about 66% of the weight of a volume of water equal to the all-over volume of the Ark which was submerged. If the four layers of logs, say four metres high, were submerged, the buoyant force might have been about 10^7 kgms., say about 10,000 tons. As already mentioned, several authors have shown that such a capacity would have been adequate for the job for which the Ark was made.

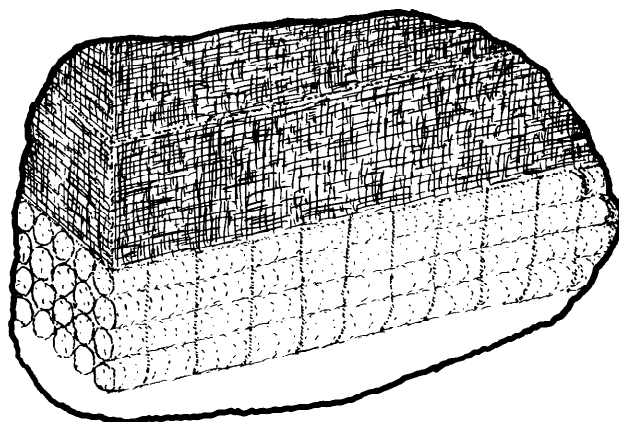


Figure 2. This is an enlarged view of one corner of the Ark, showing the way in which, it is suggested, it was built.

References

- ¹Morris, Henry M., 1971. The Ark of Noah. *Creation Research Society Quarterly* 8(2):142-144. This article has been reprinted in its entirety in Montgomery, J.W., 1972. *The quest for Noah's Ark*. Bethany Fellowship, Inc., Minneapolis. Pp. 41-46.
- ²Giannone, Ralph, 1975. A comparison of the Ark with modern ships. *Creation Research Society Quarterly* 12(1):53.
- ³Collins, David H., 1977. Was Noah's Ark stable? *Creation Research Society Quarterly* 14(2):83-87.
- ⁴Heyerdahl, Thor, 1950. *Kon-Tiki*. Rand.
- ⁵Heyerdahl, Thor, 1979. *Early man and the ocean. A search for the beginning of navigation and sea-borne civilization*. Doubleday.
- ⁶Ben Uri, M., 1975. Interests in creation week and in the flood in Israel. *Creation Research Society Quarterly* 12(2):83.

DEATH AND NICHE LIMITS†

MARK W. TIPPETS*

Received 22 November, 1979.

Some people believe that life will arise spontaneously somehow, somewhere, if conditions are right; and that having arisen it will evolve. But such people neglect to take into account death, which results if a single niche dimension becomes zero, i.e. if a single environmental or other condition does not fall within the range in which it must lie for life to be possible. If such a dimension should become zero, that means death for the individual, and extinction for the species. A few niche parameters, especially some which have a bearing on the question, whether life might exist elsewhere than on Earth, are discussed.

In most evolution-oriented textbooks on biology or ecology, it is tacitly assumed that the term niche or niche space is understood, and that therefore no precise definition is required. However, it is very important that this term be well understood indeed; for it is at the

level of the single individual organism that all of the various external, internal, and psychological environmental factors, parameters, or niche dimensions come into play that determine if the individual organism is to live and reproduce. Niche space is the multiplicity of environmental factors (physical, chemical, and biologic) interacting with each other and with the whole organism. For example:

1. Oxygen content—neither too much nor too little.
2. Water—must be a liquid and must be present.
3. Temperature—generally above 0°C and below 65°C (some organisms can live in water that is -2°C and others to about 100°C).

*Mr. Mark W. Tippetts is an Instructor in Geoscience in the Division of Natural Sciences, Los Angeles Baptist College, 21726 W. Placerita Road, P.O. Box 878, Newhall, California 91322.

†A paper, similar to this article, was given at the 15th Anniversary Convention of the Bible-Science Association, Anaheim, California, 12-15 August, 1979; and a summary is included in *Repossess the Land*, the Proceedings of that Conference. The work is used here by permission.

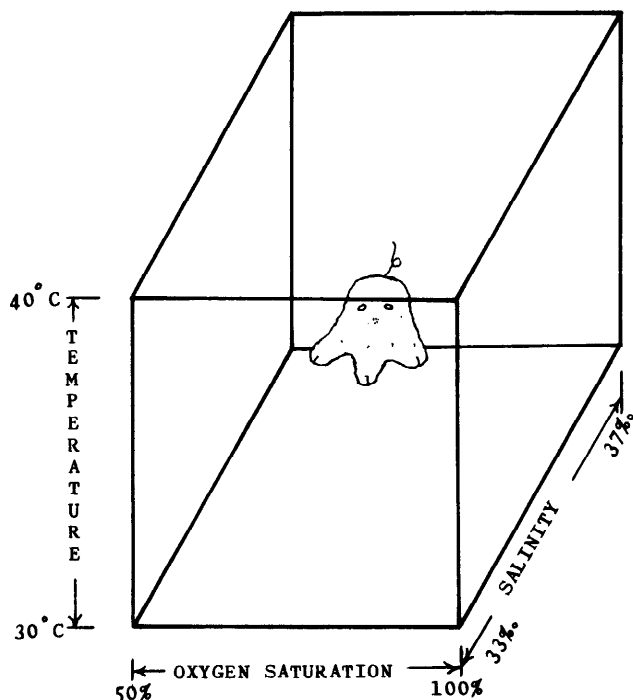


Figure 1. Niche space. This is a representation of what niche space might be like in a hypothetical case in which there were only three niche parameters. Zero niche space exists for this organism if the allowable ranges shown for the parameters are either not reached or exceeded.

4. Pressure—atmospheric or hydraulic, upper and lower limits.
5. Burial—kills the organisms buried; note all the fossils.
6. Food or vital substances—proper quantities and quality—many organisms can't live on only one type of food let alone without it.
7. Chemicals—toxins, acids, caustic substances — air and water pollution, all may make life impossible.
8. Old age.
9. Predators.
10. Accidents and injury—loss of vital substances, parts or organs.
11. Space requirements—crowding and isolation.
12. Radiations—ultraviolet, x-rays, light, gamma rays.
13. Metabolic mistakes, cancer, mutations.
14. Diseases.
15. ...
16. ...
17. ...
- n-1. ...
- n. ...

The total number of dimensions of niche space is likely not known; and they are difficult or impossible to quantify or even to name. Some niche parameters may be more important than others quantitatively; but in the long run all factors are equally important qualitatively; for even the smallest or most subtle factor that can be thought of may be of prime importance during some brief critical time in the life of the organism. The niche space is not just some small, local, close-at-

Let:

W = water
T = temperature
O₂ = oxygen
C = carbon
N = nitrogen
E = energy
S = salinity

n = number of days in which the lighted period is less than 14 hours.

Thus: the niche space parameters multiplied together will be the niche space, or, mathematically, hyper-space—N_h. So:

$$W \times T \times O_2 \times C \times N \times E \times S \times \dots \times (n-1) \times n = N_h$$

If, however, even one of the parameters is equal to zero, then the niche space is zero. Say energy E = 0. Then:

$$W \times T \times O_2 \times C \times N \times 0 \times S \times \dots \times (n-1) \times n = 0.$$

Example of how the niche space dimensions multiplied together equal niche space volume (N_h), or, mathematically, hyper-space.

No actual quantities are given here for any of the niche parameters, since the amount of each is likely unknown. Indeed, the total number of parameters is likely also unknown. However, the point is that if only one niche parameter is zero the niche volume or space is also zero, which means death for the organism concerned.

hand volume or piece of landscape but must extend to all parts of the habitat and beyond. Even the whole universe could be included; for instance the sun, moon and stars are used as navigational aids for some birds and the tides influence some sea creatures. According to Miller¹:

A niche space ... is the composite of all the environmental factors acting on an organism in its natural habitat. Each ... factor, such as temperature, ... is considered one dimension of the niche (space).

There is even a name given to such space; for mathematicians call the region of space bounded by all the hyper-surfaces a "simplex".² The term "hyper" refers to the ideas of more than three dimensions. Often the number is very much greater than three.

Moreover, each is unique and each has a unique total set of niche factors; and therefore each has its own unique niche space to fill.

Adaptation

Adaptation is commonly an undefined term. It is assumed to mean something; in general it is implied that an organism has somehow managed to improve itself so as to be more "fit" in the particular environmental niche space in which it finds itself. Somehow during its life span, when environmental factors have undergone some small change, the organism also underwent some small change in the appropriate direction; and this small change enabled it to survive long enough to have viable offspring which inherited this new small change. Since these offspring now have "better" inheritance than their progenitors they are better able to survive under changed conditions; and therefore they, in turn, can have more offspring. So evolutionary reasoning goes. This type of thinking has been shown to be incorrect. Most organisms cannot reason regarding chance random events, and so cannot

"plan" to avoid or improve their lot. Thus they are unable to cause changes that are ever upward toward increasing complexity. Neither has nature any intellect for selection. True, some organisms are said to be better adapted or less adapted to their environment. Perhaps better adapted means here that the niche space factors or dimensions are greater and so the organisms are wide-ranging or wide-spaced. But it does not follow that some organisms are more perfected than others.

Examples of Niches: Introduction

Every species experiences death of individual members. When this occurs its body begins to disintegrate. The complex molecules tend to simplify and will eventually return to their original less-ordered lower-energy (but higher entropy) state. Unless an individual organism or species is 100% adapted to its environment (i.e. perfect) it will in the long run be 100% assured of dying.

It is this author's thesis that each organism must at all times have niche space (hyper-space) for its functioning. If during its existence some single condition ensues, even for a moment, which zeroes its niche space, that organism dies. It isn't enough for the individual to survive at the 99.999+ % rate but it must do so at the 100% rate. There is no such thing as being partly alive and partly dead or in some middle ground. There is no continuum between life and death—it's one or the other. An organism that experiences death does not come back to life. Death of the organism is final for its organic existence as a living being.

The fact of life is unquestioned and it is easy to believe this obvious fact in the world in which we live. Astronauts on the moon and Viking landers to Mars and probes to other solar system bodies have indicated that there what is obvious here on Earth is not to be found. Something is very much different regarding these extra-terrestrial bodies. By whatever means life originated and was sustained on Earth, it did not happen on the Moon, Mars or elsewhere. But suppose that life had existed once on the Moon or Mars or elsewhere. What could have happened to cause it to disappear? Or what could have caused it to perish? Have lethal conditions always existed on the Moon or Mars or elsewhere?

Scientists and others speculate regarding the origin of life, and commonly give a number of conditions they believe necessary for life to come into existence. That life originated itself by chance in the dim distant geologic past on Earth or elsewhere is in current vogue, although spontaneous generation was disproved by Louis Pasteur. However, a better question is: "What conditions are lethal for an organism?" If an organism were placed on the surface of the Moon or Mars (or evolved there from the raw non-organic substances) what might cause it to die? The Moon has no atmosphere, and hence no oxygen, nitrogen, water or carbon dioxide as on Earth. No protective shield from solar radiation or cosmic bombardment. Temperatures are extreme. Mars is only slightly less hostile to life.

Dead, non-living materials only live if incorporated into and energized by living organisms. It is a quantum jump of very great magnitude between living or life and

non-living or death. Living things move, grow, reproduce and metabolize, whereas dead things do not. The living organism makes use of the dead, non-living substances; but the dead substances have not been observed to come alive of themselves. Life comes from life. Highly complex dynamic chemical activity characterizes living organisms. Simple activity characterizes the non-living realm, for instance stream flow, burning or weathering; but mostly nonactivity is observed. There has been no scientific demonstration that so-called life precursors could eventually form living matter by chance alone. Many and varied have been the experiments in which scientists have spent long hours in the attempt to create prebiotic substances in assumed early-earth environments. It is fair to say that the results have not been impressive.

Death is the antithesis of life. Death indicates that an organism in some way ceased to have niche space and therefore became non-adapted to its environment. Death implies that the organism's niche space became zero because some external or internal condition or niche dimension became zero. Thus the organism's limitations for survival were exceeded, and it died.

The evolution model demands that the individual change and that this change be inherited by its offspring. An organism is fit, in this interpretation, if it can survive long enough to have viable offspring. Adaptation means that the organism that cannot cope with altered conditions does not survive; i.e., death ensues.

An organism inherits 100% of its potential from its progenitors. Changes in this inherited material that occur later are defects, alterations or recombinations. The outworking of the genetic material may change up to a point as the environment changes. However, if the changes that take place in the environment are large enough they can reduce the ecological niche limits to zero for the organism, and the organism dies. If these limits are zeroed for all members of an extant population of an entire species that species becomes extinct.

Life exists and death occurs. Why should this be? If evolution really happened then evolutionary processes should have produced organisms having broader and broader niche parameters and hence longer and longer life spans, and eventually have led to life spans that would last forever. If evolution were getting rid of all the unfits, misfits, and partly fits, and only the fittest were the survivors, then the absolutely fittest individuals would remain, i.e. ones that are perfect (infinite niche parameters); and therefore they would not die. However, this effect—not dying—is not observed. There are, it may be, more diseases, more misery, more want, more aging and a host of other things that are zeroing niche parameters and causing organisms to die now than in the past. Death is all around because niche boundaries are being zeroed, not extended or expanded.

Water

Most organisms on Earth require liquid water in their environment in order to live. Some live in it, others drink it, more plants take it from the soil, some from mists or fogs. Other creatures like the kangaroo rat, metabolize it from the food they eat. Regardless of the

mechanism by which living things acquire their necessary liquid water, each and every one requires liquid water as part of its cellular make-up. The cellular chemistry is conducted only in the aqueous medium. If the environment is too cold and this water freezes, functions necessary for living cannot be carried out, including reproduction. Eventually the organism will die, because its life cycle cannot be completed if there is no liquid water.

One of the prime reasons for the Viking and Mariner probes to Mars was to determine if life exists and/or had evolved on Mars, which was believed to be most closely earth-like of all the planets. The temperature was known to rise above freezing during the Martian summer in favorable places; and Mars does have an atmosphere. However, the surface atmospheric pressure on Mars is only about 1/200th of the sea-level pressure on Earth. This precludes any possibility of liquid water on Mars, regardless of the temperature. The only stable forms of water on Mars are either ice (a solid) or water vapor (a gas). Horowitz³ states that:

the vapor pressure of water at the surface of Mars in the northern hemisphere is at most 0.05 millibars, even if all the vapor is concentrated in the lower atmosphere. The phase rule states that for liquid water to exist on the surface of a planet the pressure of the water vapor in the atmosphere must at some times and in some places be at least 6.1 millibars, the triple-point pressure. Below that pressure water cannot remain in the liquid phase: depending on the temperature it must either freeze or evaporate.

The atmosphere of Mars contains enough moisture that the air is sometimes near the saturation point; and as a result there can be at times clouds formed. These clouds however, cannot be like many of the clouds seen on a warm summer day on Earth. The temperature is so low that the only possibilities are tenuous ice clouds or ice fogs. This is indicated by the fuzzy edges they exhibit. According to Arvidson⁴:

If all of the water vapor in the atmosphere of Mars (not including the polar ice caps) could be condensed in one place it would form a body of water no larger than Walden Pond and further makes rain an impossibility.

Mars has water (as a vapor in its atmosphere); water (as ice) in its polar ice caps and water (chemically combined) in some of the surface minerals—up to 1% by weight⁵; and it is possible there may be frozen water locked up much like permafrost just below the surface. In many places on Mars there are channels much like erosional ones in desert regions on Earth. Many think that they were made by melting “permafrost” at some time in the planet’s past. At the present time there is no proof that this, in fact, took place.

Would it be possible for some organisms from Earth to survive in the cold, dry air or on the surface of Mars? Was the decontamination of the Martian Landers necessary? In 1977, Horowitz⁶ made the following statement:

Liquid water is essential for life on the Earth. All terrestrial species have high and apparently ir-

reducible requirement for water: *none could live on Mars.* (emphasis added)

So far as is known, Mars is sterile. It has not a single living organism anywhere in its air, on the surface, or under some rock. The basic need of living things is liquid water. Without water there can be no evolution, no survival—only death for any organism that happens along regardless of origin. Sagan⁷ puts it this way:

All that is known now is that the Earth supports life and that its life depends on the continuous existence of liquid water.

The other planets of the solar system are even worse off than is Mars as to the availability of liquid water for living organisms. This author sees, for instance, no possibility of living organisms in the atmosphere of Jupiter—too much electrical activity, ionization, turbulence, pressure, and deadly chemistry.

Chemistry, or, Life As We Know It

Science fiction writers and others entertain the idea that life, perhaps abundant life, even intelligent life, is scattered throughout the universe on “Earth-like” planets and that this extraterrestrial life is not like the life which we know, having a chemistry different from that of life on Earth. However, this cannot be the case, for Horowitz⁸ says:

The connection between life and organic chemistry (that is, the chemistry of carbon) rests on the fact that the attributes by which we identify living things—their capacity to replicate themselves, to repair themselves, to evolve and to adapt—originate in the properties that are unique to large organic molecules. It is the highly complex information-rich proteins and nucleic acids that endow all the living things we know, even “simple” ones such as bacteria and viruses, with their essential nature. No other element . . . has the capacity carbon has to form large and complex structures that are so stable. It is *no accident* that even though silicon is far more abundant than carbon on Earth, it has only minor and nonessential roles in biochemistry . . . Such fundamental facts lead to the conclusion that wherever life arises in the universe it will most likely be based on carbon chemistry (emphasis added)

In other words, life is based, and can indeed only be based, on the element carbon. This fact puts severe limits on any postulated life on other worlds.

One limitation arises from temperature. Amino acids, the basic building block of proteins, break down spontaneously at a rate dependent directly on the ambient temperature.⁹ The higher the temperature the greater the rate. Amino acids will not wait for several million years spontaneously to form protein.

Another is the chemistry of the environment. The chemistry of Venus is such that organic molecules, let alone living organisms, could not exist; for the atmosphere contains sulphuric acid and even the strongest of all simple acids: fluorosulphuric acid. No living thing could survive where acids are strong enough to dissolve most common minerals, sulphur, mercury, lead, tin and most rocks; and these acids are

indeed highly corrosive.¹⁰ Such highly active chemicals would stop the life chemistry of the cell; and so some internal niche space dimension is zeroed. Again we find an environment that is deadly.

Light: the Energizer

Light from the sun is necessary for the growth of green plants; and green plants are necessary for all other forms of living things. They are the primary producers. Organisms that live upon them or their products are consumers. However, if the amount and composition of sunlight reaching the surface of a planet are not right the effect produced is deleterious. The most significant energetic radiation reaching the Earth's surface is ultraviolet light. It is this radiation that causes a person to get a sunburn. Ultraviolet radiation is also used as a germicidal agent in health facilities. The amount of ultraviolet reaching the Earth is greatly reduced by the density of the Earth's atmosphere and especially by the ozone layer at high altitude. The concern regarding the release of fluorocarbons and possible consequent reduction of the ozone layer is well known. On Mars there is no layer to be destroyed; for the air there is very thin with practically no oxygen content, so the amount of ozone produced is next to nothing, and, hence, there is no ozone-layer shielding effect. This ultraviolet radiation apparently energizes atomic and molecular oxygen to combine through a series of reactions to produce hydrogen peroxide (H_2O_2), a powerful oxidizer, which may have an important influence on the chemistry of the Martian soil.¹¹ If living cells were present this hydrogen peroxide would have a detrimental effect—probably lethal. Further, according to Horowitz¹²:

the most surprising finding of the life-seeking experiments is the extraordinary chemical reactivity of the Martian soil: its oxidizing capacity, its lack of organic matter down to the level of several parts per billion and its capacity to fix atmospheric carbon (presumably into organic molecules) at a still lower level.

Ultraviolet radiation has a disruptive effect upon living tissue and cells, and so the high reactivity of the Martian soil would seem to preclude any chance of finding life on Mars. The radiation and chemistry are just wrong. Horowitz¹³ also suggests that organic compounds are probably actively destroyed by the strong ultraviolet radiation from the sun.

Atmospheres

The gases in the atmosphere of Mars and the Earth are of the same kinds. However, the percentages are quite different, being 96% carbon dioxide, 2.5% nitrogen, 1.4% argon, and 0.1% oxygen on Mars. The Earth's atmospheric gases respectively are: 0.03%, 78%, 1%, and 21%. The water vapor content in both planets' atmospheres varies from season to season, time of day and from place to place. On Earth the water vapor concentration can be as much as 4 or 5% when the air is saturated.

The great bulk of living substance is composed from compounds of just four elements: carbon, oxygen,

nitrogen, and hydrogen, all of which are found in the atmospheric gases of both planets. Could these gases be synthesized into organic compounds as prebiotic precursors to life on Mars? Apparently not; for Gish¹⁴ states:

the amount of radiation available from the sun at the wave lengths at which (atmospheric) gases absorb (below 1500 Angstroms), and thus available for synthesis, is less than one-thousandth of the light (up to 3500 Angstroms) absorbed by the products, and thus available for destruction. Hence destruction is 10,000 to 100,000 times more effective than production.

No wonder the Viking landers didn't find organic molecules—they would have been actively destroyed if ever produced!

Light and Darkness

As if that isn't deadly enough for living things consider the amount of solar radiation that reaches the surface of Mars. It varies by more than 44% depending upon Mars' orbital position. This is not a season effect of the slant of the axis but depends upon the distance Mars is from the sun. The corresponding variation for the Earth is about 7%.¹⁵ If we look to Venus on the other hand, we find that the amount of sunlight that finally filters through the clouded toxic atmosphere is about equal to the amount that the Earth's surface receives on a very dark, rainy day—about 1% of normal daylight.¹⁶ Again, could plants survive in a night that is 120 days long (about half of Venus' period of rotation)? Light is very important for the growth of green plants, and it must be in the correct amounts as to energy content and duration. It would appear that the niche space dimension for the correct amount of light in the proper wave lengths is zeroed on Mars and Venus. Thus the niche space must be zero; and so there can be no organisms on either of these planets.

Wind

Strong winds, such as at high altitudes or along exposed coasts, tend to stunt vegetation, because of the higher evapo-transpiration rates and the abrading effect of blowing dust and sand. The wind speed necessary just to begin to move sand-sized particles on Earth is about 10-12 mph. Natural sandblasting in places where sand blows, tends to remove the bark, leaves, and soft tissues from the windward side of plants while the lee side is protected.

Suppose on Mars there were vegetation such as lichens, bushes or trees. Since the atmosphere of Mars is only about 1/200th as dense as the air on Earth the wind velocity necessary to move sand-sized particles must be on the order of 10 times greater.¹⁷ In 1975, Pollack¹⁸ stated:

When Martian wind velocities exceed 100 mph, small dust particles are set in motion. Particles larger than a thousandth of an inch saltate, that is, travel a small distance through the atmosphere, hit the surface and bounce back into the atmosphere. Smaller particles settle out of the atmosphere so slowly that they tend to stay in suspension and to

travel great distances before they sink to the ground.

It is even believed that on occasion that Martian winds can blow at as much as half the speed of sound.¹⁹ Sagan estimates that the rate of sandblasting to be on the order of 10,000 times as great as on Earth since the average velocity of the saltated and suspended grains must approach the speed of the wind.²⁰ Therefore, (even for a postulated plant) the sandblast effect would break into cells and allow for their contents to spill and thus the niche space requirement of entire cells is zeroed.

Evolution: Can It Happen?

The notion that organisms somehow by chance evolved from simple to complex, from unordered to ordered, from less perfect to more perfect, from lower to higher, from non-living inorganic to living organic forms has been believed by many for more than 100 years. However, this evolutionary change has not been observed or documented in a single case. All that is known now is that the Earth supports life and that its life depends on (among other things) the continuous existence of liquid water.²¹ The Earth is obviously designed to be the home of living beings. It is correct in such respects as chemical composition, the presence of water, the temperature, the lengths of day and night, and of the year, and in many other features. About hypothetical Earths which would have been suitable for living beings we know nothing. But we do know that this Earth which is inhabited is suitable.²² Even those that believe in evolution admit that if life evolved elsewhere than on Earth, it would have to be on a planet not drastically different from the Earth in its temperature and composition.²³ There is however no evidence for extraterrestrial living beings, intelligent or otherwise, within reach of man's abilities to search. Sagan²⁴ does some wishful hoping (thinking) when he states:

The Martian environment is by no means so hostile as to exclude life, but we do not know enough about the origin and evolution of life to guarantee its presence there—or anywhere else.

Living organisms just do not survive, let alone originate, live or evolve, when conditions are not only hostile, but lethal. The Martian temperature remains below freezing most of the time, there is practically no oxygen, no liquid water, intense ultraviolet radiation, very high winds with sandblasting, very low atmospheric pressure, etc. and etc. . . .

Even small environmental changes in the Earth's ecology may have a detrimental effect on the organisms around which these changes occur. If their external or internal niche space dimensions (such as light, temperature, moisture) are altered, especially if it is zeroed, the result is not evolution but degeneration and eventually individual or species death (extinction). These changes do not increase the complexity of the environment but degrade it to a simpler, less complex, less diverse condition.²⁵

Evolutionists would have us believe that organisms are "preadapted" to this changing environment and therefore would be able to cope as the environment changes. But Morris²⁶ says:

It would seem therefore that anything that would change the environment today (for example, by altering the chemical components of the atmosphere and hydrosphere through pollution), decrease populations (perhaps by war, famine, or pestilence), or increase the mutational pressures (such as by increasing the radioactive component of the biosphere through nuclear testing), would contribute positively to further evolution and therefore should be encouraged, at least if evolutionists are correct in their understanding of evolutionary mechanisms. In other words, the very processes which modern ecologists most deplore today are those which they believe to have been the cause of the upward evolution of the biosphere in the past.

It is strange that modern scientists who believe evolution to be the answer to where the world originated and life is heading are in reality, by their actions, creationists at heart, "knowing" that environmental changes tend to be harmful and often deadly, not leading to higher beings. Creationists, for their part, are convinced that unplanned, chance, perturbations in the environment have detrimental effects on the ecosystem.

Under normal, environmental conditions, organisms live, grow, reproduce, and have variations. These changes, though, are conservative, not creative or evolutionary effects. Things tend to remain the same under suitable living conditions. Complexity of the ecosystem is not increased unless there is some informational input from the outside. If the fossil record means anything, the ecosystem is less diverse now than in the past. Williams²⁷ speaking to this issue states:

Conservation processes operate more efficiently under conditions suitable to living organisms . . . Degeneration processes prevail under conditions unsuitable to living organisms, . . . Which organisms survive? Those that are able to utilize the conservation processes available to them. Those that cannot utilize them cannot cope with the degeneration processes and consequently . . . suffer, die and even become extinct. Struggle does not improve organisms. The less the struggle, the more improved the organisms. Struggle weakens organisms. . . . Even conservation processes are inefficient. This inefficiency results in a slow deterioration of living organisms.

The environment appears to remain stable, but it is in reality slowly undergoing changes which bring about a deterioration, i.e. some niche space is being eliminated. This is not evolution in the sense that things, by chance, are being improved, but rather it is "devolution". Regardless of what is done, the energy expended, and the time spent, the Earth and its environment are slowly decaying and cannot continue indefinitely. It will die. Morris²⁸ puts it this way:

Eventually, however, if the present world (no matter how carefully its resources were guarded) were to continue indefinitely operating under present laws of nature, it would die.

It is implied in Scripture that this is what would happen if God doesn't change the present conditions of the Earth. See, for instance, Romans 8:20-22 (The Living Bible):

For on that day thorns and thistle, sin, death, and decay—the things that overcame the world against its will at God's command—will all disappear, and the world around us will share in the glorious freedom from sin which God's children enjoy. For we know that even the things of nature like animals and plants, suffer in sickness and death as they await this great event.

Conclusion

In the ecology of living organisms, each species has its environmental niche space. Each niche space is bounded by a number of dimensions (some known, others not known) that define where organisms experience their life cycles. If just one niche dimension is zeroed the organism dies. Each niche space is different for each species, so are the niche dimensions; and lethal conditions can be different. But some conditions are clearly lethal. Even if a "Noah's Ark" of animals with the necessary vegetation were transported to Mars, most would survive for no more than a few minutes; and none would go through a single life cycle under the prevailing surface conditions. Even if the dimensions of an organism's niche space were known exactly and that space could be duplicated, still the probability that that organism—or any other kind of life—would arise by chance alone is zero, even under those ideal conditions. If, on the other hand, the living organism were placed in that niche, still the probability of its eventual death is 100%.

References

- ¹Miller, Julie Ann, 1979. Food web. *Science News* 115(15):250-251.
²Steen, Lynn Arthur, 1979. Linear programming: solid new

- algorithm. *Science News*. 116(14):234-236.
³Horowitz, Norman H., 1977. The search for life on Mars. *Scientific American*. 237(5):52-61.
⁴Arvidson, Raymond E., Alan B. Binder, and Kenneth L. Jones, 1978. The surface of Mars. *Scientific American*. 238(3):76-89.
⁵*Ibid.*, p. 87.
⁶Horowitz, *op. cit.*
⁷Sagan, Carl, and Frank Drake, 1975. The search for extraterrestrial intelligence. *Scientific American*, 232(5):80-89. See especially p. 87.
⁸Horowitz, *op. cit.*, p. 54.
⁹Sagan, *op. cit.*, p. 81.
¹⁰Young, Andrew and Louise Young, 1975. Venus. *Scientific American*, 233(3):70-78. See especially pp. 75-77.
¹¹Leovy, Conway B., 1977. The atmosphere of Mars. *Scientific American*, 237(1):34-43. See especially p. 39.
¹²Horowitz, *op. cit.*, p. 61.
¹³*Ibid.*, p. 55.
¹⁴Gish, Duane T., 1976. Origin of life: critique of early stage chemical evolution theories. ICR Impact Series, n. 31, p. i-viii, January, p. iv.
¹⁵Leovy, *op. cit.*, p. 42.
¹⁶Young, *op. cit.*, p. 77.
¹⁷Sagan, Carl, 1975. The solar system. *Scientific American*, 233(3):23-31. See especially p. 29.
¹⁸Pollack, James B., 1975. Mars. *Scientific American*, 233(3):106-117. See especially p. 116.
¹⁹Sagan, *op. cit.*
²⁰*Ibid.*
²¹Siever, Raymond, 1975. The earth. *Scientific American*, 233(3):82-90. See especially p. 87.
²²Armstrong, Harold L., Ed., 1976. Design in inorganic nature. *Creation Research Society Quarterly*, 13(2):81 and 86. See especially p. 86.
²³Dickerson, Richard E., 1978. Chemical evolution and the origin of life. *Scientific American*, 239(3):70-86.
²⁴Sagan, *op. cit.*, p. 30.
²⁵Douglas, John H., 1978. The ark is sinking. *Science News*, 114(14):133.
²⁶Morris, Henry M., no date. Creation and the environment: ICR Impact Series, n. 13, p. i-iv., p.i.
²⁷Williams, Emmett L., 1976. A creation model for natural processes. *Creation Research Society Quarterly*, 13(1):34-36.
²⁸Morris, *op. cit.*, p. iii.

ON THE STAR OF BETHLEHEM

GERARDUS D. BOUW*

Received 15 July, 1980.

It is shown that, while a star really appeared to herald Our Lord's birth, all the proposed naturalistic explanations of the star are inadequate. Hence the star was a supernatural sign. In the course of the investigation, evidence is adduced to show that Our Lord's birth was in the year 2 B.C.

Introduction

Attempting to decisively date the birth of Christ or His crucifixion is a formidable task for any chronologist; and trying to ascertain the nature of the so-called Christmas Star is an even more formidable task for the astronomer. This paper reviews the current ideas surrounding the Star of Bethlehem and it also attempts to date the birth of the Lord Jesus Christ using a variety of evidence.

To avoid confusion from the outset, it will be noted that all dates given in this paper will not include the mythical year zero. Many modern commentators to the contrary, there properly should not be a zero year in a calendrical system referring to any historical event. The first year of Christ's stay on earth would, by definition, be the year A.D. 1; the year before his birth would by the same definition be the year 1 B.C. Hence there is no room for a year zero.

Naturalistic explanations for the Star of Bethlehem abound; and most of them can be summarily dismissed. In order then, to ascertain the validity of any and all naturalistic attempts at explaining the star, we need to

*Gerardus D. Bouw, Ph.D., graduated in Astronomy, and has also taught Computer Science. His address is 4800 Broadview Rd., #11, Cleveland, Ohio 44109.

collect all that is actually and reliably known about the star. For that we must turn to the Bible.

The Biblical Evidence

The first mention of the star occurs, traditionally, in Numbers 24:17 where Balaam, in blessing the nation of Israel, says:

... there shall come a Star out of Jacob, and a Sceptre shall rise out of Israel.

In this passage it is stated that the Star shall rise out of Jacob. When it comes to constellations, each of the twelve sons of Jacob is associated with one of the twelve signs of the zodiac. For example, on the strength of Genesis 49:8-12, Judah is associated with the constellation of Leo, the lion. Some support for such associations may be gathered from Joseph's dream as recorded in Genesis 37:9-11 and from Genesis 1:14. But there is no record, as far as the author's research has suggested, that Jacob was ever associated with any constellation whatsoever. If Genesis 37:10-11 is any indication, then Jacob is associated with the sun, not with any constellation.

Thus if we take Numbers 24:17 as referring to the Star of Bethlehem, then either the wise men saw a star ascending from the very land of Israel and placing itself in the sky, or else a part of the sun was torn loose and was observed as a star by the wise men in the east.

The only other Scriptural references to the star occur in Matthew 2 where we read in the second verse that the wise men asked Herod:

Where is he that is born King of the Jews? For we have seen his star in the east, and we are come to worship him.

Apparently, the wise men no longer saw the star, having seen it in their native land (presumably, Babylon); for verses 9 and 10 continue with:

When they had heard the king, they departed; and, lo, the star, which they saw in the east, went before them, till it came and stood over where the young child was.

When they saw the star, they rejoiced with exceeding great joy.

Herod then interviewed the wise men and asked them when they first saw the star. As for the time of the appearance of the star, Matthew 2:16 reports that Herod slew all the children of Bethlehem:

from two years old and under, according to the time which he had diligently enquired of the wise men.

This passage would seem to allow for a delay of as much as two years between the appearance of the star and the visit of the wise men. It seems that Jewish Talmudic tradition holds that there would be a two-year delay between the appearance of the star and the actual birth of the Messiah.¹ If this were the common belief in Herod's day, then no doubt Herod was not taking any chances by executing the children two years old or under.

Apocryphal References

In addition to the Biblical references, there are also three apocryphal references to the star. One of these ap-

pears in the blasphemous *Protevangelion* where it is reported that the wise men said unto Herod:

We saw an extraordinary large star shining among the stars of heaven, and so out-shined all the other stars, as that they became not visible, and we knew thereby that a great king was born in Israel, and therefore we are come to worship him.²

A second reference is to be found in the *Epistle of Ignatius to the Ephesians* and it is like unto the first:

A star shone in heaven beyond all the other stars, and its light was inexpressible, and its novelty struck terror into men's minds. All the rest of the stars, together with the sun and moon were the chorus to this star; but that sent out its light exceedingly above them all. And men began to be troubled to think whence this new star came so unlike to all the others. Hence all the power of magic became dissolved; and every bond of wickedness was destroyed; men's ignorance was taken away; and the old kingdom abolished; God himself appearing in the form of a man, for the renewal of eternal life.³

Both of these passages claim that the star was supremely bright; but if this were the case, then why is there no record of the star in any other culture? There are other cultural accounts of Joshua's long day (or night as the geographical case might be) and also of Hezekiah's sign. There is even a Roman record of the three hours of darkness which occurred while Christ hung on the cross; but this star, which is reported by these manuscripts to have exceeded the combined brightness of the moon, sun, and stars; was somehow missed by the Romans, Chinese, Mayans, Babylonians, and even by the Jews themselves. The apocryphal accounts are thus obvious fabrications, especially considering that they are found embedded in passages which proclaim that salvation is by water baptism,⁴ and that ignorance is no more (see above) and that Mary was fed by angels throughout her childhood.⁵

The third apocryphal account is found in the extremely blasphemous *First Infancy Gospel*:

And at the same time there appeared to (the wise men) an angel in the form of that star which had before been their guide in their journey; the light of which they followed till they returned into their own country.⁶

This passage is interesting only in that it mentions that the star was an angel, a consideration to which we shall turn our attention toward the end of this paper.

Thus it appears that all that is known of the Star of Bethlehem, from Scripture, is that it was a single star; that it was not particularly bright since it had not been noticed by Herod or the Rabbis; that it disappeared until the wise men saw it again en route from Jerusalem to, presumably, Bethlehem, a distance of a little more than 6 miles. Furthermore, it went ahead of them until it finally stood over the house wherein the young child was. Finally, the visit of the wise men may have been some two years after the appearance of the star, possibly, even after the birth of the Lord.

We are now ready to consider some of the naturalistic explanations which have been put forth in order to account for the star.

Some Suggested Naturalistic Explanations

The suggestion which can be quickly dismissed is that the star was actually the planet Venus which can sometimes take people by surprise by its brilliancy. It can even be seen in daylight and it is the most commonly reported "UFO" today. But if Venus had been the star, then it would have been recognized in the morning, being the morning star. Furthermore, the wise men were doubtlessly aware of its position and motion so that it is extremely unlikely that it would take them by surprise.

A second suggestion is that the star was a meteor or fireball. Such "shooting stars," which are little particles of rock or nickel-iron ranging in size from a grain of sand to many tons, are short-lived, common phenomena. They are so common, in fact, that it hardly seems likely that any fireball or bolide (exploding meteor) could have aroused the wise men to a 450-mile journey to Jerusalem. After all, most meteors last less than 10 seconds.

It has been suggested, by Joseph Ciotti,⁶ that the Star of Bethlehem was an early sighting of the planet Uranus. Uranus was discovered by Sir William Herschel in 1781. It is barely below the detectability of the naked eye and it was located in the constellation of Pisces during the years about Christ's birth. But even though Pisces is made up of faint stars, it is doubtful that the slow-moving, exceedingly faint Uranus would have been detected. Even if it had been seen there is nothing inherent in its appearance that would urge the wise men toward Jerusalem.

A somewhat more feasible possibility for the star is the suggestion that it was an exploding star—a nova or supernova. Far eastern records do record two "temporary stars" around Christ's birth.⁸ The first appeared some time in the second month (March 10 to April 7) of the second year of the *Ch'ien-p'ing* period (5 B.C.) near the stars of alpha and beta Capricorni. This star was observed for seventy days and there is some question as to whether or not motion was recorded for it. If it did move then it would have been, most likely, a comet. At its appearing, it would have risen 4½ hours before sunrise; hardly an early morning or "eastern" object.

The second reported sighting hails from Korea. It is rather vague insofar as its date may not have been correctly recorded.⁹ This object was reported as appearing in late winter or early spring in the year 4 B.C. in the constellation of Aquila. Some have suggested that the 5 B.C. and the 4 B.C. objects may be one and the same,¹⁰ but Morehouse¹¹ has suggested that the 4 B.C. object was a supernova which can now be identified with a binary pulsar, PSR 1913+16b. That pulsar has a period of 0.059 second and Morehouse's identification with the Aquila object is not at all unreasonable.¹² Yet there is nothing at all unique about either the 5 B.C. or the 4 B.C. objects that would provoke the wise men into journeying to Jerusalem.

It has also been suggested that the Star of Bethlehem was a comet. But, outside the possibility that one or both of the above objects were comets, there appears to be no record of any comet around the time of Christ's birth. Mention is sometimes made of the 11 B.C. appearance

of Halley's comet; but it is far too early. Since a bright comet may move as much as ten degrees per day, it is difficult for one either to remain visible for two years or even to lead and stop over Bethlehem in a way that was clearly discernible to the wise men. A comet as the Christmas star has one other drawback and that is the fact that comets are always viewed as unfavorable omens.

But The Star Really Appeared

The suggestion that the star was merely a legend or a fabrication on Matthew's part fails on three counts. It is claimed that Matthew concocted the star in order to fulfill the prophecy of Balaam in Numbers 24:17. But the necessity of having to concoct such an object can be questioned since it is not at all clear that Balaam's prophecy requires a literal star for its fulfillment. Yet had Matthew felt it necessary then he would have explicitly pointed to the fulfillment of the prophecy for he is certainly not slack in his use of the clause: "that it might be fulfilled which was written." The second argument against the position that Matthew made up the star is that his star was far too subdued. For truly legendary stars of the type that Matthew is purported to have invented, we need only look at the first two of the three apocryphal accounts mentioned previously in this paper.

The third argument against the "counterfeit" hypothesis is that the passage in Numbers does not require fulfillment by a literal star. It speaks of a Star rising out of Jacob, not out of any constellation or horizon. Furthermore, Scripture uses stars and angels interchangeably; hence the very birth of Christ would have been fulfillment enough.

Some Other Suggestions

Seiss¹³ came up with another interesting suggestion for the Star of Bethlehem. He and Bullinger¹⁴ both refer to the Arab Christian historian, Abulfaragus (1226-1286), who indicated that Zoroaster was a student of Daniel the Prophet. In the Zoroastrian bible, the *Zend Avesta*, it is written that the appearance of a new star in the constellation of Virgo would herald the birth of the Messiah.

By virtue of the fact that the word *coma*, which in Hebrew signifies "to long for" (see Psalm 63:1), is also the name of a constellation north of Virgo; both Seiss and Bullinger conclude that the constellation of Coma must be the one wherein the Star of Bethlehem appeared.¹⁵

Seiss' account gets confused when he reports a flare-up of a star in the constellation of Coma in the year 125 B.C. He reports that that was the very star which, becoming visible in daylight, caused Hipparchus to recognize the transiency of the stars and thus to draw up his famous star catalog. Seiss then mentions a Chinese report of a flare-up of the same star about the time of Christ's birth; but he has either confused this with the two reports already mentioned, or he had access to an account which is now lost.¹⁶ It is reported that Ptolemy wrote that the same star was barely visible in his day (A.D. 150). Seiss finally identifies the star as 5

Comae which he claims was the Christmas star which also passed overhead at Jerusalem and was seen by the wise men when they looked down the well.

The story of the well cannot be accurately dated. It claims that the wise men travelled by day to Jerusalem and that the star was seen when one of the wise men looked in to a well. Now it is a demonstrable fact that the stars are visible, in the day time, when seen from the bottom of a long shaft; but there are several flaws with the account that the wise men saw the star in the well. First of all, they would have had to take deliberate precautions to avoid having their heads in the way of the star's light. Secondly, the star must still be fairly bright and thirdly, they could not have seen it going ahead of them on their journey from Jerusalem. Lastly, the star's visibility in a well would not have uniquely pinpointed the place but would only have indicated the proper latitude, not the longitude.

It is easy to check on Seiss' theory that 5 Comae was the Star of Bethlehem. In order to do so, the author has written a FORTRAN computer program which calculates precession to double precision. Both Bethlehem's and Jerusalem's latitudes were precessed forward in time from 1 B.C. to A.D. 1950. The precession formulae used were those of Escobal.¹⁷ The zenith trace was then plotted on a 1950 star chart and from that plot, a number of objects which passed more or less overhead at Bethlehem in the time of Christ were selected. Their 1950 positions were then precessed back to 1 B.C. and their zenith angles at meridian transit were reduced to miles north or south of the two latitudes of Jerusalem and Bethlehem. The results are given in Table I.

According to Table I, the object which appeared to pass closest to directly overhead at Bethlehem was Gamma Lyrae. It passes due overhead about a half a mile north of Bethlehem. Seiss' suggestion for the Christmas star, 5 Comae, was overhead almost 13.5 miles south of Bethlehem.

When it comes to possible unreported exploding stars, two planetary nebulae appear close to the zenith trace. The brightest is the Ring Nebula, M 57, in Lyra. It would have been directly overhead about 41 miles north of Bethlehem. The second planetary is an anonymous one which is not even listed in the New General Catalog. It is located in the constellation of Cygnus, its 1950 coordinates being 21 hours, 31.2 minutes in right ascension and its declination being 39 degrees 24 minutes. None of these objects appear to satisfy all the criteria which scripture accords to the

Star of Bethlehem, also not Seiss' star which apparently lasted for 275 years and would thus hardly be considered special.

Most of the above interpretations for the Christmas star are rejected by the majority of Christian astronomers and laymen. In order to ascertain the validity of those which commonly are accepted, we must first combine secular history and the Bible to date the actual birth of Christ.

When Was Christ Born?

Luke 3:1 indicates that John the Baptist started his ministry in the fifteenth year of the reign of Tiberius Caesar. There is little doubt that Caesar Augustus died in A.D. 14, the date being attested to by coins and historians of that era. So the first year of Tiberius' reign dated from August 19, A.D. 14 to August 18, A.D. 15. Hence his fifteenth year was from August A.D. 28 to August A.D. 29.

Now there are only two possible dates for the crucifixion which allow for the resurrection to have occurred on the first day of the week, and the years for those dates were A.D. 30 and A.D. 33. Traditionally (perhaps as with Ussher¹⁸ who based his conclusion on a comparison of Daniel 9:27 with Matthew 26:28), Christ's ministry on earth is taken as having lasted three and a half years. This indicated that the A.D. 33 date is the correct one for the crucifixion.

In support of this conclusion, Luke 3:23 states that:

And Jesus himself began to be about thirty years of age

at the time of his baptism by John (v.21).¹⁹ This would then have been some time during or after the fifteenth year of Tiberius.

These considerations pinpoint the A.D. 33 crucifixion date. Jesus' ministry thus began in the fall of A.D. 29, early in the sixteenth year of Tiberius, with John having started some six months earlier, perhaps at the time of Passover or else at the time of Pentecost (Leviticus 23:21).

All this serves to date the birth of Christ as the fall or late summer of 2 B.C.; the birth of John being more specifically dateable as about the 25th of March, 2 B.C., that day being the first day of spring and one human gestation period after the first course of Abia (Luke 1:5, 8, 23).

It is interesting to compare the various dates for Christ's birth. Most modern commentators place it in 5 B.C. or earlier. Some modern ones place it as early as 7 B.C. In doing so, they run contrary to the testimony of the historians who were closest to the fact of the birth. Only Sulpitius Severus of the fourth century held for the birth of Christ being as early as 4 B.C. A second century gnostic group called the Alogi seemed to have agreed with him but, as we shall see, they appeared divided on the issue.

Irenaeus held for the birth of Christ to be either 4 B.C. or 3 B.C.

When it comes to a date of 3 B.C., we find only three adherents: Clement of Alexandria, Orisius, and Cassiodorus Senator.

The list for a date of 3 to 2 B.C. (i.e., corresponding to the Jewish year) is longest of all including: Julius

Table I. Objects which passed overhead near Bethlehem at the time of Christ's birth.

Name of object	Distance from Jerusalem object passed overhead.	Distance from Bethlehem object passed overhead.
γ^1 Andromedae	7.75 miles south	2.69 miles south
γ^2 Andromedae	7.60 miles south	2.55 miles south
β Perseii = Algol	23.54 miles south	18.49 miles south
ξ Leonis	14.68 miles north	19.74 miles north
5 Comae	18.47 miles south	13.42 miles south
γ Lyrae	4.53 miles north	0.53 miles north
M 57 = Ring Nebula	35.61 miles north	40.66 miles north
Anonymous Pl. N.	27.69 miles north	32.75 miles north

Africanus, Hippolytus of Rome, Hippolytus of Thebes (first fragment), Jerome, Origen, Photius of Constantinople, Zonares, Eusebius of Caesaria, Bar Hebraeus, Chrysostom, Basilides, Tertullian (who opted for the spring of 2 B.C. at which time Saturnius instead of Cyrenius was governor of Syria), the *Paschal Chronicle* and the *Chronicon Cyrlicum*.

Opting for a birth date of 2 B.C. are Epiphanius and the early Syrian historical treatise, the *Chronicon Edessenum*.

Dating Christ's birth as either 2 or 1 B.C. is the second fragment of Hippolytus of Thebes.

Holding out for a birth date of 1 B.C. are Dionysius Exiguus and Furius Dionysius Folocalus who was the editor of the *Chronograph* of A.D. 354.

Finally, Epiphanius reported the Alogi also held a date of A.D. 9.

The average of all these estimates yields a date of 2.52 B.C. (not counting the Alogi whose inclusion brings the average to 2.16 B.C.). This is perfectly in line with the Biblical date of 2.3 or 2.25 B.C. Thus the year of our Lord's birth can quite readily be established as 2 B.C.

Josephus, Herod's Death, and Roman Matters

Then why all the modern estimates of 4 B.C. or earlier? The answer to that question lies in the date usually affixed to the death of Herod. Josephus reported that Herod died some time after a lunar eclipse. There was a partial eclipse of the moon in the early morning hours of March 13, 4 B.C. which reached its maximum phase around 2 A.M. But there are a number of serious problems associated with identifying Herod's death with the 4 B.C. eclipse. These problems have been summarized quite well by Martin²⁰ who points to the total lunar eclipse of January 9-10, 1 B.C. as the one to which Josephus refers Herod's death.

If this is indeed the right eclipse, then this also enables a chronology of the governorship of Syria to be constructed which allows for Cyrenius (Luke 2:2). Quintilius Varus was governor of Syria until 4 B.C., having assumed the governorship about 7 B.C. A stone inscription found near the Anio River outside of Rome is readily identifiable as referring to Varus, who, according to the inscription, was twice governor of Syria.

Josephus reports (*Antiq.* 17, 58) that Varus succeeded Sentius Saturnius as Governor of Syria shortly before the death of Herod. Josephus further indicates that Saturnius was governor that previous spring. Now either this was in 7 B.C. (which means that Herod died no later than 6 B.C.) or else Josephus is referring to the second time that Varus was governor of Syria, namely, 2 B.C. Furthermore, Josephus also notes that Syria had a number of governors during the rule of Saturnius (*Antiq.* 16, 280, 285, 357, 361).

Now, as Martin has pointed out, the year 2 B.C. was also the silver jubilee of the rule of Augustus. It was a year in which there were great celebrations in Rome as the Senate conferred the title of *Pater Patriae* on Augustus Caesar. Apparently, there was a special taxation of the Roman world in commemoration of the 25th anniversary of Augustus' rule. This was the taxation referred to in Luke 2:1-5. It was a special tax, as indicated by Luke 2:1 and by the very fact that it was

decreed rather than automatic. The annual taxes were more or less automatic; they required no proclamation.

Indications are, then, that Caesar Augustus proclaimed a special, unscheduled tax as part of his silver jubilee (February 2 B.C. to February 1 B.C.) and that Joseph went to Bethlehem to pay said tax toward the onset of the rainy season (at the last possible moment, in other words) thus finding no room at the inn.

It is common to identify the taxing mentioned by Luke with one of the censuses. The last Roman census before the birth of Christ occurred in 8 B.C. The next census did not occur until A.D. 14. The censuses were scheduled to occur every 20 years with updates every five years. The update nearest the birth of Christ was thus in 3 B.C. These, like annual taxes, were more or less automatic, requiring no proclamation.

Armenian sources, as well as Josephus, report that in 3 B.C. the census also entailed an oath of fidelity to Caesar. But the oath was to be administered at the temples, not in the home towns of the participants. Hence this oath of allegiance could not have been the taxation referred to by Luke.

Now Luke 2:2 reports that:

this taxing was first made when Cyrenius was governor of Syria,

indicating that Cyrenius was sole governor of Syria, not a co-regent. Josephus reports that Saturnius was governor in the spring of 2 B.C. and that Varus replaced him in the autumn of 2 B.C. But it seems likely that both of these regents would be in Rome for the summer festivities, thus leaving room for Cyrenius to be governor of Syria from the early summer of 2 B.C. until the early fall of 2 B.C.

The indications are that Jesus was born late August or early September of 2 B.C., the new moon before the new year being the 29th of August that year. Had he been born the 29th, then 40 days later his presentation in the temple would have fallen on the Day of Atonement. Five days later would have been the Feast of Tabernacles when all Jewish males were legally required to be in Jerusalem. Luke 2:39 reports that after this, they returned to Nazareth.

There are two things to notice about the coming of the wise men. First of all, at no point in Scripture does it say that they saw the child in Bethlehem. They asked for the birthplace and that was identified as Bethlehem, but Scripture does not say that the star led them to Bethlehem. The star could have led them to Nazareth. Secondly, it is clear that when the wise men saw him, Jesus was no longer an infant but was a child and he was no longer in a manger but was in a house. It is thus not at all inconceivable that the wise men came late in 2 B.C. and happened upon Joseph and Mary in Bethlehem. These might have been there visiting family and friends at the Feast of the Dedication (Hanukah) in December. This would then date the flight into Egypt in late December and Joseph, Mary, and Jesus would then not have stayed in Egypt any longer than about 40 days; for Herod would have died January 38 of 1 B.C.

If then, the birthdate of Christ can be established as 2 B.C., what of the usual Christian interpretations of the Star of Bethlehem? The most popular of these accounts is the 7 B.C. triple conjunction of Jupiter and Saturn. A

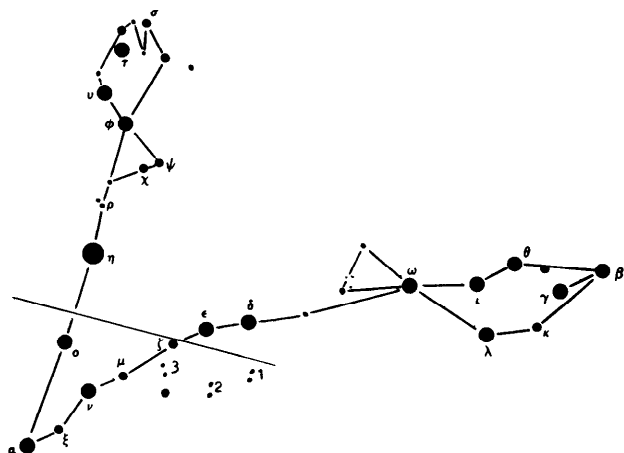


Figure 1. The constellation of Pisces showing the relative positions of Jupiter and Saturn during their triple conjunction of 7 B.C. The position labelled 1 marks the location of the two planets on May 27, 2 indicates their position on October 5, and 3 shows the December 1 location. In each case Jupiter is the northern point and Saturn is the southern point.

tremendous amount of mythology has been constructed around the account since Kepler wrote about it in the sixteenth century. The scenario of the 7 B.C. conjunction is as follows:

The Theory of Conjunction

On May 27 of 7 B.C., Jupiter and Saturn approached each other and came as close as 0.99 degree from each other. This distance is about twice the apparent diameter of the moon which is about 0.5 degree. They then proceeded further apart only to reverse direction, approaching each other again until a separation of 0.98 degree occurred on October 5. The final conjunction occurred December 1 of 7 B.C. when there were 1.05 degrees separating them.

One of the mythological embellishments which have become affixed to the triple conjunction has to do with the Day of Atonement. The Day of Atonement fell on October 3 in the year 7 B.C. Hence a number of writers have dated the central conjunction as happening on that day. But Tuckerman's tables²¹ indicate that the conjunction occurred two days after the Day of Atonement on October 5. The 30th of September is also sometimes erroneously given as the date of the second conjunction.

A second myth that is often repeated about the triple conjunction of 7 B.C. is that the two planets fused into one brilliant star. In actual fact, they never came any closer to each other than about two apparent lunar diameters; hardly noteworthy at all. Furthermore, an even closer triple conjunction of Jupiter and Saturn occurred some 59 years earlier. It, too, was in the constellation of Pisces and would have been an even more spectacular and significant herald of Christ's birth. But no wise men are reported as having showed up in Jerusalem at that time.

A third myth associated with the 7 B.C. conjunction is the story that it was Kepler who first associated the conjunction with the birth of Christ. Actually, the Annals

of the Abbey of Worcester, in reporting on the 0.17 degree approach between Jupiter and Saturn during their triple conjunction in Pisces in 1285, noted that such an event had not happened since the birth of Christ.²² All in all, then, it seems very unlikely that the triple conjunction of Jupiter with Saturn in 7 B.C. was any portent to the Lord Jesus Christ's birth.

Martin²³ claims that the star referred to by the wise men was none other than the planet Jupiter. But if that were so, then there would be negative significance in addressing Herod with the words: "We have seen his star in the east" (Matthew 2:2) since such an event occurs regularly as clockwork every 13 months. Martin thus claims Jupiter as the Star of Bethlehem, but others²⁴ have, by the same type of argument, selected Saturn.

Planetary Configurations at that Time

Yet there were a number of significant and unusual planetary configurations in the years 3 to 2 B.C. Sequentially, they start with a conjunction of Jupiter with Venus on the 12th of August, 3 B.C. At that time the planets came within 0.23 degree of each other, about half of the apparent angular diameter of the moon. That conjunction was followed by another on the first of September of that year when Venus and Mercury approached each other to within 0.36 degree.

On the 14th of September of 3 B.C. Jupiter had the first of a triple conjunction with the star Regulus, the brightest star in the lion. At that time it passed about 0.63 degree from the star. The following 17th of February, the second of the triple conjunctions took place. This time the separation of the two objects was 1.19 degrees. The last of the triple conjunction occurred on May 9 of 2 B.C. when the star and the planet were 1.06 degrees apart.

The following month, on June 17, 2 B.C., Jupiter again came into conjunction with Venus. This time the conjunction was truly spectacular as the two brightest objects in the sky outside of the sun and the moon merged together into what, to most human eyes, appeared as one object. At their closest, they were only 0.05 degree apart.

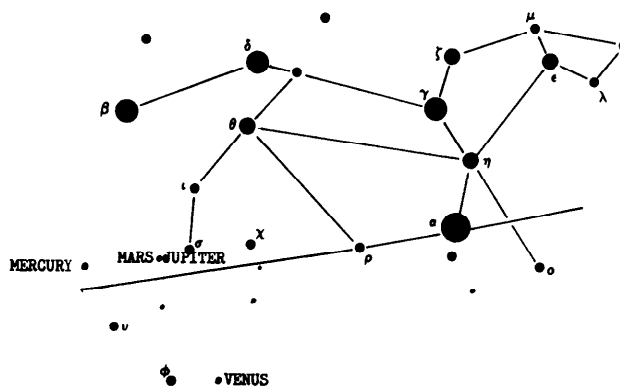


Figure 2. The constellation of Leo showing the positions of the planets in that constellation on August 29, 2 B.C. Here, as in Figure 1, the ecliptic is shown as a straight line which does not connect two stars.

Finally, on the 27th of August of 2 B.C., Mars and Jupiter passed within 0.14 degree of each other. At that time all the major planets, except for Saturn, were in the constellation of Leo, being massed within 10 degrees of each other.

Spectacular and intriguing though such conjunctions may be, yet they cannot possibly be the Star of Bethlehem. Matthew plainly recorded that there was one star, not a group of stars. Hence all speculations which involve planetary configurations must be ruled out from the start. Besides, had the star been a planet, then Matthew could have used that word instead of "star," for our very word "planet" comes from the Greek word which Matthew would have used (Compare Jude 13). This does not mean that the above planetary configurations did not possibly have significance, for the very purpose of their creation was that they be for signs (Genesis 1:14). All it means is that the Star of Bethlehem itself could not have been a planet or a planetary configuration.

Thus it appears that the most spectacular planetary configurations all occurred in the year preceding the historic date of Christ's birth.

What, Then, Was The Star?

But what of the star? The wise men originally saw it in the eastern sky, in the light of dawn, as the Authorized Version clearly states in Matthew 2:25:²⁵

For we have seen his star in the east, and are come to worship him.

Then there is the requirement of Matthew 2:9 that the star definitely moved and stood still:

and, lo, the star, which they saw in the east, went before them, till it came and stood over where the young child was.

Thus the star moved and stood still. Not only that, but the star had to be close enough to the wise men in order to be able to lead them, to go "before them." Strictly speaking, there is no natural phenomenon known which can do this unless it be ball lightning. But ball lightning is too transient a phenomenon to have led the wise men for very long. It is certainly not a star.

That leaves us with only one alternative. The Star of Bethlehem was a miracle; an angel. Angels are often referred to as stars in the Scriptures. One such reference is Revelation 1:20 where we read:

The seven stars are the angels of the seven churches. Other references could be cited.²⁶ This resolves all difficulties about the nature and the behavior of the star since angels can move and stay still. Perhaps the angel first appeared in the constellation of Virgo, while the sun was yet in that constellation, even as the *Zend Avesta* required. If so, then it would have appeared about the first day of autumn in 4 B.C., some two years before the actual birth of Jesus as the Talmud indicated.

References

- ¹Montefiore, H.W. 1960. *Novem Testamentum*, II. E. J. Brill, Leiden, p. 211.
- ²Protevangelion 15:7 in *The Lost Books of the Bible and the Forgotten Books of Eden*. Collins-World, 1977, p. 35.
- ³Epistle of Ignatius to the Ephesians 4:11-13. *Ibid.*, p. 171.
- ⁴*Ibid.*, verse 9: that through (Christ's) passion he might purify water to the washing away of sin.
- ⁵Protevangelion 8:2. *Ibid.*, p. 28.
- ⁶The First Gospel of the Infancy of Jesus Christ 3:3. *Ibid.*, p. 40.
- ⁷Bunton, G. W. 1977. *The Star of Bethlehem*. Bernice P. Bishop Museum Press, Honolulu, pp. 7 & 10.
- ⁸Clark, D. H., J. H. Parkinson and F. R. Stephenson. 1977. An astronomical re-appraisal of the Star of Bethlehem—a nova in 5 B.C. *Quarterly Journal of the Royal Astronomical Society*. 18(4):443-449.
- ⁹*Ibid.*, p. 445.
- ¹⁰*Ibid.*, p. 445.
- ¹¹Morehouse, A. J. 1978. The Christmas Star as a supernova in Aquila. *Journal of the Royal Astronomical Society of Canada*. 72(2):65-68.
- ¹²Morehouse interpolates the Aquila supernova as having occurred between those associated with the Crab nebula and the Vela pulsars. The latter has been associated with an apparent supernova reported in an ancient Sumerian tablet, reputedly 6,000 years old. The Crab Nebula pulsar has a period of 0.033 second; PSR 1913+16b has a period of 0.059 second and the Vela pulsar has a period of 0.089 second. If we assume that the three pulsars are similar and correctly identified with their supernovae, and if we assume that t_0 is the initial period and r is its slow-down rate, then we can date the Sumerian tablet. We find that for 1978:
for the Crab Nebulae $t_0 + 924 r = 0.033$
for the Aquila object $t_0 + 1981 r = 0.059$
for the Vela pulsar $t_0 + r = 0.089$
Solving for t we find that the tablet may actually be as recent as 1200 B.C.
- ¹³Seiss, J. A. 1882. *The Gospel in the stars*. E. Claxton and Co., Philadelphia. Reprinted in 1972 by Kregel Publications, Grand Rapids. Pp. 28-29 and 161-162.
- ¹⁴Bullinger, E. W., 1893. *The witness of the stars*. London. Reprinted in 1976 by Kregel Publications, Grand Rapids. Pp. 34-40.
- ¹⁵Both Bullinger and Seiss depict Coma as a baby boy standing on the lap of a maiden. Seiss claims that the picture is found on the Egyptian Dendera constellation chart and, indeed, it is so depicted. But on the Dendera chart the figure is to the south of both Leo and Virgo, not to the east of Leo and to the north of Virgo as Seiss and Bullinger both depict it. Furthermore, Bullinger claims that the Dendera dates from about 2,000 B.C. (p. 36), but my own examination of the chart reveals that the Scorpio-Sagittarius region is closest to the horizon of the chart. This indicates that the chart is roughly 1500 years old; certainly not much more than 2,000 years old. This is consistent with the fact that the chart was found in a building dating from the Ptolemaic era (circa second century B.C.). It was probably not an original fixture in the building when the latter was erected but was probably added long after the building was new. For a copy of Bossi's 1820 drawing of the Dendera and for more information see: Allen, D. A. 1977. *An astronomer's impressions of ancient Egypt*. *Sky and Telescope*. 54(1):15-19.
- ¹⁶However, there is a pulsar, CP 1133, only 6 degrees west of Coma in the constellation of Leo; but it is west of Denebola which clearly places it in Leo; and it was not at all overhead in Israel in the time of Christ.
- ¹⁷Escobal, P.R. 1968. *Methods of astrodynamics*. John Wiley and Sons, New York. Pp. 277-280.
- ¹⁸Ussher, James. 1658. *The Annals of the World*. E. Tyler, London. p. 820.
- ¹⁹Critics have often claimed that the Greek does not say that Jesus "began to be about" 30 years old but that, instead, the Greek actually says that Jesus was about 30 years old "when he began his ministry." In actual fact, however, no Greek manuscript has the words "his ministry" in it at all, it being purely a fabrication of the imaginations of the critics. To set the record straight, the Greek literally reads: "Himself Jesus began were-ing about thirty years being son . . .". If the middle-voiced "began" is separated from "to be" (or "were-ing") then the text should not be interpreted as "began his ministry", which words do not occur in the Greek, but, instead, the text would then be translated as "Jesus, himself was about 30 years old, began being the son . . .", which is clearly a nonsensical reading. Hence the correct translation of the Greek, as is attested to by all Reformation translations, is "And Jesus himself began to be about thirty years of age, being (as was supposed) the son . . .".
- ²⁰Martin, E. L. 1978. *The Birth of Christ Recalculated!* Foundation for Biblical Research, Pasadena. Chapter 2. Beware of some of Martin's most recent revisions which have thus far only been published in his newsletter. For example, he holds for a coincidence with the

14 September 3 B.C. conjunction of Jupiter and Regulus with the new moon. The new moon was actually on the 9th of September, not the 14th. The dates of new moon for 3 B.C. for the months of August and September are August 10 (23:12 Jerusalem time) and September 9 (13:09). For 2 B.C. they are August 29 (19:28) and September 28 (10:21).

²¹Tuckerman, Bryant. 1962. Planetary, Lunar and Solar positions—601 B.C. to A.D. 1. *Mem. of the Am. Philosophical Soc.* 56. American Philosophical Society, Philadelphia.

²²Luand, H. R., ed. 1869. *Ann. Monastici*, IV. London. P. 447.

²³Martin, E. L. 1978. *Op. cit.* also see Martin, 1976. The celestial pageantry dating Christ's birth. *Christianity Today*. December 3, pp. 16-22.

²⁴Hughes, D. W. 1977. Matters arising. *Nature*. 268(5620):565.

²⁵Bible critics often make much of the Greek *en te anatole* here, indicating thereby that this is a technical term meaning heliacal rising. They then claim that the translators of the Authorized Bible could not have known this. Yet, despite their implications to the contrary, the singular form, *anatole*, is used another time in Scripture. It appears in Luke 1:78 where it is translated as "dayspring" and where "heliacal rising" would be utter nonsense. Examination of the A.V. indicates that the criticism is groundless for the phrase "in the east" must of necessity refer to the prior noun, the star, rather than the subject of the sentence which is "we". Hence the star was seen in

the eastern sky, which can only be the morning sky. I have been unable to trace the *en te anatole* criticism back any further than Keller's book, originally written in German, which was translated into English by William Neil in 1956 under the title of *The Bible as History* (Wm. Morrow and Co., N.Y.). P. 350. Keller's original criticism was directed against all German translations but Neil applied the criticism to the English Bible without checking on the veracity of the application. The German Bibles use *Morgenland* which literally means "morning-country". But even in the German Bible the phrase is placed so as to describe the star, not the location from which it was observed. The latter is the case for all Reformation translations so that the criticism is spurious.

²⁶Num 24:17; Jg 5:20; Jb 38:7; Ps 104:4; Dn 12:3; He 1:7; 2Pe 1:19; Jude 13; Re 2:28; 9:1; 12:24.

(Editor's note). The following additional references may be of interest. Bouw, Gerardus D., 1980. A note on the upcoming triple conjunction of Jupiter and Saturn. *Creation Research Society Quarterly* 17(2):138-189. Comments of some planetary configurations occurring now. Maier, Paul L., 1968. Sejanus, Pilate, and the date of the Crucifixion. *Church History* (1):3-13, gives an argument, from Roman history, for 33 A.D. as the year of the Crucifixion. And Filmer, W.E., 1966 The chronology of the reign of Herod the Great. *The Journal of Theological Studies* XVII (2):283-298, re-investigates the question of the date of Herod's death.

ASA GRAY AND THEISTIC EVOLUTION

RANDALL R. HEDTKE*

Received 22 October, 1979.

In this article are discussed the scientific evidence which prompted Asa Gray to try to persuade Charles Darwin to adopt theistic evolution, and Darwin's reasons for rejecting theistic in favor of atheistic evolution. In their arguments, both men appealed to the fossil record. Besides their interpretations of that record, the one by Georges Cuvier is mentioned, and it is noted that yet others are possible. So various alternative interpretations of the record are considered, to see which one best fits the facts.

Proponents of theistic evolution should realize that their point of view, for good reason, was never seriously considered by the founders of evolution theory—except for Asa Gray. Theistic evolution, if not originated, was at least avidly promoted by the Harvard professor of botany, Asa Gray. Theistic evolution or the design principle (evidence of intelligent design in nature) attempts to include theism while not excluding evolution. It is an attempt to incorporate both *a priori* systems.

In a private letter, Gray explains his position as follows: "Since atheistic doctrines of evolution are prevailing and likely to prevail, more or less, among scientific men, I have thought it important and have taken considerable pain to show that they may be held theistically."¹ And in an anonymously written article, Gray explains his position similarly: "It would not be dealing fairly by our readers, and, especially, it would be unmindful of the apologetic value of natural theology, were we to look at this theory from any other point of view, than the twofold one of science and theology."²

Gray was not without influence, and he used it to try to persuade Darwin to adopt theistic evolution. Briefly stated, his argument for design goes like this: Did Dar-

win mean to exclude theism entirely? Gray had been comforting Americans by pointing out how Darwin recognized Divine purpose, citing, for example, the three quotations that Darwin had posted in the front of the *Origin*—two from theologians and one from Bacon—which emphasized "Divine power," "intelligent agent," and "book of God's word."³

If Darwin does not mean to exclude theism, why not assume that the Creator directed the evolutionary process? Gray described his concept of theistic evolution metaphorically as "streams flowing over a sloping plain (here the counterpart of natural selection) may have worn their actual channels as they flowed; yet their particular course may have been assigned; and where we see them forming definite and useful lines of variation, after a manner unaccountable in the laws of gravitation and dynamics, we should believe that the distribution was designed."⁴ John Dewey, one of the founders of the progressive education movement, aptly described Gray's theistic evolution as "design on the installment plan. If we conceive the 'streams of variations' to be itself intended, we may suppose that each successive variation was designed from the first to be selected."⁵

Needless to say, as the textbooks will verify, Gray's "design on the installment plan" was rejected by Darwin. In a private letter, Darwin informs Gray of the re-

*Mr. Randall R. Hedtké's address is Route 1, Clearwater, Minnesota 55320.

jection: "If the right variation occurred, and no others, natural selection would be superfluous." Himmelfarb describes Darwin's rejection in more detail: "For if each variation was predetermined so as to conduce to a proper end, there was no need for natural selection at all. The whole point of his theory being that, out of undesigned and random variations, selection created an evolution pattern."⁶ Publicly, Darwin rejected Gray's argument for theistic evolution, when on the last page of *Variation of Plants and Animals Under Domestication*, he concluded, "However much we may wish, we can hardly follow Professor Asa Gray in his belief in lines of beneficent variation."⁷

Darwin, of course, (whether or not he was right) could not admit supernatural intervention, if he was to have natural selection the great thing which he wanted it to be. If the Creator, periodically, introduced streams of beneficent variations, that is, useful variations which were preordained to accumulate into new kinds, in a miraculous way, this was really a slowed-down version of special creation. Dupree reports that Gray had to pay for his insistence on the design principle: "With Darwin's decision against the design argument, Gray lost his place as a shaper of strategy within the inner circle of friends."⁸

It mattered little to Gray if theistic evolution made natural selection superfluous; he thought the mechanism was overrated anyway:

We believe that species vary, and that "Natural Selection" works; but we suspect that its operation, like every analogous natural operation, may be limited by something else. Just as every species by its natural rate of reproduction would soon completely fill any country it could live in, but does not, being checked by some other species or some other condition—so it may be supposed that variation and natural selection have their struggle and consequent check, or are limited by something inherent in the constitution of organic beings.⁹

Similarly, Gray states that:

The organs being given, natural selection may account for some improvement; if given of a variety of sorts or grades, natural selection might determine which should survive and where it should prevail.¹⁰

Continuing the same line of thought, Gray again states that:

If it be true that no species can vary beyond defined limits, it matters little whether natural selection would be efficient in producing definite variations.¹¹

Gray felt that Darwin's theory was inadequate to explain the origin of life. Even if one were to concede that the natural selection mechanism works, the theory would still require a mechanism to provide correlated variations for selection. Natural selection does not create variations.

Gray's theistic evolution was more than an effect to save the creation concept while including evolution; it was also an hypothesis based upon the data from geology and paleontology. It was an effort to explain the fossil record which to him was inexplicable in terms of special creation or atheistic evolution. The stringing-

out of the fossils from "simple" to "complex" indicated, contrary to special creation, a coming into existence of new life forms at successive periods in the earth's history. On the other hand, the absence of intermediate fossils, although compatible with special creation, contradicts atheistic evolution. Gray describes it this way:

Why it is asked, do we not find in the earth's crust any traces of transitional forms? The lame answer is, that "extinction and natural selection go hand in hand." In other words, traces of the higher forms exist, but the transitional ones, having served their ends, are lost! You might as well say that, when in after ages the site of a battle between the Caffres and British shall be disturbed, there will be found only the traces of the superior, conquering race. But it will not do to plead imperfection of the geological record. If any data may be relied on in this question, those supplied to us by the paleontologist may be so.

The truth is, that if the author has wholly and signally failed to produce even one unquestioned corroborative proof of true transitional variety among present forms of life, he cannot discover material in the geological record for a chapter on transitional varieties in paleontology. But while we shall not ask our readers to survey the fossiliferous deposits, there are two subjects we wish to refer to ere we close. These are the question of breaks in the introduction of life, and the question of miraculous action.¹²

From the very outset, even before the publication of the *Origin*, Gray, aware of its contents, could not reconcile the lack of intermediate forms with Darwin's development hypothesis. To Joseph Hooker, later director of Kew Gardens and close friend of Darwin, he writes: "Assume the extinction of any quantity of intermediate forms and you can then imagine the development of the present vegetable kingdom by excessive variation. But just consider what an enormous amount of sheer, gratuitous assumption this requires!"¹³

Even T. H. Huxley, "Darwin's bulldog," was compelled to agree with Gray about the fossil record:

What, does an impartial survey of the positively ascertained truths of paleontology testify in relation to the common doctrine of progressive modification? It negatives these doctrines; for it either shows us no evidence of such modification, or demonstrates such modification as has occurred to have been very slight; and, as to the nature of that modification, it yields no evidence whatsoever that the earlier members of any long-continued group were more generalized in structure than the later ones.¹⁴

For Gray, then, the breaks in the introduction of life can be explained by miraculous action:

The question of the presence of miracle, at various points in the history of the earth, is one which has been, with a strange want of logic, almost universally regarded by eminent men with suspicion. Why? We suppose very few, if any, not even excepting Mr. Darwin, would be willing to deny that there has been the exercise, at some period of the

earth's history, of creative power—in a word, miracle. But if you acknowledge its presence at any one point, why be suspicious of it, or deny its probability, at any after-point in the history? If in every respect you find that what demanded a miracle at A, is again found existing at E, after having ceased to be before it again made its appearance, first at B, second at C, and third at D, is there anything to forbid the conclusion, that at every one of these stages there was miraculous action?¹⁵

Cuvier's Views Contrasted with Gray's

It would be well to digress for a moment and consider Georges Cuvier's attempt to solve the riddle of the fossil record. The reader should be aware that Cuvier, one of the most influential men in science in his day and the founder of paleontology, was writing prior to the publication of the *Origin*, yet at a time when the idea of evolution or the transformation of life preoccupied many men in science, and while Sir Charles Lyell's uniformitarian geology was gaining wide acceptance over catastrophic geology. Cuvier, like Gray, could not reconcile the absence of intermediate fossils with evolution theory:

He based his entire refutation upon the incompleteness of the fossil record. If the fossils could not show us the course of the supposed transmutations, what reason was there to believe that these unusual events had actually occurred? The fossils were our only record of life in the remote past, and their lesson was obvious and not at all, Cuvier believed, what the transformists would have liked it to be. Not a continuous series of almost similar creatures but rather an interrupted sequence of dissimilar forms was what was discovered. "We may," said Cuvier, "respond to them (transformists) in their own system that, if the species have changed by degrees, we should find some traces of these gradual modifications; between the paleotherium and today's species we should find some intermediary forms: This has not yet happened."¹⁶

Whereas Gray's attempt to solve the riddle of the fossil record was "progressive," Cuvier's was "extinctive." As Coleman describes it:

His system was, if anything, "extinctive," eliminating by catastrophe, and not "progressive," creating (through God) new and higher creatures as an aftermath of catastrophe. There had been a succession of discrete populations, each more or less complete, and each neatly perishing by the action of some remote catastrophe.¹⁷

Nordenskiöld makes this clarification about Cuvier's catastrophic geology:

The assertion that so often occurs in literature that, in his view, life had been created anew after each catastrophe is utterly incorrect; on the contrary, he points out that isolated parts of the earth may have been spared on each occasion when it was laid waste, and that living creatures have propagated their species anew from these cases, which indeed he expressly applies to the human race.¹⁸

As the reader may have gathered, Cuvier's explanation of the fossil record required the rejection of uniformitarian geology which Coleman describes as follows:

Rain, snow, and ice, Cuvier admitted, do attack and wear away the mountains and hills, but this argument assumed "the pre-existence of mountains, valleys, and plains, in a word, all the inequalities of the world, and consequently could not have given rise to these inequalities." Sedimentation could produce no major changes in the level of the sea, whatever minor changes were known being either still in question or purely local phenomena. Volcanos, the principle factor in the Huttonian (James Hutton, who preceded Lyell in advancing the idea of uniformitarian geology) system, generated curious and extensive local upheavals profoundly changing the surrounding countryside but not, Cuvier believed, disturbing the adjacent strata. Astronomical causes such as comets or precession were equally rejected. Cuvier concluded that all of these forces lack the strength and generality which, judged by the effects, are required and that "it is in vain that one seeks, in the forces presently acting on the surface of the earth, causes sufficient to produce the revolutions and the catastrophes the traces of which its surface discloses to us."¹⁹

Nordenskiöld describes Cuvier's catastrophic geology this way:

He at once takes it for granted that these changes had the character of violent catastrophes; that they were violent he considers to be established by the fact of stratifications which, judging from the nature of the fossils, have demonstrably taken place in the sea, are now found on the one hand elevated to enormous heights and on the other hand overthrown and inverted. That all this took place with great rapidity is obvious to his mind, not only from the sharp lines of demarcation shown by the various strata, but also from the fact that many of them contain such extraordinarily numerous animal remains that it can only be assumed that they died a sudden death as the result of upheavals which obliterated all life (in some areas?) for the time being.²⁰ (Parentheses mine.)

Needless to say, Cuvier's series of catastrophes is not the brand of geology preferred by either the atheistic evolutionists or the special creationists.

The Various Theories Contrasted

What all of this condenses down to is that Gray had made the fossil record explicable at the high cost of destroying the natural selection mechanism, that which made Darwin's theory unique from all previously formulated evolution theories. Gray's "design on the installment plan," as Dewey described it, was, more specifically, "creation on the installment plan." Theistic evolution is not really evolution at all. Cuvier had made the fossil record explicable at the expense of both the evolutionist's uniformitarian geology and the special creationist's flood geology, meaning a single, world-wide catastrophe.

From Gray's, Cuvier's and Huxley's point of view, the

atheistic evolutionists, if their theory was to be credible, would have to produce large numbers of intermediate fossil forms as predicted by the theory or formulate an hypothesis based upon facts to explain their absence; otherwise, it is in violation of a well established axiom in science which states that, "A single absolute conflict between fact and hypothesis is fatal to the hypothesis; *falsa in uno, falsa in omnibus*."²¹

Likewise, the special creationists are obliged to explain the stringing-out of the fossils from "simple" to "complex" compatibly with their point of view.

Let us review briefly what has been learned concerning the fossil record: It is not possible for the same evidence to at once refute and support an hypothesis. The absence of intermediate fossils is prime evidence against evolution theory; and it is the responsibility of evolutionists to prove the existence of such forms or formulate a credible hypothesis based upon facts to explain their absence. It is not the critic's responsibility, to try to prove a negative. Evolutionists have failed in this responsibility, yet the theory which they defend has not had to bear the full weight of this conflicting fact, because the stringing-out of the fossils from "simple" to "complex" is "as it should be." The net result is that the conflicting fact appears not to be as serious as it should be. Nevertheless, we are still left in the impossible situation of having the same evidence at once both support and refute an hypothesis.

It seems to me, I must add, that we creationists are ourselves not the paragons of objectivity that we should try to be when we dwell on the lack of intermediate forms and ignore the stringing-out from "simple" to "complex." We must find a way to bring the stringing-out of the fossils into conformity with special creation, so that the full weight of the conflicting fact of no intermediate forms will fall upon the theory of evolution. Therefore, with this historical information in mind, I wish to again offer the concept of Relative Fossil Production Potential (RFPP) as a possible explanation for the stringing-out of the fossils from "simple" to "complex."²²

Relative Fossil Production Potential

The qualitative equation goes like this: Quantity of Fossils Produced = Habitat + Population Size + Size and Structure. Ostensibly, the fossil record reveals the sequence in which organisms evolved into existence, but, in reality, according to RFPP, it reveals an ecological-geological fossilization phenomenon. Generally speaking, the so-called "simple" kinds have greater likelihood of producing more fossils than the so-called "complex" kinds. Consider, if you will, the fossilization potential of clams as compared to camels, which represent opposite ends of the fossil record.

The factors that determine fossil production cannot be applied to the various kinds of plants and animals in any mechanical law-bound sense; but it is obvious nevertheless that variations in fossil production potential must exist. For example, fishes must have a greater RFPP than most reptiles and the RFPP of algae must be greater than most land plants. Whereas RFPP predicts a tendency for fossils to be strung-out, the evolutionary interpretation of the fossil record is a law-bound predic-

tion; it is obliged to reveal a stringing-out of the fossils from "simple" to "complex," as well as intermediate kinds of fossil. Contrary to the prediction, the fossil record has revealed many anomalies from the viewpoint of evolutionary progression, which, on the other hand, are predictable according to RFPP. The Lewis "overthrust" in Montana is frequently cited as an example. In this area "Pre-cambrian" rocks (rocks that are characterized by an absence of distinguishable fossils, making them even older than the "Cambrian" rocks which contain invertebrate fossils) are lying above "Cretaceous" rocks which allegedly are of the period when reptiles evolved.

Another example that contradicts the evolution interpretation of the fossil record, but serves to demonstrate RFPP, is the discovery of pollen grains from Angiosperm and Gymnosperm trees in "Pre-Cambrian" rocks. Flower-producing plants and cone-producing trees were not supposed to have evolved for hundreds of millions of years after the "Pre-Cambrian" rocks were laid down. Which has the greatest RFPP, pollen grains or the trees that produce them? Applying the factors in the qualitative equation, the pollen grains, which are produced like dust in the air, must have a population size millions of times greater than the parent trees; and their tiny size, with a covering that is somewhat resistant to decomposition, lends itself to deposition and preservation in sediment. Couple these two factors to a wide-spread wind-blown habitat, and it is conceivable that the pollen would be discovered in "Pre-Cambrian" rocks while the contemporaneous parent plants may have become part of the "Carboniferous" coal strata which evolutionists believe to be millions of years younger.

Many more out-of-sequence anomalies have been reported which may be considered evidence for flood geology rather than uniformitarian geology. For this reason, the RFPP concept originally was based upon flood geology, yet I would be committing an error common to the natural philosophers, that is, overloading the theory, if I were to insist that RFPP, in itself, is proof of flood geology and can only be considered in reference to flood geology. RFPP is a fact about our environment and must be considered regardless of what one's brand of geology may be. RFPP is applicable to either uniformitarian or catastrophic geology. Evolutionists, it would seem are obligated to incorporate RFPP, a relevant fact, into their interpretation of the fossil record. If they would, my thinking is that it would be sufficient, especially when also considering the conflicting fact of the absence of intermediate fossils, to account for the stringing-out of fossils and make the evolution interpretation superfluous.

Summary: The Hypotheses Compared

Let us summarize, as I see them, the merits and weaknesses of the various hypotheses that pertain to the fossil record. Asa Gray's theistic evolution hypothesis, that life came into existence at consecutive periods in the earth's history, has the virtue of explaining the stringing-out of fossils and predicts no intermediates. Its drawback seems to be that the stringing-out from "simple" to "complex" is law-bound, consequently, it does

not explain the anomalies where fossils are found out of sequence, with no evidence of overthrust.

Georges Cuvier's hypothesis based, apparently, upon special creation and a series of catastrophes, might explain the stringing-out and certainly predicts no intermediate fossils. Out-of-sequence fossils are not an anomaly to his hypothesis; it is predictable that they could occur.

Charles Darwin's evolution hypothesis accounts for the stringing-out of fossils, but is contradicted by the lack of numerous intermediate fossils which it predicts should be found. Also, it is hampered by the law-bound prediction that fossil remains will be found in sequence from "simple" to "complex" as they supposedly evolved into existence.

The final hypothesis, based upon special creation and relative fossil production potential, explains the stringing-out and predicts no intermediate fossils. The stringing-out is not law-bound; therefore, out-of-sequence anomalies are predicted, or at least allowed. Its advantage, though, is that it takes into consideration a fact of life that the other hypotheses do not incorporate, namely, that some kinds of organisms have a greater potential for leaving a greater quantity of fossil remains than others.

Of the four hypotheses, Darwin's evolution hypothesis seems to be the least likely candidate, even though it is the only hypothesis presently in the textbooks.

The quotes contained in this article reveal how the history of evolution theory has been distorted and unwanted parts suppressed, in the popular textbooks. As a result, over the years, evolution theory has become scientific dogma, consequently, the mind-set for most people is to think of it philosophically, when, in reality, it is a scientific statement about our environment that does not agree with the facts.

Footnote

I quoted from two articles anonymously published in the *North British Review* in 1860 and 1867; Darwin attributes the authorship of the 1860 article to a Rev. Mr. Dunns and identifies Fleeming Jenkin, a British engineer and inventor, as the author of the 1867 article. He also refers to the article in the sixth edition of the *Origin*, but does not venture publicly to name Jenkin.

I located the articles in Poole's *Index to Periodical Literature*, Vol. I, 1802-1881, listed under the name of Asa Gray. In the preface to the index, Poole testifies to having reliably identified the authors of anonymous articles published in the *North British Review*. I find Gray's essays on evolution theory in *Darwiniana* (T. H. Huxley also

wrote a book of essays entitled *Darwiniana*) compatible with the anonymous articles in the *North British Review*.

Also, in a letter to the editor in *Nature* magazine, we see the similarity of thought between it and those published in the *North British Review*, regarding limited variability. The article was published under Gray's name in 1883; this was about one year after Darwin's death. The gist of it reads as follows:

Fairly is it said that "the theory merely supposes" this. For omnifarious variations is no fact of observation, nor a demonstrable or, in my opinion, even a warrantable inference from observed facts. It is merely an hypothesis to be tried by observation and experiment.

He concludes:

The upshot is, that, so far as observation extends, it does not warrant the supposition of omnifarious and aimless variation; and the speculative assumption of it appears to have no scientific value.

Darwin's position on the question of limited variability or unlimited variability (alleged useful-for-survival mutations being the sources of variability) was diametrically opposed to Gray's position: "That a limit to variation does exist in nature is assumed by most authors, though I am unable to discover a single fact on which this belief is grounded."

References

- ¹Dupree, A.H. 1959. Asa Gray. Harvard University Press, p. 359.
- ²Gray, A. 1860. The origin of species. *The North British Review*, 32:456.
- ³Ward, H. 1927. Charles Darwin—the man and his warfare. The Bobbs-Merrill Co., Indianapolis, p. 321.
- ⁴Dupree, A.H. *Op. cit.*, p. 297.
- ⁵Dewey, J. 1951. The influence of Darwin on philosophy. Peter Smith Co., New York, p. 12.
- ⁶Himmelfarb, G. 1959. Darwin and the Darwinian revolution. Chatto and Windus, London, p. 286.
- ⁷Darwin, C. 1896. The variations of animals and plants under domestication. AMS edition, New York, p. 428.
- ⁸Dupree, A.H. *Op. cit.*, p. 301.
- ⁹Gray, A. 1963. *Darwiniana*. Harvard University Press, pp. 110-111.
- ¹⁰Gray, A. 1860. Review of Darwin's theory on the origin of species by means of natural selection. *The American Journal of Science and Arts*, 29(86):179.
- ¹¹Gray, A. 1867. The origin of species. *The North British Review*, 46:317.
- ¹²Gray, A. 1860. *Op. cit.*, p. 481.
- ¹³Dupree, A.H. *Op. cit.*, p. 265.
- ¹⁴Himmelfarb, G. *Op. cit.*, p. 272.
- ¹⁵Gray, A. 1860. *Op. cit.*, pp. 486-487.
- ¹⁶Coleman, W. 1964. Georges Cuvier—zoologist—a study in the history of evolution theory. Harvard University Press, p. 150.
- ¹⁷*Ibid.*, p. 151.
- ¹⁸Nordenskiöld, E. 1928. The history of biology. Tudor Publishing Co., New York, p. 338.
- ¹⁹Coleman, E. *Op. cit.*, p. 131.
- ²⁰Nordenskiöld, E. *Op. cit.*, p. 338.
- ²¹Jevons, W.S. 1958. The principles of science—a treatise on logic and the scientific method. Dover Publications, New York, p. 516.
- ²²Hedtke, R. 1971. A geo-ecological explanation of the fossil record based upon divine creation. *Creation Research Society Quarterly* 7(4):214-221.

PANORAMA OF SCIENCE

Horned Beetles

Recently in the Scientific American William G. Eberhard discussed five beetles in the family Scarabaeidae.¹ In each of these beetles the arrangement of the horns is very distinctive, yet for a long time none seemed to be of any particular use to the beetle. In fact Darwin never did understand their function, and con-

cluded they must serve to impress females. Gilbert J. Arrow wrote a whole book arguing that beetle horns are functionless, their evolution having run wild, free of the restraints of natural selection.

Only lately have actual studies of the life histories of these beetles been made; and Eberhard shows that their horns do indeed have vital functions. Though he makes

the usual mention of "why a particular shape evolved in a particular species," he then goes on to speak of the *design* of the horns in relation to the task it has to perform.

The first beetle he discusses is *Golofa porteri* which lives up high in the Andes on bamboo-like plants, and competes with other members for possession of their edible shoots. Eberhard constructed similar supports in his laboratory and found that when the males confront one another each holds onto the support with its middle and hind legs, wraps its long front legs around the other's body, tilts its prothorax, and thus inserts its curved head horn under the other's body. The attacker then jerks its head up in order to throw the other beetle off of the support. This procedure is not always successful, in which case the original occupant of the shoot may succeed in throwing off the attacker by a similar procedure. This beetle also has a thinner prothoracic horn, the function of which has not as yet been determined.

Rhinostomas barbirostris, or the bearded weevil, lives on fallen palm trees, the females drilling small holes for their eggs. The male has an elongated beak somewhat like that of a Playtpus. When a rival male comes near, the defender lowers his beak, quickly inserts it under the other's body, and snaps his head up, raising his body up on his long front legs, thus attempting to knock the intruder off of the tree trunk. The top of the beak is even covered with small knobs and spikes so that it will not slip when it is raised up against the other beetle's body! Again, the defense is not always successful.

Another use made of horns is the lifting of opponents as exemplified by the tropical scarab, *Podischnus agenor*. These scarabs inhabit the stalks of sugar cane, making tunnel-like burrows in them. Their horns are pincerlike, the head having a long upward and backward curving horn, and the prothorax a forward-projecting rather short one. The larvae of these beetles live in the soil, digesting its humus content, and then pupating there. Their mandibles are used to cut through the tough cane fibres, and they feed on the sweet cane juice as they burrow the tunnel. They attract a female by the emission of a pungent odor called a pherome, and mating takes place at the entrance of the tunnel, which the female then enters. Now any other male invading the burrow tries to displace the defending male by inserting its head horn under the other's body, and the prothoracic horn over it. Each tries to lift the other off the sugar cane stalk and drop it on the ground.

A large speckled plant beetle closely related to *Doryphora punctissima* has a short horn curving forward from the under side of the thorax, a most unlikely place for a horn it would seem. Actually they are remarkably well designed for their purpose, for they function rather like a can opener. These beetles feed on small vines and the attacker beetle hooks its horn under the edge of the other's body, then pushes forward and upward, thus prying the other off the leaf, as a can opener does a bottle top.

Even more bizarre are the horns of a darkling beetle related to *Molion muelleri*. Their small head-horn hooks forward and their sturdy mandible horns, which look like antlers, rise up and curve slightly out from the

head, ending in flattened tips that point forward, and also slightly inward. They can be opened and closed. Now when these two darkling beetles meet head on in a tunnel of a log, the more aggressive one rolls over 180 degrees so that its "antlers" can act as pincers for grasping its opponent behind the head. By so doing it also becomes subject to attack, and pairs of these beetles have been found thus interlocked. It is not known exactly what they fight over, or what "victory" consists of in this species.

Eberhard concludes that horns therefore function in intraspecific fighting, and have evolved because winning such fights is selectively advantageous. Yet many questions remain unanswered, he says, such as why such a spectrum of horn designs is found within a single beetle genus, such as the dung beetle *Athyreus*. Presumably these species live under *similar* conditions, yet have remarkably dissimilar horns. Just why should this be, Eberhard asks. There is also the question of how "minor" or small males nearly devoid of horns coexist with "major" or large horned males of the same species. These unarmed beetles should lose fights and so fail to reproduce, the genes for hornlessness thus being rapidly eliminated from the population. Now two species have been carefully studied as regards this problem.

In the bearded weevil a continuous range of sizes exist up to four times longer, and twenty times heavier than the smallest, depending on the feeding conditions of the larvae. The very small males simply avoid contests with large males, and sneak by them while they are fighting with each other; and thus mate with the females. When the large male does notice a small one, he flips him away with his large elongated beak, but mating by then has often occurred; if not the small male may simply try again.

A more complex situation exists in the sugar cane beetle *Podischnus agenor*. Here when body size is plotted against horn size, two distinctive body plans are found, which do not intergrade. These are coded by two distinct sets of genes, a minor or small version, with minimal horns, and a major one with substantial horns. It also appears that each male is genetically capable of developing either morphology depending on how much food the larvae obtain. The minors compensate for their inferior fighting ability by emerging from the soil earlier, and then dispersing over a wider area than the major ones.

Eberhard then tries to explain how these two types could have evolved. He postulates a competition for vital resources as being so intense that smaller individuals are virtually excluded from reproduction, yet one in which inadequate feeding conditions for the larvae continue to result in small adults. This would favor alternative behavioral patterns for smaller individuals, such as earlier emergence, so that sufficient reproductive capability is left to maintain the small sized or minor type, and eventually the two distinct non-intergrading types result.

Like many other evolutionary hypotheses the conditions postulated by Eberhard have not actually been observed, especially the intense competition for vital resources.

To creationists it is interesting that Eberhard says

that observers of the horned beetles "check to see whether the *design* of the horns seems to be compatible with the mechanical demands of the task to which they are applied." Surely a design needs a designer! Again when discussing the prying ability of *Golofa porteri* he says "the male is *endowed* with a pair of monstrously elongated front legs." Endow here means to equip with, implying someone to do the equipping. Concerning the possible evolution of horns as intricate as those of the beetles described by Eberhard, of what possible use could a mutation causing an incipient horn of the "bottle opener type" be? For until such a horn is properly curved and of sufficient strength and length it would be quite a useless structure indeed.

Again, the horns of *Podischnus agenor* are intricately designed to fit into the body, the prothoracic horn fitting snugly against the resident beetle prothorax and horny wing covers, and the long head horn fitting the rear end of its body. Here also these horns could hardly have been selected for when merely bulges from the prothorax and head.

As creationists we also are faced with problems trying to explain such complexity of horn design. Possibly this is because insects are of such *comparatively* small size. Thus if a horned beetle were magnified to the size of a horse, then indeed as Darwin said "with its polished bronzed coat of mail, and vast complex of horns it would be one of the most imposing animals in the world." So then these creatures from the viewpoint of their Creator are fully as important as any other creatures. They certainly perform useful tasks; the larvae of the tropical scarab eat soil and digest its humus content, thereby making it more available for plant use. Some from the human point of view are pests, such as the same beetle when mature and making burrows in sugarcane stalks.

As regards interpreting these intricate endowments of the horned beetles, two sayings of our Lord may be helpful. Thus He says in Matthew 10:29: "Are not two sparrows sold for a farthing? And one of these shall not fall to the ground without your Father. But the very hairs on your head are numbered. Fear not therefore, ye are of more value than many sparrows." Even the smallest of God's creatures are very important to Him, so much so, that the death of even one sparrow comes within the notice of divine providence.

Secondly our Lord says, Matthew 6:28-29: "Consider the lilies of the field how they grow; they toil not, neither do they spin: and yet I say unto you that even Solomon in all his glory was not arrayed like one of these." Though used primarily to caution us not to be unduly concerned about where the money will come from for food and clothing, these verses are important in giving us an insight into God's concern for making a beautiful as well as useful creation, even as regards seemingly unimportant creatures. So in making the various scarab beetles, creation of the minor type of hornless sugar cane borer would no doubt have been sufficient to provide for the continuity of this species. But the major type was also created with its intricate horns, and resulting duels during the mating season, possibly as a way to insure the greatest possible genetic variability and resulting survival of the species.

Now in so doing the horns were beautifully proportioned and admirably designed for their tasks, resulting in most remarkable creatures. In fact it might well be said that one rule of creation is, that although many creatures are the "work horse type" and relatively drab (though all have much beauty) in every family of plants and animals some are always the "show case" of creation. That is, they are endowed with more beauty or intricacy of design than seems really necessary for their mere existence. How else can one account for the "lilies of the field," such superbly colored butterflies as the swallowtails, the peacock among the pheasants, or the intricately designed horned beetles? Right in my own back yard each spring day the brown towhee, *Pipilio fuscus*, is patiently at work hunting for seeds and insects. It is a rather drab grey brown sparrow. Not so frequent is the rufous sided towhee, *Pipilio erythrophthalmus*, which likes to rummage among dead leaves. It is a very beautiful bird with a white belly, robin red sides, iridescent black head, and intricately arranged rows of white spots on its back and wings. Evolutionists would be rather "hard put" to explain the origin of such a beauty.

As Eberhard modestly and correctly concludes: "That horned beetles have been so often the subject of speculation but so seldom the subject of serious study is curious. Surely there is time for the contemplation of these splendid animals with which we share the earth."

—Contributed by Walter E. Lammerts

Stormy Waters Underseas

A recent news release describes a new kind of underwater storm.² Sea water samples from depths of 5000 meters were muddy. Deep sea water is usually crystal clear, but samples taken from the Atlantic Ocean sea floor south of Nova Scotia contain 100 times more sediment than water samples collected from most parts of the ocean and was several times more turbid than any sample previously taken.

The mud was being kicked up by intermittent deep ocean currents more rapid than any previously described. The speed was estimated to be as high as 20-50 cm/sec. Interestingly, the high currents rise and fall rapidly and, in some cases, change directions. Turbidity decreased 20 percent in an hour and 5 percent in a minute, suggesting sediment in clouds smaller than 1 km in size. The cause of such underwater turbulence is in debate.

Such sea floor turbulence is of interest to creationists because of our emphasis on flood geology. Evidence indicates rapid and profound changes are occurring, even at great depths today. Such evidence obviously raises questions regarding dating by sedimentation and should provide an area for further research.³

—Contributed by E. Norbert Smith

Decrease of Earth's Magnetic Field Confirmed

A satellite launched by NASA in 1979 has gathered new data on the earth's decreasing magnetic field. Magsat, as the satellite was called during its eight-month lifetime, measured the earth's main magnetic field.

The overall intensity of the earth's field was found to be declining at a rate of 26 nanoteslas per year, with a half-life of just 830 years!⁴ Thomas Barnes' results based on earlier data gave a decay rate of 16 nanoteslas per year and a 1400 year half-life.⁵⁻⁹

The revised figure, if correct, means that the earth's magnetic field is decaying more rapidly than previously thought. Extrapolation shows that the field strength should reach zero in 1200 years. The earth is younger, and the time later, than many think.

—Contributed by Don B. DeYoung

References

⁴Eberhard, William G., 1980. Horned beetles. *Scientific American* 242 (3):166-182.

²Kerr, Richard A., 1980. A new kind of storm beneath the sea. *Science* 208 (4443):484-486.

³See also the entire winter 1978 (vol. 21, no. 1) issue of *Oceanus*.

⁴1980. Magsat down; magnetic field declining. *Science News* 117 (26):407.

⁵Barnes, Thomas G., 1973. Origin and destiny of the Earth's magnetic field. Creation-Life Publishers, San Diego. P. 36.

⁶Barnes, Thomas G., 1971. Decay of the Earth's magnetic moment and the geochronological implications. *Creation Research Society Quarterly* 8 (1):24-29.

⁷Barnes, Thomas G., 1972. Young age vs. geologic age for the earth's magnetic field. *Creation Research Society Quarterly* 9 (1):47-53.

⁸Barnes, Thomas G., 1973. Electromagnetics of the earth's field and evaluation of electrical conductivity, current, and joule heating in the earth's core. *Creation Research Society Quarterly* 9 (4):222-230.

⁹Barnes, Thomas G., 1975. Earth's magnetic energy provides confirmation of its young age. *Creation Research Society Quarterly* 12 (1):11-13.

BOOK REVIEW

Unknown Earth: a handbook of geologic enigmas, compiled by William R. Corliss, 1980. The Sourcebook Project, P.O. Box 107, Glen Arm, Md. 21057. 833 pp. Price: \$19.95.

Reviewed by Douglas E. Cox*

The importance of the anomaly in scientific research has been increasingly recognized since the publication of Kuhn's *The Structure of Scientific Revolutions*.¹ According to Kuhn, discovery commences with the awareness of anomaly.

Perhaps anticipating an increased interest in this subject, William Corliss has edited a handbook on geologic anomalies, containing information that either contradicts current geologic theories, or raises questions not considered to have been adequately answered.

Most Creationists would probably agree that geology is one area of science that is overdue for some revolutionary concepts. *Unknown Earth* is likely to be a catalyst in these revolutions of the future. A reader might easily conclude that a major overhauling of the fundamental axioms of geology lies ahead.

Corliss relates that he became interested in the scientific anomaly upon reading a creationist classic by George McCready Price: *Evolutionary Geology and the New Catastrophism*.

A number of creationist works, including several items from the *Creation Research Society Quarterly*, are reprinted in this handbook. However, this viewpoint is not favoured at the expense of others. Corliss does state, in the Preface: "It will soon become obvious to the reader that secondary objectives are the posing of challenges to establishment science and the stimulation of useful controversy."

He has taken some pains to present each side of the many controversial topics. The selections are the most interesting and controversial items gleaned from a survey of an enormous amount of scientific literature, including the complete files of the journals *Nature* and *Science*.

The largest of 7 chapters is headed "Stratigraphic

anomalies." Topics include vertical cylinders in sandstones, problems in the drift, objections to the glacial theory, anomalies connected with the formation of coal, the problem of the origin of cyclothems, the origin of petroleum, the significance of salt deposits, the question of the existence of low-angle thrust faults demanded by evolutionary dating schemes, lakes containing old sea water below a layer of fresh water, and reports of "stone lines" in soils.

Highlights of chapter 2, dealing primarily with topographic features, include discussions on the famous Carolina Bays, oriented lakes in other regions, large meteorite craters, evidence for large-scale emergence and submergence, submarine canyons, mima mounds, and evidence contrary to the continental drift hypothesis.

These two chapters occupy more than half the book. Highlights of the remaining five chapters include discussions of peculiar rocks, tektites, unusual concretions, remarkable erupting slickensides, catastrophic burials of fish, puzzling extinctions, mammoth graveyards in Arctic muck, living toads and frogs entombed in sedimentary rocks, biologic evidence for extreme sea level changes, terrestrial magnetism, petrifications, natural fission reactors, anomalous pleochroic haloes and the implications for the age of the earth, discordant radiometric ages of rocks, and finally, a chapter containing accounts of legends of the deluge.

This is by no means a complete account of all the topics covered. Many of the original articles are reproduced in full. Others are summarized, or excerpts are printed.

The text is illustrated with photographs and clear, attractive drawings by John C. Holden.

This handbook would be useful to anyone interested in understanding the earth, and it provides fascinating reading. It contains the "other side" of the geologic story, the one that is absent from most of the text books. It will be a valuable addition to the bookshelf of many Creationists, especially those engaged in research.

Reference

¹Kuhn, T., 1970. *The structure of scientific revolutions*, 2nd. ed. University of Chicago Press, Chicago.

*Mr. Douglas E. Cox's address is P.O. Box 18, Petersburg, Ontario, Canada.

NOTICES OF BOOKS

The Other Earth by Floyd Parker, 1978. Parlec Publishing Co., 520 Avenue E., Garland, Texas 75040.

This small book is written as science fiction, but it is science fiction with a message which is certainly not fictional.

The plot is, that three astronauts land, unintentionally, on a planet which has remained hidden from the Earth, and whose existence was unknown. It turns out that this planet began by being much like the Earth. But it never had a fall, so it and its inhabitants are still in the original, unfallen, state. The development of the story leads into suggestions for the answers to what might seem problems which would arise in a continuing unfallen state.

Readers may disagree in places with the astronomy or physics (which are not claimed to be very exact), or possibly with certain points of theology, or Scriptural

interpretations. But I believe that they will find much of interest here.

Wonderfully Made for This Life and the Next, by W. Russell Shull, 1979. Published by Macalester Publishing Company, 1571 Grand Avenue, St. Paul, Minnesota 55105. 22 pages, 50 cents, reductions for 10 or more copies.

The "... for this life ..." part of this little work contains some very readable remarks on the wonders of Creation, and thus could provide a Creationist with some apt illustrations. The "... for the next ..." part contains some analogous comments, and inspirational remarks, on spiritual matters. The low price, handy pocket size, and easy mailability of this booklet make it very suitable for literature racks, and for passing on to acquaintances and correspondents.

LETTERS TO THE EDITOR

Difficulties About a Canopy of Ice

The proposal of my friend, Luther Westberg, in the December, 1979, issue of the *Quarterly*¹ needs a reply. It is suggested that a pre-flood canopy containing water equivalent to a layer 450 feet deep over the entire globe was dispersed as ice crystals in a structurally rigid rotating sector of a spherical shell from latitude 45°S to 45°N extending from 3,000 to 22,000 miles above the Earth's surface. This would be about 7×10^{29} kg of ice. The shell is to be supported by a combination of structural strength and the centrifugal force resulting from its rotation. Sunlight is to be conducted to the Earth's surface by fiber optics through the ice crystals. There are many difficulties with this scheme, particularly those involving energy considerations:

1. The average density of ice in that volume of space would be only 3.30×10^{-7} g/cm³. Thus, if there were one ice fiber passing through each cubic centimeter of the space occupied by this structure, the diameter of the average ice crystal could be only about 1/150 mm. Therefore, the ice shell would be like a cloud of spider webs in space, and it could have very little rigidity. We have previously shown that a solid ice shell would collapse under gravity and that rotation could not support any kind of a spherical ice shell.²

2. It would appear that fiber optics could have very little to do with conduction of light through such a shell. The light would simply be scattered by the dispersing crystals, and only a fraction would pass through to the earth.³

3. Such a structure could not possibly rotate rigidly, since, having very little structural strength, its various levels would have to rotate at orbital velocities, with periods varying from 3.3 to 23.7 hours. The only possible way that dispersed materials can orbit a planet is in planar rings similar to those of the planet Saturn.

4. The proposal that early collapse of the polar sec-

tions of the ice canopy could have produced the polar ice caps and the super cold required to freeze mammoths, etc., is not acceptable. The average gravitational energy of the ice in Westberg's canopy would be around 10,000 to 12,000 cal/g, depending on the density distribution of the ice crystals. So if any portion of the original spherical shell fell to the Earth's surface, a heat catastrophe would result, not glaciation or a deep freeze effect, even if the temperature of the ice canopy were absolute zero. And certainly the later collapse of the entire canopy would sear the whole globe with superheated steam, rather than produce a deluge.

In the same issue of the Journal Glenn R. Morton intimates that a model is being developed in which orbiting ice rings are captured by the atmosphere of an expanding Earth.⁴ If the original ice rings had an average radius of about 4,000 miles, their average kinetic energy would be about 7,400 cal/g. If the amount of ice in the rings were equivalent to a layer 40 feet deep over the Earth's surface, the total orbital kinetic energy would be sufficient to heat the coalesced ice rings and atmosphere to a temperature of around 10,000 °C. However, since any expansion of the Earth and the resulting coalescence of ice with the atmosphere would be slow, it might be possible for the heat to appear and be radiated into space over a period of many years, with the result that much water would be added to the upper atmosphere, later to precipitate as rain or snow.

However, it is presently this writer's opinion that at least some of the flood waters precipitated from the heavens came by special divine provision, supervening the laws of nature.

References

- ¹Westberg, V. Luther, 1979. Floodtime changes in the Earth's heating and lighting. *Creation Research Society Quarterly* 16(3):182-184.

*Kofahl, Robert E., 1977. Could the Flood waters have come from a canopy or extraterrestrial source? *Creation Research Society Quarterly* 13(4):203-204.

¹*Ibid.*, 202-203.

*Morton, Glenn R., 1979. Can the canopy hold water? *Creation Research Society Quarterly* 16(3):164-169.

Yours in His service,
Robert E. Kofahl
Science Coordinator
Creation-Science
Research Center
P.O. Box 23195
San Diego, California 92123.
Received 8 May, 1980.

Reply to Kofahl

I am always glad to have comments, and mathematical analysis of the situation, from Kofahl.

I have commented on some of these points in my reply to Morton.¹ For instance, the thickness of the canopy may be reduced to several miles. As I said in the article: "estimates depend very much on the assumed conditions under which the water fell." For instance, to fall from 3,000 miles in 47 days would take an average speed of less than 3 m.p.h. The fall was slowed, and the material cooled, by all the sub-zero air forced from below to above around the melting fringes at about 45 latitude.

As for item 1, I agree that the canopy was unstable. That, as suggested in my recent tract, *Created Perfection Lost*, is why God omitted "it was good" on the second day.

Kofahl's item 2 has already been mentioned in my reply to Morton.

It is agreed (item 3) that the canopy was unstable. But it lasted for about 1,600 years.

Finally, trouble about heating (item 4) would be alleviated by the slow fall, and the cooling, as mentioned above. Hail may fall from a considerable height, and considerably more quickly; and it still ends up as ice on the ground.

I might suggest also that recent observations of rings around several planets might suggest that at one time some arrangement of material, quite likely ice, around a planet was the rule, rather than the exception.

Reference

¹Westberg, V. Luther, 1980. Reply to Morton. *Creation Research Society Quarterly* 17(2):138.

Sincerely,
V. Luther Westberg
3400 Westach Way
Sonoma, California 95476.
Received 20 June, 1980.

Comments on the Tower of Babel

Strickling's article on the Tower of Babel, March 1980 issue, draws some rather different conclusions regarding Genesis 11:1-9.¹ He is convinced that language diversification is *not* in the text, and that the "confused language" was "incoherent babble" which

was brought upon the whole population in the nature of a physical disturbance in the brain. Although I agree that the text does not teach all that is sometimes drawn from it, I do not feel Mr. Strickling has proved his case, and feel the evidence fits a more traditional view.

Statement: "The Biblical passage describing the Confusion stands isolated from all other parts of the Bible making chronological placement difficult."

I would suggest that Gen. 11:1-9 is not as isolated as the author suggests. It is not unusual in Genesis for the writer to stop momentarily in telling the unfolding history, give genealogical information which extends into the future, especially where a line will not again be dealt with, and then return to the story at hand. Chapter 10 is such an insertion, with chapter 11 picking up where chapter 9 left off. But since Gen. 11:10-26 is also genealogical material, does not that leave 11:1-9 isolated at least at that end? Not at all. 11:10-26 is indeed genealogical but differs from that in chapter 10. There is no attempt here to trace down to descendant nations and then return to the story; this IS the story, traced only in barest outline down to Abraham where the treatment will again be extensive.

Statement: "There is also a legendary association of Abraham with the tower of Babel; this too arguing for a later period."

I would suggest that Jewish legendary material, drawn from the Talmud and Midrash and for which no dates can be established, is hardly admissible as valid evidence! Dating the Tower of Babel to the time of Abraham creates additional problems. Such a suggestion does not fit what we know historically—the plain of Shinar (Sumer) was populated long before the time of Abraham (see Gen. 10:10), yet 11:11 seems to presuppose a migration following the flood into an area as yet unpopulated. Secondly, we have abundant evidence of the multiplicity of languages *prior* to the time of Abraham—we even have multi-language dictionaries and word lists (unless Mr. Strickling is prepared to date Abraham vastly earlier than Biblical genealogies would seem to suggest!)

Statement: "There was one language before, during, and after the catastrophe."

I fail to find what his evidence for this is. Indeed, I fail to see the need for specifying *one* language in verse 1, if there remained only one language *after* the event. Now this need not involve the "miraculous creation of new languages" (a position he rejects); it *might* involve a situation where the people were forced to find new ways to communicate. But even this is speculation. Incidentally, the first Biblical reference to languages is *not* at the time of Joseph; we find it in the parenthesis in chapter 10, but also when Jacob and Laban erect a pillar of witness (Gen. 31:47). The names are given in Hebrew and Aramaic.

Statement: "Judging from the name of the place 'Babel,' their speech became a babble... In other words, they apparently lost the power of coherent speech! They could only babble!"

Now whether or not our English word "babble" is in any way related to the place name "Babel," I do not know; I DO know it is not legitimate to read the English meaning of "babble" back into the Hebrew word!

The name "Babel" is a bit of a linguistic problem. The Bible seems to relate the name to the verb *balal*, the word "to confuse." The Babylonians themselves understood it as *Bab-ili*, "Gate of God," and most Hebrew lexicons accept this origin of the name, rather than the Biblical one. It is interesting, however, that Ringgren points out (*Theological Dictionary of the Old Testament*, Vol. 1, p. 466f., Eerdmans, revised ed., 1977), that the word is "neither Sumerian nor Akkadian," and that the rendering "Gate of God" "seems to be a learned interpretation." So let's assume it does come originally from this event, means "confusion," and that the Babylonian meaning is a later interpretation. But what precisely does the verb *balal* mean? "To babble incoherently?" Is it even possible to determine the meaning precisely?

The Hebrew word *balal* carries the normal meaning of "mix, mingle," and is used frequently of flour or cakes "mixed" with oil. In one instance it seems to have the meaning, "anoint." The only instances where the word is used in connection with languages, are the two occurrences in this text! Determining the fine shade of meaning when used of languages, then, is difficult. The more frequent meaning of "mix" is helpful, but not the shade of meaning here; there the word is always used with a preposition; here it takes a direct object. Our other source of information is of course the text itself. Here follows a very literal translation from the Hebrew:

v. 7: "Let us go down and let us *confuse* their language so they will not understand a man the language of his companion."

v. 9: "For this reason one calls her name *Babel*, because there Yahweh *confused* the language of the whole earth and from there Yahweh scattered them over the face of the whole earth." (NOTE: The word "language" here is actually the word "lip," and is used commonly of a language or dialect.)

From this we *can* determine that the language was not understood; we *cannot* determine that it was *spoken* incoherently. Even after "confusion," it is still described as "language," verse 7. We *can* determine that there is a definite connection between the scattering and the "confusing" of the language. Again, it would seem that we *cannot* determine definitely whether new languages were given to them, or whether they had to develop patterns of speech on their own. If anything, verse 7 may seem to suggest that ability to communicate had not been lost, as they were still apparently speaking "language." There is a point in the development of languages where a curtain seems to be drawn, and the origin of major language groups is shrouded in mystery. Perhaps this is that point. Mr. Strickling suggests a natural diversification of language at a uniformitarian pace. But if the development of language groupings were simply a natural development, one would expect to find evidence of a time when they first began to diverge.

In summary, while I see difficulties in determining the nature of the confusion of languages, and how this relates to the development of language groups, I suggest that Mr. Strickling's suggestions do not stand the test of close scrutiny. (See, however, my postscript.) His article

has been helpful in forcing a closer examination of the text.

Postscript

Upon re-reading Mr. Strickling's article, I notice a point which I previously missed. What was the extent of the population involved in the incident at Babel? He suggests that the text "merely documents the effects on a single group of people"; and I tend to agree. It is highly questionable whether the entire population developing after the flood would have moved to the plain of Shinar. But if this did involve just one wave of migration, it would seem reasonable to assume that only this group would have been affected by the diversification of tongues (assuming the traditional view). Mr. Strickling's suggestion has opened an area where further study is needed.

Reference

¹Strickling, James E., 1980. The Tower of Babel. *Creation Research Society Quarterly* 16(4):222-223.

Sincerely, in Christ
Vernon A. Raaflaub
Academic Dean and Instructor
in Old Testament
Canadian Lutheran Bible Institute
4837-52A Street
Camrose, Alberta, Canada
Received 23 May, 1980

"Babel" and "Babble" not Necessarily Related

With regard to James Strickling's article, "The Tower of Babel",¹ I find one major point of dispute. In his section on the "Nature of Confusion," he states that "Judging from the name of the place (Babel), their speech became a babble." From this, he surmises that those present lost the ability of coherent speech. Etymologically, this is difficult to defend. The Hebrew term for "confound" is *balal*, often used in a technical sense of mixing cakes or flour with oil for sacrifices (Ex. 29:4; Lv. 2:4).

However, the word Babel signifies "gate of god" (cf. Assyrian form, *Bab-ili*). It seems more likely that the meaning of "gate of god" better fits the context in that a theme of the section is man's direct disobedience to God through building the tower, an indication of man's united effort in contradistinction to God's mandate to "fill the earth".

The identification, confusion of tongues = babbling = incoherent speech, should not be derived from the name Babel. Von Rad (*Genesis*, p. 150) states that the connecting of Babel with current concept is merely a popular invention and etymologically irrelevant. Those who do so, in fact, argue by circular reasoning. The argument would thus read: To babble is taken from the Genesis 11 account involving Babel, where languages were confused, thus Babel must mean incoherent speech since that is where it took place in history.

To argue for such a view, i.e. connecting Babel with "confound", one must postulate a *paronomasia*, or the

repetition of like sounding words, similar in sense or origin. The rhyming sense of baLAl and BaBEL would then allow a connection to be made between the two words.

Reference

¹Strickling, *op. cit.* (in the previous letter).

Sincerely,
Ronald W. Phelps
525 North Lake Drive
Dallas, Texas 75218
Received 28 May, 1980.

Only One Confusion of Language

Mr. James E. Strickling, in his article: "The Tower of Babel"¹ proposes that there were: "at least two occurrences of the phenomenon in question" (i.e., the confusion of language). The reason given was that there are only two places in which a legend of confusion of language is found: in Mesopotamia and on the North American continent; and that such a distribution argues against its having reached both places by diffusion.

However, in my opinion there was only one confusion of language: that at the Tower of Babel. My belief rests on two grounds.

First, the Biblical account says that our ancestors were building the tower so that they, as one people with one language, would not be scattered all over the world from there.² The Lord confounded the language; and they were scattered all over the world from there by the Lord. We see in the Biblical account that there was one people, one language, and one place in which the language was confounded, the result being the scattering of the people over all the earth from that one location: Babel.

Secondly, there is other evidence for a dispersion of people. Thor Heyerdahl, in his book *Early Man and the Ocean*, lists fifty-three cultural traits which are common to the early civilizations of Asia Minor, Egypt, Cyprus, and Crete; and to the pre-European civilizations of Mexico and Peru.^{3,4} I suggest that the legend of the confusion of language could be added to that list.

Heyerdahl, in his book, has presented convincing evidence to show that the part of the New World in which these civilizations were found might well have been settled, or at least influenced, by people from Mesopotamia, or elsewhere in the Old World. They could have crossed the Atlantic in reed ships, taking advantage of the Canary Current, which flows westward from the Canary Islands off the coast of Africa into the Gulf of Mexico.

It can be concluded, then, that the Bible contradicts the notion of at least two occurrences of the confusion of language. The distribution of legends of the confusion can be explained as a result of diffusion, rather than two isolated occurrences.

References

¹Strickling, *op. cit.*

²Genesis 11: 1-9.

³Heyerdahl, Thor, 1979. *Early man and the ocean. A search for the beginnings of navigation and seaborne civilizations.* Doubleday.

⁴Schmich, John E., 1979. Review of *Early man and the ocean.* *Creation Research Society Quarterly* 16(3):187-188.

Sincerely,
J. Daniel Stoops
2539 Grand
Joplin, Missouri 64801.
Received 5 June, 1980.

Reply to Comments on the Tower of Babel

I appreciate the various comments on my paper, and I would like to have had the benefit of them much earlier. Actually, several of the points raised were called to my attention by scholars outside the C.R.S. before the paper was published; however, it was too late to make any changes.

Concerning the "chronological placement"—

The point made by Raaflaub on the possibly inadmissible Jewish legendary evidence is one of those I received earlier. His observation on the continuity of the genealogies is most interesting. After reading the account with this in mind, I tend to agree. The "they" in Genesis 11:2 appears to refer to the sons of Joctan (Genesis 10:29) or their descendants. (This meaning would support the contention that the Biblical record documents the effect on only one group of people.)

Lack of evidence for "one language before, during, and after"—

It is difficult to see what evidence Raaflaub is looking for at this point: (1) It follows that if multiple languages were *not* involved (as suggested), then there *was* only "one language before, during, and after"; 2) The whole argument which follows (excluding consideration of time and location of the event) is in support of this contention (of *no* language diversification).

I suggest that the reason the recorder specified one language (at the beginning of the account) was to emphasize the consternation associated with the "confounding"; e.g., even though the victims spoke the same language, they could not communicate orally.

"Babel/babble"—

My error in reading back the English meaning and the true meaning of "Babel" were among the points called to my attention earlier. Even so, this does not constitute a refutation to my suggestion. I reject the idea of multiple languages because it is not stated in the account; it is a highly subjective interpretation. My interpretation of incoherent speech is an observable alternative.

The net result of Raaflaub's analysis of *balal* seems to be "confusion." He agrees that the text does not specify the creation of new languages, and this is my basic contention. He states that the English word "language" is translated from the Hebrew word for "lip". The word thus has more than one meaning in English (perhaps including oral sounds other than language?). But he then restricts the meaning of this less-than-specific term in verse seven to be language as we would understand the word "language." Is this not close to "reading back" the meaning?

I do not pretend to be a Hebrew scholar (I have no knowledge of the language); but why should a word meaning "mix" (Phelps) be read as suggesting a mixing of groups speaking different languages any more than a mixing of individuals uttering who-knows-what?

In passing (and in keeping with Raaflaub's and Phelps' observation on the meaning of "Babel"), "Gate of God" apparently memorializes the place at which God "entered" to physically interfere/intervene in human activity. It was called Babel not because the language was *confounded* there—but because the language was *confounded there*.

"Origin of major language groupings"—

Perhaps the reason for the mystery surrounding the origin of major language groups is that language in antiquity just didn't leave that many tracks. We might look within one of those groups at our own language. Two thousand years ago, there was no English language; today, in varying degrees, it practically encompasses the world. Much of its (uniformitarian) development can be easily traced.

"Raaflaub's Summary"—

Raaflaub says that my suggestions do not stand up to close scrutiny, yet he concedes to my starting point as stated above. An alternative interpretation is thus admissible. If there were no new languages, what possibility remains? Confused speech—as the text states.

Raaflaub's evidence for a more traditional view (his first paragraph) is not cited. By "traditional" he presumably means "language diversification", which he admits is not explicit in the Biblical account. This leaves only the nonbiblical evidence, one such account being cited in my paper—evidence which Raaflaub does not address (other than concerning the time of the event).

A number of additional legends recently came to my attention (again, too late to incorporate). The distribution is not restricted to Mesopotamia and North America as I indicated in my paper, but is nevertheless quite spotty. *It is still my opinion* that more than one group of people was affected. This is not to say that there was no diffusion involved whatsoever. (Neither am I saying that the possible multiple occurrences were simultaneous).

The content of the legends varies. Some tell of the creation of new languages; however, others speak only of a confusion (inability to understand one another)—which again does not necessarily mean language diversification. One source uses the term "jabbering" to describe an East African experience. It is only natural that the popular interpretation (diversification) would eventually arise, explicit in some of the legends and projected into the others. The alternative is not immediately obvious after centuries of conditioning to one viewpoint.

If I have indeed forced a closer examination of the Biblical text, then my intentions have been at least partially realized.

James E. Strickling
5705 DeKalb Lane
Norcross, Georgia 30093.
Received 27 June, 1980.

Liquids are not Disorderly

May I offer two comments on Armstrong's recent article on thermodynamics?¹

(1) A quiescent liquid or solution, in condition to crystallize, has already a specific structure—it is already ordered—and not a random jumble at all.² This has been shown by such experimental techniques as X-ray diffraction. It is proved also by such phenomena as surface tension, which reveal the presence of intermolecular forces in the liquid. For such forces will tend to orient the molecules into the most stable, least-energy configuration, giving some sort of structural lattice. The structure may be very tenuous, with not so much long-range order, for a liquid is easily stirred up. But the order is there. That is why running water will not freeze.

Is the situation not rather as if a lot of child's play blocks were shaken together? They would tend to take up some square arrangement. But that would come, not from the random shaking, but from the cubical shape—a kind of order—which the blocks already had.

Incidentally, would something of the sort not be true even of gases, for there are intermolecular forces at work there, too? True, the structure might again be tenuous, and it is very hard to get a sample of gas really quiescent.

Considerations of this sort, I submit, void the whole "crystals" and "dissipative structures" approach of the evolutionists. I am surprised, sometimes, that so few creationists have caught on to how useless that approach is.

(2) Calculations of entropy, it seems to me, are largely irrelevant to the problem, because of the arbitrariness of the definition of entropy in terms of energy and temperature. Thus entropy can be changed by adding or removing heat at a constant temperature, but such operations seem to have nothing to do with the presence or absence of structure, design, and intelligence. Entropy as the term is used in statistical mechanics or in information theory is more to the point. But still the question is, whether it is possible to get structure and regularity from energy applied in some random way? Of course, the answer is: no!

It seems to me also that the equivocation of terms like "entropy" and "order" can be a real problem in the thermodynamics debate; and the solution is to pin the evolutionists down to exactly what the words which they are throwing around mean. I find it clearer to think in terms of available energy, available structure, and available intelligence, and to avoid the use of the word "entropy" entirely.

References

¹Armstrong, H.L., 1980. Evolutionistic defense against thermodynamics disproved. *Creation Research Society Quarterly* 16(4):226-227 & 206; and 17(1):72-73 & 59.

²See, e.g., Barker, J.A., 1963. Lattice theories of the liquid state Pergamon, and Macmillan, New York. Chapter 1.

R.G. Elmendorf
Elmendorf, Inc.
Bairdford, Pennsylvania 15006.
Received 22 May, 1980.

Could the Ark Have Been A Reed Ship?

To your question as to whether the ship referred to in Genesis chapter six, and known to us as Noah's ark, could be a reed boat, I can answer in the affirmative.

The text in the modern revised version of the Bible, the *New English Bible*, is thus translated: "Make yourselves an ark with ribs of cypress; cover it with reeds and coat inside and out with pitch."

To this can be added that the Hebrew version, brought from Ur in Mesopotamia by Abraham about 1800 B.C., reflects the much earlier Assyrian version of the deluge in which the Assyrians record that their god

told their equivalent of Noah to save mankind by tearing down his reed house and building it into a ship.

Cordially yours,
Thor Heyerdahl
Colla Micheri
17020 Laigueglia
Italy

Received 6 August, 1980

(Editor's note.) It is scarcely necessary to remark that Dr. Heyerdahl has probably had more experience with reed ships than anyone else living today. So his thoughts on these matters certainly call for careful consideration.

A CALL FOR RESEARCH REPORTS

C.R.S. members wishing to present short reports of their own origins projects at the annual meeting, April, 1981, are invited to submit a one-page abstract of the data and conclusions to be presented. These abstracts should be sent to Dr. Emmett Williams, 5093 Williamsport Drive, Norcross, Georgia 30071. Emmett Williams will prepare the agenda and notify those participants whose papers are accepted for presentation. All those wishing to attend are invited, as this meeting is open to the public, free of charge. It will be held at the Concordia College Science Auditorium, Ann Arbor, Michigan, on Friday, April 10, 1981; time to be announced (probably at 1 p.m.).

A CREATIONIST JOURNAL

We have seen recently the journal *Biblical Creation*, which is published in Britain by the Biblical Creation Society. The topics covered are such as would be of interest to most Creationists; those in a recent issue include a critique of the notion of chemical evolution; a re-examination of the dating methods supposed to show a great age for the Earth; and an examination of the doctrine of theistic evolution. The level of treatment is

such that, while technically correct, the articles should be readable by any reasonably well-informed person.

Creationists will be glad to see this effort. There is certainly more than enough work in Creationism to go around among those who are willing to undertake it.

Further information about this Society and its publication may be obtained from the Secretary, at 16, Woodview Avenue, Chingford, London E4, England.

PLACEMENT SERVICE

Do you know of academic vacancies to which creationists might be directed? The Creation Research Society would like to be in the position to inform creationist scientists of such vacancies. If you know of such positions will you please inform Dr. John W. Klotz, 5 Seminary Terrace North, St. Louis, MO 63105 describing the position, the academic requirements and training required and any other information that might be available. You will be helping provide students with information on the question of origins which you yourself share.

Graduate students interested in placement may also write to Dr. Klotz who will provide them with information on available positions as they are known to the CRS.

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 creationism, with a current membership of over 600 voting members (with graduate degrees in science) and over 1800 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as probably the outstanding publication in the field.

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

Membership Voting membership is limited to scientists having at least an earned graduate degree in a natural or applied science. Dues are \$12.00 (\$13.00 U.S. for overseas) per year and may be sent to Wilbert H. Rusch, Sr., Membership Secretary, 2717 Cranbrook Road, Ann Arbor, Michigan 48104. Sustaining membership for those who do not meet the criteria for voting membership, and yet who subscribe to the statement of belief, is available at \$12.00 (\$13.00 U.S. for overseas) per year and includes subscription to the Annual Issue and Quarterlies. All others interested in receiving copies of all these publications may do so at the rate of the subscription price for all issues for one year: \$15.00 (\$16.00 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:

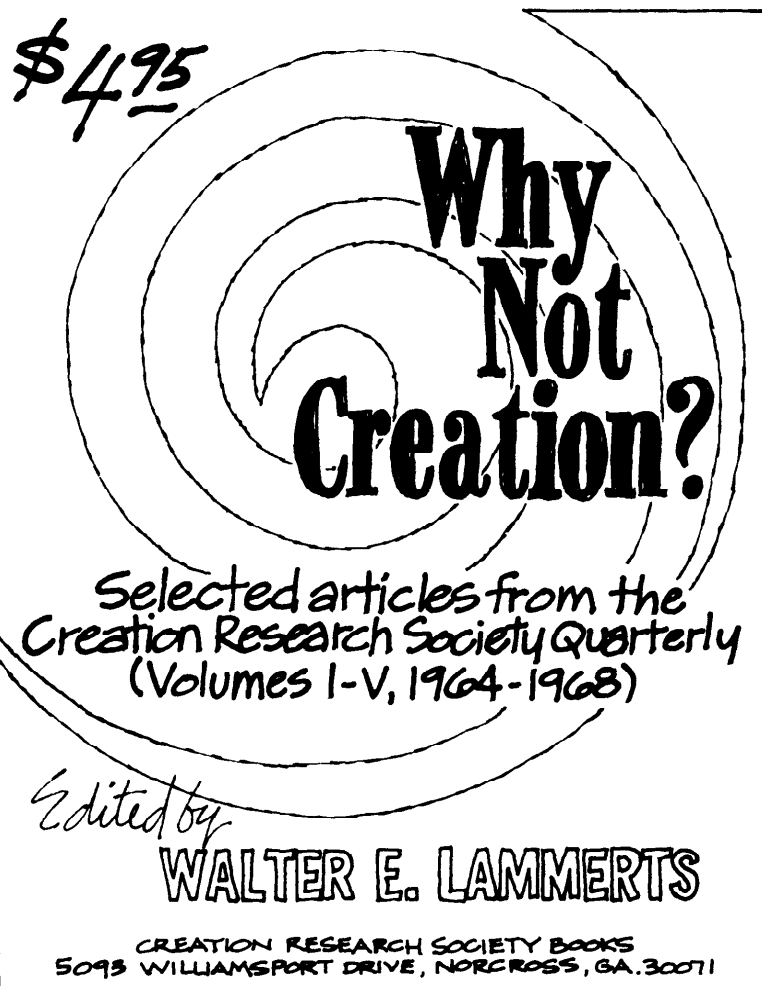
1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.

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.

Board of Directors *Biochemistry*: Duane T. Cish, Ph.D., Institute for Creation Research, 2716 Madison Avenue, San Diego, CA 92116. *Biological Sciences*: Wayne Frair, Ph.D., **Secretary**, The King's College, Briarcliff Manor, NY 10510; George F. Howe, Ph.D., **President**, Los Angeles Baptist College, Newhall, CA 91321; John R. Meyer, Ph.D., Los Angeles Baptist College, Newhall, CA 91321; Wilbert H. Rusch, Sr., M.S., LL.D., **Membership Secretary**, Professor of Science, Concordia College, Ann Arbor, MI 48105; E. Norbert Smith, Ph.D., Northeastern Oklahoma State University, Tahlequah, OK 74464; Paul A. Zimmerman, Ph.D. Concordia Junior College, River Forest, IL; *Engineering*: D. R. Boylan, Ph.D., Professor of Engineering, Iowa State University, Ames, Iowa 50011; *Genetics*: John W. Klotz, Ph.D., Director of Graduate Studies, Concordia Seminary, St. Louis, MO 63105; *Geology*: Clifford L. Burdick, M.S., D.Sc., 924 N. 6th Avenue, Tucson, AZ 85705. *Geophysics*: Harold Slusher, M.S., D.Sc., University of Texas at El Paso, TX 79902. *Physical Sciences*: Harold Armstrong, M.S., **Publications Editor**, Queens University, Kingston, Ontario, Canada; Thomas G. Barnes, D.Sc., University of Texas at El Paso, TX 79902; Richard G. Korthals, M.S., **Treasurer**, P. O. Box 135, Arcadia, MI 49613; Henry M. Morris, Ph.D., Institute for Creation Research, 2716 Madison Avenue, San Diego, CA 92116, and President of Christian Heritage College, San Diego; George Mulfinger, M.S., Continental Telephone Laboratories, Norcross, GA; Emmett L. Williams, Jr., Ph.D., **Vice-President**, Bob Jones University, Greenville, SC 29614. *Science Education*: John N. Moore, M.S., Ed.D., 136 Brody Hall, Michigan State University, East Lansing, MI 48824.



OTHER BOOKS PUBLISHED BY THE C.R.S.

Textbooks

Biology: a Search for Order in Complexity. (Revised Edition, 1974.) A textbook for high school presenting creation AND evolution. 595 pp., 436 illustrations, \$9.95.

Teacher's guide to accompany Biology: a Search for Order in Complexity. Paperback, \$1.95.

Investigations into Biology: Student's Laboratory Manual. Paperback, \$1.95.

Investigations into Biology: Teacher's Laboratory Manual. Paperback, \$1.95.

The books listed above are all available from Zondervan Publishing House, Grand Rapids, Michigan.

Reprint

A Decade of Creationist Research, by Duane T. Gish. Reprinted from the *Quarterly* for June, 1975. 16 pp., 75 cents postpaid, 50 cents each for orders of 100. Order from the College Bookstore of Concordia College, 4090 Geddes Road, Ann Arbor, Michigan 48105.