

Creation Research Society Quarterly

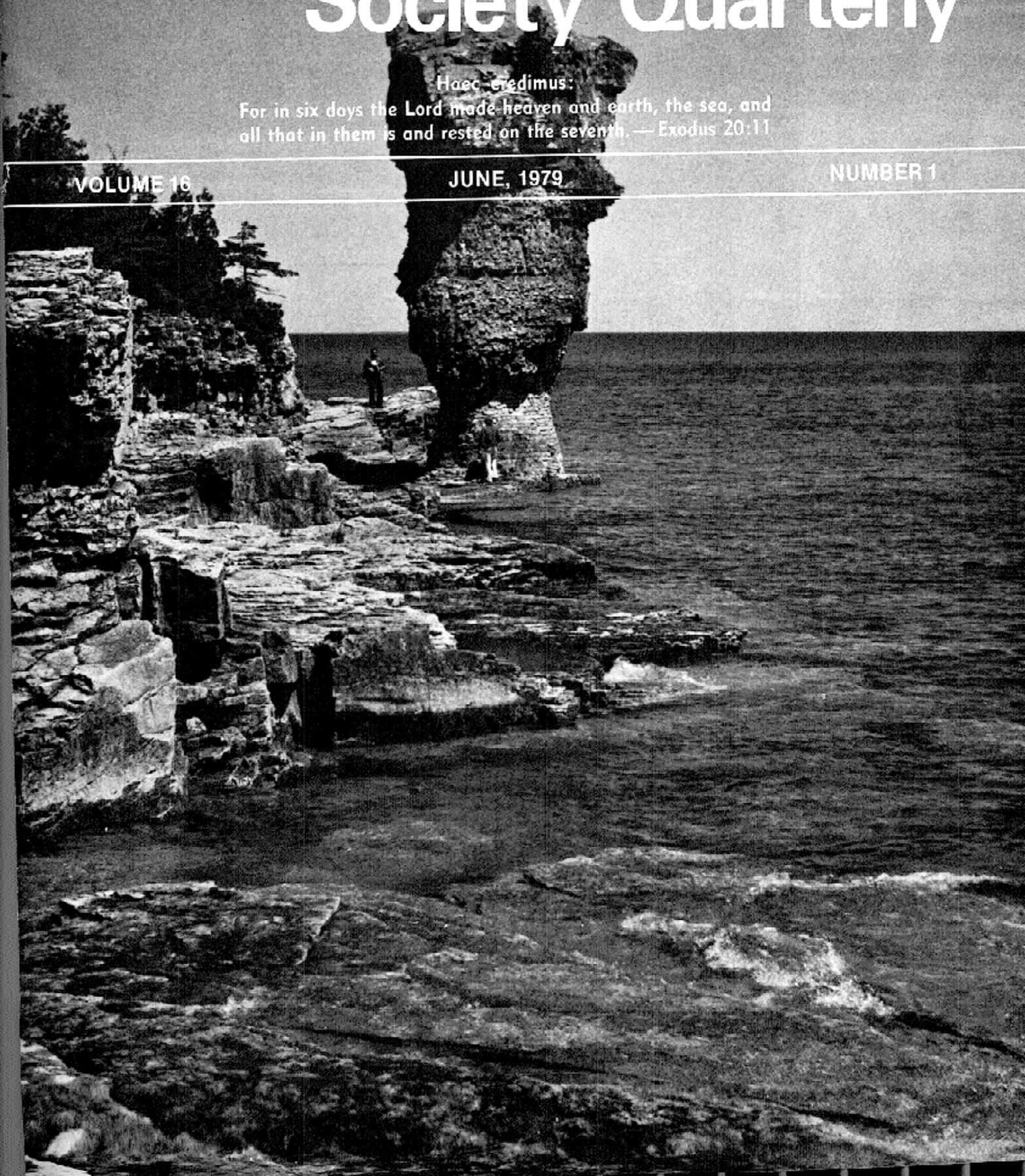
Haec credimus:

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

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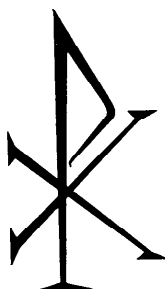


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COVER ILLUSTRATION

Many Creationists believe that among the things which happened soon after the Flood was the ice age. By having a fairly short ice age at that time, they hope to reconcile the geological evidence with the Scriptural account.

Mr. Douglas E. Cox, who supplied the picture for the front cover, argues otherwise in his article elsewhere in this issue of the *Quarterly*. He proposes that there is no need to admit an ice age, either soon after the Flood or at any other time. For the evidence which is supposed to show that such an age happened can be explained as well otherwise; and there is other evidence against an

(Continued on back cover)

SURTSEY: A MICRO-LABORATORY FOR FLOOD GEOLOGY†

MARVIN L. LUBENOW*

Received 16 August, 1978

The contemporary Evangelical debate over "Flood Geology" centers upon the legitimacy of extrapolating present-day rates of geologic processes into the past, and using this extrapolation to challenge the possibility of a significant portion of the earth's sediments and fossils being the result of the Noahic Flood of Genesis 7-9. The problem is complicated by the impossibility of repeatable experiments or present-day observations on a flood that is thought to be a singularity, of world-wide extent, and of over one year in duration.

The birth, in 1963, of the volcanic island, Surtsey, off the coast of Iceland, may cast some light on the problem. Since Surtsey's birth was both unique and spectacular, most works on geology make mention of it. Only two Icelandic scientists write about what may be the most significant geological factor of all—the development of a mature landscape in days or weeks on Surtsey that would normally take thousands of years elsewhere. Since the two geologic forces operating on Surtsey—volcanism and marine action—are also two of the forces thought to be in operation during the Noahic Flood, Surtsey may be as close as one can come in the natural world to a micro-laboratory for "Flood Geology."

"Flood Geology" is the term usually applied to the concept that a large portion of the geologic activity that has taken place on planet Earth took place during or in conjunction with the Noahic Flood recorded in Genesis 7-9. Evangelicals taking issue with "Flood Geology" can be roughly divided into two schools depending upon their attitude toward biological evolution. "Progressive Creationism" is the term applied to the school of thought that, although rejecting biological evolution, accepts more or less the time scale of the geologic column and the concept known as uniformitarianism in geology. An alternate position known as "Theistic Evolution" accepts both biological evolution and geologic uniformitarianism.

Uniformitarianism in geology extrapolates present-day rates of geologic processes into the past. It seeks, in this way, to determine not only the age of specific geologic formations, but the age of large portions of the earth's crust. Although these ages are usually stated to be only relative, they are sometimes given absolute values. Radioactive dating methods are said to corroborate the vast ages implied by the concept of uniformitarianism. It is declared by most uniformitarian Evangelicals that a universal flood lasting just over one year is simply not sufficient to explain a sizable portion of the past geologic activity evidenced in the earth's crust.

"Progressive Creationists" have tried to explain the Noahic Flood in several different ways. The concept of a local flood has been popular in some Evangelical circles. However, this explanation is not in harmony with the details of Genesis 7-9, and calls for a questionable exegesis of the text. Furthermore, since there have been innumerable local floods since the time of Noah, it is obvious that the Noahic Flood was a radically different kind of flood or else the covenant God made with Noah becomes meaningless. In this covenant, God said (Genesis 9:8-17) that He would never again destroy the earth and all flesh by a flood and that He would set

the rainbow in the sky as a sign of that covenant.

A second explanation of the flood seems equally lacking in credibility. It is the idea that the Biblical Flood had very little, if anything, to do with rocks and fossils. It was primarily a judgment of God upon sinful people. Hence, it produced very little permanent geologic change upon the earth. This view seems to call for a greater miracle than any that are stated or implied in the Genesis account, and it fails to comprehend the very nature of the Genesis Flood.

The Noahic Flood was actually a combination of supernatural and natural forces. Just a few of the supernatural elements of the flood are: (1) God causing the catastrophe of the flood in the first place (Genesis 6:13,17); (2) God giving the dimensions and the plans of the ark to Noah (Genesis 6:14-16); (3) God bringing the animals to the ark (Genesis 6:20); (4) God shutting the door of the ark (Genesis 7:16); and (5) God making a wind to pass over the earth (Genesis 8:1).

On the other hand, there were a number of geologic factors that, although originated by the supernatural agency of God, when once unleashed would do immense amounts of geologic work without the further intervention of the supernatural. These forces are: (1)

ELECTION RESULTS

249 ballots were cast in the annual election, held earlier this year. The following persons were elected to the Board of Directors for a term of three years, 1979-1981.

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Richard G. Korthals
Henry M. Morris
Wilbert H. Rusch
Harold S. Slusher
E. Norbert Smith

Only ballots postmarked not later than 1 March 1979 were counted, as had been announced.

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†This article is based on a paper prepared for the American Scientific Affiliation, at Hope College, Holland, Michigan, 11-14 August, 1978; and the Sixth National Creation-Science Conference, Wichita, Kansas, 20-23 August, 1978.

Rain for forty days and forty nights (Genesis 7:4,12); (2) The fountains of the deep opened up releasing vast amounts of magma (as lava) and subterranean water. (Genesis 7:11); (3) A wind to pass over the earth (Genesis 8:1); (4) Tidal action of the flood waters, possibly caused by the moon's gravitational pull and unhindered by the continents because they were submerged (Genesis 8:3,5); (5) Although it is not specifically mentioned in Genesis, we can also infer intense earthquake activity because of the very close association of the volcanic zones of the earth with the earthquake zones.

Given the intensity of these four and probably five geologic factors and the duration of the flood, the fact that the flood was a judgment for the sin of man would not hinder an intense amount of geologic work from being done with abundant evidence remaining even today. It was God's stated intent to destroy the earth with its life (Genesis 6:7,13) and this intent was carried out (Genesis 7:21-23). The New Testament confirms that fact (II Peter 3:5-6). To suggest that all of these forces were unleashed to destroy the earth and its life without leaving much geologic trace is incredible. In fact, it would require a miracle of the highest order to keep geologic work from being done. It hardly needs to be said that the Bible nowhere even remotely implies that such an unlikely miracle took place. It would be in keeping with the nature of God that He would want the effects of this judgment to be clearly seen by man in order to serve as a warning to man of the judgment of God upon sin.

There are two ways in which geologic work can be accomplished. A very large amount of geologic work can be accomplished by very passive geologic forces if these passive geologic forces have an immense amount of time in which to work. This same amount of geologic work can be accomplished in a very brief moment of time if the geologic forces are intense or violent enough. Only rather recently have some geologists recognized the importance of this concept of catastrophism in interpreting the geologic record. Derek V. Ager (University College of Swansea, and 1976 President of the British Geologists' Association) writes:

So we come back again and again to the notion of the rare catastrophic happenings playing a major role in the working out of the stratigraphic record as we find it today.

The hurricane, the flood or the tsunami may do more in an hour or a day than the ordinary processes of nature have achieved in a thousand years.

We cannot demonstrate anything really comparable to the sudden mass extinctions of the past happening at the present day. . . . What is more, we cannot even see the processes going on today that might lead to such extinctions. I feel that we rely too much on the present state of affairs, too much on uniformitarianism, when interpreting the fossil record. . . . It may be said of many palaeontologists, as Professor Hugh Trevor-Roper said recently of 18th century historians: "Their most serious error was to measure the past by the present." We may arrive, therefore, at the second

proposition of this book: **PALAEONTOLOGISTS CANNOT LIVE BY UNIFORMITARIANISM ALONE.**¹

There is, without question, a measure of truth in uniformitarianism if by that one refers to the regularity of nature established by God (Genesis 8:22). In fact, the entire foundation of modern science rests upon this regularity in nature. It is this regularity that makes experiments possible. The problem with the doctrine of uniformitarianism is that it is often used as an atheistic club arbitrarily to rule out any possible divine intervention in the past—either regarding Creation or the Flood. This atheistic aspect of uniformitarianism is not only implied in the practical application of the concept to the rock strata, but is stated without equivocation in many secular university classrooms.

A philosophical weakness is resident in the doctrine of uniformitarianism that most secular and some Christian geologists seem to have missed. In order to state with authority that the present is the key to the past, one would either have to possess the attribute of omniscience, which only God possesses, or else one must be able to establish witnesses for the entirety of past geologic history in order to know with certainty that there are no exceptions to the concept of uniformitarianism. The Scriptures plainly declare that there has been a major exception, a singularity in the past history of this planet. This major exception—the Flood—could not help but have had a tremendous impact on the past geology of our planet.

In dealing with those who do not accept the amount of geologic work such a flood could accomplish in a brief period of time, a problem presents itself in terms of scientific validation. By the very nature of the Biblical Flood—a singularity happening only once and of world-wide extent—it is totally beyond scientific verification by experiment. It is for this reason that the recent birth of the volcanic island, Surtsey, takes on special significance as an indication of the speed with which geologic processes can, under certain conditions, take place.

Surtsey, named after a figure in Icelandic mythology, began as a submarine volcanic eruption on November 14, 1963, about 400 feet below the surface of the Atlantic and 20 miles south of the coast of Iceland. It is 75 air miles southeast of the Icelandic capital, Reykjavik. The next day, November 15, a narrow black ridge broke the surface of the ocean as the top of the cinder cone appeared. A new island was born.

The birth of a volcanic island is not completely unknown in recorded history—especially off the coast of Iceland. But in all such previous cases, they were soon eroded away by the onslaughts of the ocean. The tephra—ash, cinders, and pumice—usually involved in the initial stages of the eruption was not resistant enough to oceanic erosion. However, on April 4, 1964, the lava flows began on Surtsey, flowing intermittently until June 5, 1967—the last time lava was seen flowing on the island. The lava flows provided a very hard cap to the island thus insuring its permanence as the southernmost of a group known as the Westman Islands, all of them probably having been formed in

about the same way as was Surtsey.

The lava flows also changed Surtsey from a cinder cone to a shield volcano. It thus became the first time in possibly 3,000 years that man had witnessed the creation and development of a shield volcano. At the height of the lava flow, as much as one acre was added to the island's size daily. By April 1965, the island had become circular in shape with a diameter of 1.7 km, an area of 1¼ square miles, having a tephra cone of 170 m. (568 feet) in height, and a composite cone of 122 m. in height which housed a lava lake. During the course of Surtsey's development, two smaller islands were born nearby as a result of submarine eruptions but were soon eroded by the sea and disappeared.

It is not entirely surprising that Surtsey was born where it was. It sits atop the Mid-Atlantic Ridge, the chain of fissures and submarine mountain ranges stretching from the Arctic to the Antarctic. There has been recent volcanic activity along this ridge—1957 in the Azores, 1961 in Askja volcano in Iceland, 1961 in Tristan da Cunha in the South Atlantic, and 1963 at Surtsey. In fact, Iceland constitutes the largest above-sea section of this 10,000-mile-long Mid-Atlantic Ridge and gives geologists a unique opportunity to study the Ridge on dry land. Iceland, itself, seems to be splitting apart at this line as is indicated by numerous gaping fissures all over the median zone of the country. It is believed that the entire Ridge is undergoing this type of tension process. The point of all this is that Surtsey is on one of the very few geologically active zones on earth, and this makes a vast difference in the rate of geologic processes.

Surtsey has become famous. Its initial volcanic activity was very dramatic and colorful. Further, the birth of an island was utterly unique in our scientific age. The result is that there is scarcely a geology book published since 1963 that does not have one or more pictures of Surtsey in eruption. The popular textbook, *Physical Geology*, by Longwell, Flint, and Sanders has a two-page spread of Surtsey introducing the chapter on volcanism.² The work by Nigel Calder, *The Restless Earth*, has one picture of Surtsey on the front jacket, a second picture on the back jacket, and a third picture of Surtsey in the book itself.³ Most general geology books published today have a paragraph or two on Surtsey in the text as well as one or more pictures of its dramatic eruptions.

Yet, for all of this fame and photography, most geologists have completely missed the true geological significance of Surtsey. Surtsey's true significance is that the combination of the sea and volcanism—two of the same forces that were at work in the Noahic Flood—have in days or weeks produced a landscape so varied and mature *that it gives the appearance of being thousands of years old*. Even creationists have been strangely silent regarding the striking evidence Surtsey presents for Flood Geology. Other than a three-page review of a book on Surtsey by Dr. Wilburt H. Rusch, Sr., in *Why Not Creation?*⁴ the only creationist reference of which I know is on pages 142–143 of Whitcomb's *The World that Perished*. So let us consider the geological activities on Surtsey."

Of all that has been written in English on Surtsey, only three publications by two Icelandic scientists mention this rapid development of a mature landscape. The first, and still the most complete account of the geology of Surtsey, was written by the official Icelandic geologist, Sigurdur Thorarinsson. He flew over Surtsey within hours after the eruption was first sighted and kept a continuous written and photographic record of developments on Surtsey. He was the first scientist to set foot on the island itself, and by the time his book, *Surtsey: The New Island in the North Atlantic*, was published in 1964, he had made more than one hundred visits to Surtsey by sea and air including a large number of actual landings on the island. His book was first published in Iceland with an English translation. In 1967, it was published with very slight changes in the text and a different format by Viking Press in New York. It remains the definitive book on the geology of Surtsey. Later, Thorarinsson wrote a more popular account of Surtsey for *National Geographic* that was published in May, 1965.

The second author to write about the maturity of Surtsey's landscape is Icelandic biologist Sturla Fridriksson. His book, *Surtsey*, published in 1975 by John Wiley and Sons, New York, deals basically with the biota of Surtsey. Since it is a precise account of how animals and plants invaded a sterile volcanic island, it is also of importance to creationists who are interested in plant and animal migrations after the Flood.

The closing paragraphs of Thorarinsson's book set forth the dramatic geological changes that took place on Surtsey. The section is entitled, "you wander and wonder":

When the news of a volcanic eruption in the sea off the Vestmann Islands reached the ears of Icelandic geologists in the early morning of November 14, 1963, some of them had to have it repeated to them, and received it with a grain of salt all the same. And when they in the spring and summer of 1964 wandered about the island which was being born then, they found it hard to believe that this was an island whose age was still measured in months, not years. An Icelander who has studied geology and geomorphology at foreign universities is later taught by experience in his own homeland *that the time scale he had been trained to attach to geological developments is misleading* when assessments are made of the forces—constructive and destructive—which have molded and are still molding the face of Iceland. *What elsewhere may take thousands of years may be accomplished here in one century*. All the same he is amazed whenever he comes to Surtsey, *because the same development may take a few weeks or even a few days here*.

On Surtsey only a few months sufficed for a landscape to be created which was so varied and mature that it was almost beyond belief. During the summer of 1964 and the following winter we not only had a lava dome with a glowing lava lake in a summit crater and red-hot lava flows rushing down the slopes, increasing the height of the dome and transforming the configuration of the island from

one day to another. Here we could also see wide sandy beaches and precipitous crags lashed by the breakers of the sea. There were gravel banks and lagoons, impressive cliffs, grayish white from the brine which oozes out of the tephra, giving them a resemblance to the white cliffs on the English Channel. There were hollows, glens, and soft undulating land. There were fractures and faultscarps, channels and screes. There were often furious gales and sandstorms, which reduced the visibility to zero, and Aegir, the Northern counterpart of Neptune, dealt blows of no less violence. You might come to a beach covered with flowing lava on its way to the sea with white balls of smoke rising high up in the air. Three weeks later you might come back to the same place and be literally confounded by what met your eye. Now, there were precipitous lava cliffs of considerable height, and below them you would see boulders worn by the surf, some of which were almost round, on an abrasion platform cut into the cliff, and further out there was a sandy beach where you could walk at low tide without getting wet. The next time you came there, glowing lava-falls rush over the sea-cliff. One day, the surf had cut a large section out of a tephra wall. The next, the lava spread across the sandy beach, protecting the cliff from further inroads by the sea. In this way destructive and constructive forces waged a constant battle for this island, which is and will be a true paradise for geomorphologists.⁵

Later, in his more popular account in *National Geographic*, Thorarinsson states:

For geologists and geomorphologists it is a great adventure to explore this new island. Contours shift from day to day, *and in one week's time we witness changes that elsewhere might take decades or even centuries*. We observe gravel downs, calm lagoons, and bluffs so whitened by brine that they recall the chalk cliffs of Dover. *Despite the extreme youth of the growing island, we now encounter there a landscape so varied that it is almost beyond belief.*⁶

Thorarinsson's book is illustrated with fifty-four remarkable photographs of the development of Surtsey. One of the most striking, from the standpoint of rapid geologic processes, is plate no. 39 showing a very level sand beach perhaps 150 yards wide and a quarter of a mile long on the northwestern side of the island. This photograph was taken April 16, 1964. Since Surtsey broke the surface of the ocean as a volcano on November 15, 1963, it means that this large sand beach developed in just five months. Yet, it is not the first time mention of a beach is made in the book. On what appears, from the text, to be Thorarinsson's second actual landing on the island itself, February 19, 1964, he writes:

At 3 o'clock that afternoon seven of us, including two women, stood on the sandy beach of Surtsey on the northeastern side.⁷

This means that there was a sandy beach on Surtsey just three months after the island had broken the surface of the ocean as a fiery volcano. The rapidity of this

development staggers the imagination.

Biologist Fredriksson is much more concerned about the invasion and development of life upon this volcanic island. Yet, the first forty-seven pages of his book are devoted to geological matters. He, too, studied the island from its birth. His observations confirm those of Thorarinsson. In his "Preface", Fredriksson writes:

But here something quite different and much greater had happened: a whole island had been created, and an extensive area of land had been formed from the primary rock. From the depths of the ocean there had been built up a broad base, on the top of which was an island with mountains and craters, lava flows, cliffs, gentle slopes, flat sandy beaches and withered coastal strips with worn, rounded pebbles and boulder rims *that gave the landscape an ancient appearance*. Surtsey had thus a diversity of topographical features and a variety of substrates in marine and terrestrial habitats.⁸

He further describes these boulder rims as follows:

This shaping-up of the island is caused by the predominant waves generated by low pressure areas moving from the south-west. Boulder rims run along the shores 4 to 5 m above sea-level, extending from the lava edges and encircling the ness (Plate 9). These boulders are well rounded 0.5 to 1.5 m in diameter, forming terraces with sand, gravel and cobbles. In severe winter storms and high tides most of this coastal plain can be flooded and a high-water mark is found at the foot of the tephra cones (Figure 6.5). A great part of the ness is now covered with silt, sand and cobbles, with some boulder ridges and even some small sand dunes. Both the lagoons have been filled up by beach material.¹⁰

There is no indication in the book as to when the picture of the boulder rim was taken. Since the book was published in 1975, and one normally assumes that a book is one year in preparation, that gives a maximum time of eleven years for the formation of a boulder rim of very ancient-appearing rocks. However, a soil map of Surtsey drawn in 1970 shows this boulder rim surrounding the island at that time.¹¹ That would give the outside age of the boulder rim as seven years.

Surtsey has several lessons for geologists—indeed, for all of us. The first is that terms found so often in geological literature, such as "ancient landscape" or "mature landscape" are at best subjective and misleading. They may be used to refer to development or progress, but they have no meaning as far as age is concerned. One simply cannot speak authoritatively of age unless one knows the type and intensity of the forces that produced that landscape.

The second lesson of Surtsey is that it appears that there could be a very fundamental error involved in the time measurements of geological phenomena when one extrapolates into the past. To use today's measurements in determining the time involved in past geologic activity, one first must assume that the earth has always been shaped by very passive forces such as are at work in almost all of the world today. If, however, the bulk of the past geologic activity took place under intense and

violent conditions—such as the Flood—then today's measurements of the rates of geologic processes mean nothing in interpreting earth history. In fact, they not only mean nothing, they are totally misleading. To geologists who are in bondage to the doctrine of uniformitarianism, these sobering words of Sigurdur Thorarinsson should help produce an agonizing reappraisal of the entire concept.

An Icelander who has studied geology and geomorphology at foreign universities is later taught by experience in his own homeland *that the time scale he had been trained to attach to geological developments is misleading when assessments are made of the forces—constructive and destructive—which have moulded and are still moulding the face of Iceland. What elsewhere may take thousands of years may be accomplished here in one century.* All the same he is amazed whenever he comes to Surtsey, *because the same development may take a few weeks or even a few days here.*¹²

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- ⁹*Ibid.*, Plate 9, facing page 31. (Emphasis added.)
- ¹⁰*Ibid.*, p. 37.
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- ¹²Reference 5, p. 39. (Emphasis added.)

PANGAEA SHATTERED

MARK W. TIPPETTS*

Received 1 December 1978

Current geological facts and theory support the concept of plate tectonics—continental drift and sea-floor spreading. A short time span for such drift is shown to be reasonable being supported by rapid rates of sedimentation and fossil formation. Further, there is no viable theory for magnetic reversals of the Earth's magnetic field. Plate tectonics may be used, in part, to explain the distribution of flora and fauna as well as some of the ethnic groups on Earth.

Introduction

Since the mid-1960's there has been a radical change in the thinking of the geo-scientists. Before that time it was generally believed that the continents were fixed as to location and the only significant changes that took place were subsidence of sedimentary basins, the formation of geosynclines and mountain building supported by a concept of isostasy. Now, due to many facts that have come to light—magnetic stripes on the ocean floor, geometric fit of the coastlines, strike of shear zones, island chains and island arcs—it is seen that the continents have not always been in the positions they now occupy. In fact, they can be reassembled, much like a giant jigsaw puzzle, into a former single supercontinent called Pangaea (all land), composed of two major parts, Laurasia in the northern hemisphere and Gondwanaland in the southern hemisphere. Information is rather sketchy and inconclusive, being mostly confined to the Appalachian and Ural Mountains regarding pre-Pangaea continents.

During the Deluge there could have been some continental drifting, as shown by mountain belts such as the Urals and the Appalachian Mountains which appear to be older than the land mass known geologically as

Pangaea. This supercontinent lay astride the equator and apparently reached well into both the Antarctic and Arctic regions. The Tethys Sea was an embayment between Laurasia and Gondwanaland and the entire supercontinent of Pangaea was surrounded by Panthalassa, the world ocean and ancestral Pacific.

Noah's Ark, it is suggested, came to rest on the mountains of Ararat near the western end of the Tethys Sea. During the century following the Deluge, Noah and his progeny would have migrated to the area of Babel. At this time the tongues were confounded; and perhaps 100 years later (during Peleg's lifetime) Pangaea started to break up. Between these two events the peoples could have migrated to the farthest regions of Pangaea. At an easy slow pace of 16km per day (10 miles per day) it would have taken at most two years. There would have been no need for land bridges or ships as both man and animals could have easily walked to any part of Pangaea without difficulty. The historical distribution of peoples, vegetation and animals could have easily come about during the two centuries following the Flood; and their separation due to the breakup of Pangaea would have kept them isolated.

Dr. John Piley¹ indicates that there is an ethnic connection between the black-skinned peoples in lands bordering the Indian Ocean, in particular, E. Africa,

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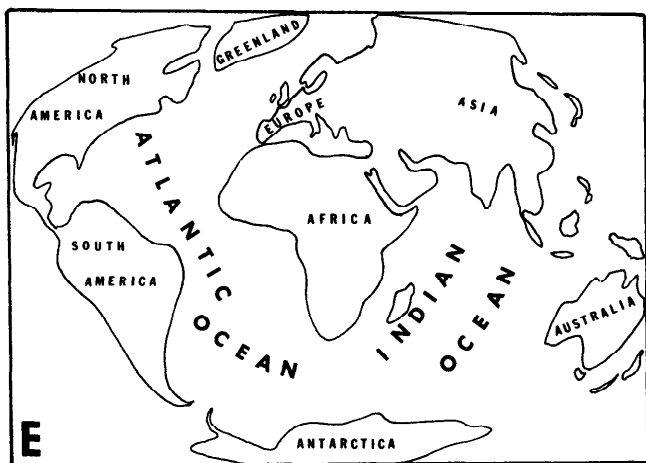
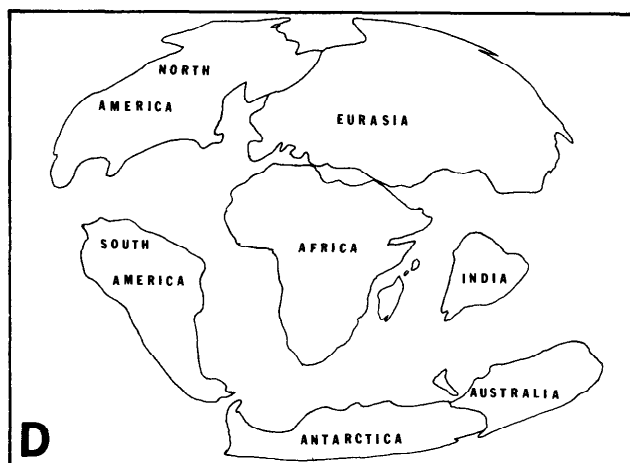
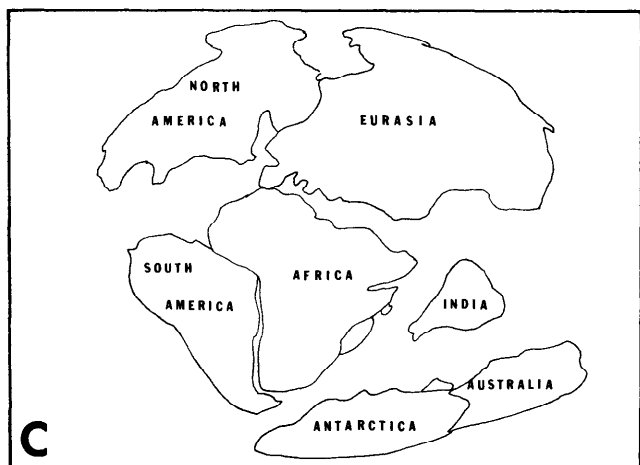
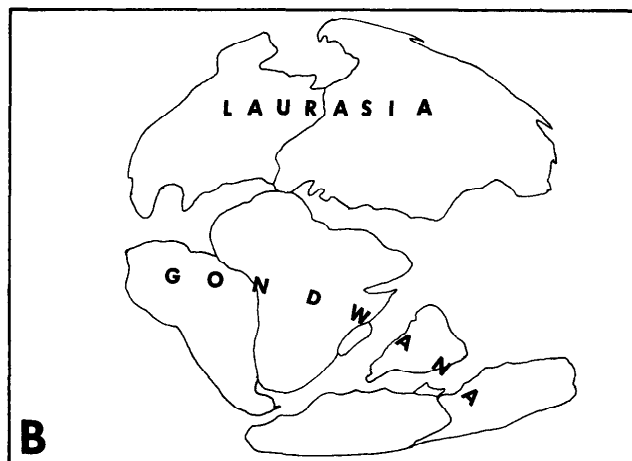
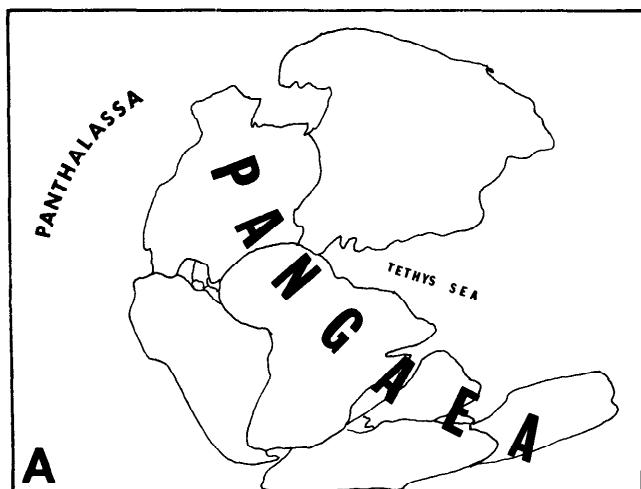


Figure 2. Map 1: A, B, C, D, E: BREAKUP OF PANGAEA. See also Reference 37. This is a generalized series of maps showing the progressive stages in the breakup of Pangaea. Distortion of the land-masses is due to map projection.

Madagascar, Australia, and India. This distribution of black-skinned peoples could have come about if they migrated on foot to the eastern and northern coasts of southern Pangaea (Gondwana) (See Figure 1-A) in the century following Babel. Later drift of the southern continents would account for the present distribution. South America had no black-skinned peoples, except rather recently, because they did not reach the future South America before Africa and South America

separated. Pilkey also indicates that two tribes of central Spain are ethnically related to tribes of Venezuela and the Caribbean Sea. Also there is a connection between the Algonquin Indians of eastern North America and the peoples of Morocco in northwestern Africa. Each of the above examples can be explained on the basis of plate tectonics, i.e., motion of parts of the Earth. There are probably many more.

Perhaps the pyramid builders of Africa and Yucatan and the mound builders of North America and Europe arrived in their respective localities before Pangaea's breakup. The vegetation and animals now found as fossils of Gondwanaland could have become very abundant before the breakup of Pangaea. The continental glaciers of both hemispheres could have developed as a result of the drastic changes in the Earth's climates following the Flood and rapidly melted as the continents moved apart.

The Glossopteris succession in the southern hemisphere developed before Pangaea's breakup. During the movement of the various plates there would be a continual change in the Earth's climates—some probably very drastic—such as the sudden and complete

deep freeze in Siberia and part of Alaska as indicated by mammoths still frozen, frozen during a warm summer day. There were, probably, many seismic sea waves generated by the many earthquakes necessarily caused as the crustal plates slid across the face of the earth and interacted with each other. These seismic sea waves might be the cause for the cyclic depositions observed, especially in the coal measures as the waves move onto and off the land.

The time table on plate tectonics according to this viewpoint is short—just a few thousand years—not the several hundred million by standard geologic evolutionary uniformitarian reasoning. It is estimated that the continents could come to their present locations in about 2,000-3,000 years at most. The time table for the events is probably true in a relative way; but if taken absolutely it is in error. The sequence of events, based upon similarities of biologic and physical contents and positions as well as chemical makeup, shows that the continents and major islands were once part of a great landmass.

The three questions concerning plate tectonics that remain unexplained are: (1) what is the cause for magnetic anomaly zebra stripes, (2) what is the time required, and (3) what is the mechanism that drives the crustal plates across the surface of the Earth? It is currently believed by nearly all earth scientists and others the magnetic stripes on the floor of the world's oceans are the result of basaltic lava acquiring permanent magnetism parallel to the earth's magnetic field as they cool through the Curie point during emplacement along mid-ocean ridges. These stripes are normal and reversed, alternately. It is believed that this normal and reversed polarity results from reversals of the earth's magnetic field. However, there is no known mechanism or theory that will explain why the earth's field should alternate between normal and reverse polarity.

The theory of mantle convection is in current vogue as the driving force of crustal plate movements. This convection is thought to rise along divergent junctures (mid-ocean ridges) and sink along convergent junctures (oceanic trenches and island arcs). However, these motions have not been and probably cannot be detected. Seismic waves from earthquakes travel through the mantle but do not show that motion is taking place. If the motions are as slow as earth scientists would have us believe (perhaps as much as 18cm/year—7 inches) it is understandable why they elude detection.

The rates of most geological processes are either not known or incompletely known. The amount of time required for and between geological events, such as deposition of one sedimentary bed upon another, is not known. Since neither rates of geological processes nor the amount of time between events is known, it is mostly a matter of speculation as to the amount of time necessary to form the geological record as seen in the rocks of the earth's crust. Therefore, this author is free to use as little time as seems necessary to agree with the time indicated from a literal interpretation of Scripture.

Magnetism

Magnetic reversal is a basic foundation of the theory of

plate tectonics. The magnetic anomalies which are detected in all ocean basins form a pattern that has been interpreted as indicating that the earth's main magnetic field has during geologic time reversed at varying intervals as many as 171 times. This zebra stripe effect, which parallels the mid-ocean ridges being symmetrically disposed about them, is taken by earth scientists as proof that the sea-floor has moved away from the ridges equally in both directions at constant slow rates. While there is little doubt that this pattern exists there are difficulties of interpretation. One of which is: how can the earth's main magnetic axial dipole change 180° at irregular intervals?²

Differences in the direction of the magnetism in the surface rocks, both volcanic and sedimentary, have been observed and studied for decades. The two main observations have been (1) the general direction of magnetism of secular change with "geologic" age assigned—mostly with depth of burial and (2) the 180° reversal between some strata.

Before the advent of the plate tectonic theory the slow change in magnetic direction in rocks with age or depth of burial was generally believed due to pole wandering. That is to say, during geologic time the earth's magnetic pole was not fixed but it was free to move over the face of the earth—even crossing the equator was not out of the question. The present theory has the magnetic pole stabilized as to position but it is the continents or crustal plates that are in motion.

The fact that the earth has a magnetic field has been known for hundreds and possibly for thousands of years. Observations of the field orientation have been recorded for both Paris and London since the mid-1500's. These data show that the magnetic direction changes with time and that there is a distinct westward drift of about 0.2° per year. In 1839, Gauss rigorously proved that by far the greater part of the magnetic field originates below the earth's surface.³

The earth's field is a dipole as if the earth has a large bar magnet buried inside. However, there can be no literal bar magnet within the earth; for geophysical and seismic evidence indicate that the internal conditions within the earth make a permanent magnet an impossibility. Holmes⁴ states:

The magnetic field cannot be a permanent property of the material of the core. Above a certain temperature, known as the Curie point, all magnetic materials lose their magnetism. For iron at atmospheric pressure the Curie point is 770°C (1418°F); for nickel, 330°C (626°F); and for magnetite, 580°C (1076°F). With increasing pressure the Curie point drops. Thus the high temperature and the liquid-like state of the outer core both render permanent magnetization impossible (F° added).

It is commonly believed that the core of the earth is composed of a liquid mix of iron and nickel (by density and seismic considerations of the earth); but according to Humphreys⁵ there are good reasons for thinking it could be water.

The magnetic field of the earth must originate from some mechanism other than a permanent magnet. The

only other way a magnetic field can be generated is by a flow of an electric current. Either, there must be some "machine" for generating the current within the earth's structure (a dynamo within the earth's core) or else a freely circulating electric current was started at the creation of the earth and is currently running down. Holmes⁶ believes the former, for he states:

The magnetic field must therefore be continuously produced and maintained, and this again suggests the generation of electric currents in material of high electrical conductivity and capable of internal movements. Only the outer core, being what we can best describe as a metallic liquid, fulfills these conditions.

Barnes⁷, however,

after due consideration comes to the conclusion that the source of the earth's magnetic field is a *real* electric current, freely circulating in the molten core of the earth. Like any electric current in a conductor, it expends energy. Its present rate of energy loss is 813 million watts. At the present time the earth's magnetic field is decaying and will, if the present rate continues, reach zero in only about 2,000 years.

Those that believe that the earth is very old use the dynamo theory as a means of maintaining the earth's magnetic field over long time periods. This theory also allows for some magnetic reversals. However, Leet, Judson, and Kauffman⁸ state:

The cause of the earth's magnetism has remained of the most vexing problems of earth study. A completely satisfactory answer to the question is still forthcoming.

What is known then, is that magnetic minerals align themselves with the prevailing earth's magnetic field at the time of deposition or as they cool below the Curie point, and this magnetism remains fixed even if the rocks are shifted to other positions or if the earth's magnetic field changes in direction. What is not known, however, is how the earth's field is generated and if (in fact) the field can reverse itself. Mere belief that the earth's magnetic field is dynamo-generated and that it reverses is not evidence. It is known that the earth's field has retained the same orientation for at least 10,000 years⁹.

When samples of rock were taken from the mid-ocean ridge in the Atlantic it was found that¹⁰:

... The magnetic polarity measured in the rock samples does not seem to agree with the integrated polarity measured by surface towed instruments. ... results of magnetic-intensity measurements on samples collected by the *Alvin* also do not exhibit any simple relation to the magnetic intensity measured by deep-towed or surface towed instruments.

In other words, the magnetization of the ocean floor rocks that can be directly sampled have fields that are different from the overall magnetic stripe pattern measured by towed magnetometers. The overall field observed must be the result of deeper level effects.

Some minerals and rock are capable of undergoing

magnetic self-reversal. That is, they may be magnetized in the direction of the prevailing earth's magnetic field and then later their field changes by 180° to the exactly opposite direction. Cox¹¹ noted that:

Rocks of reversed polarity invariably contain ilmeno-hematite; normal rocks invariably contain magnetite. ... in the laboratory, only a small fraction of 1 percent of the rocks have been found to be self-reversing.

Armstrong¹² gives several other mechanisms that could cause rocks to acquire a magnetic field other than aligned with the earth's current field. He states:

Apparently shock, in general, can cause magnetic effects, at least in some cases. An author has described remnant magnetization, in rocks around Lake Superior, as shock-induced. Also, the authors of a recent article have suggested that magnetization could have been caused by stresses, fractures, etc., which the rocks have undergone. This might help to show what should be made of the supposed magnetic reversals.

Magnetic reversals observed on the floor of the ocean are real, but their cause is at the present time *unknown*.

To a first approximation, the appearance of the magnetic stripes parallel to mid-ocean ridges almost requires magnetic reversals; but no mechanism is known that answers all questions. There is even doubt regarding the time intervals between magnetic bands for Hide¹³ states:

... that the shortest interval of time that can be resolved by paleomagnetic studies of the geocentric axial dipole component of the earth's magnetic field might be very much longer than the value often assumed by many paleomagnetic workers ...

So although magnetic banding is detected on the floor of the ocean there is doubt as to the origin and to the timing of their reversal. Further, there are regions on the floor of the ocean in which the pattern is not regular; for Heirtzler¹⁴ indicates there are:

areas where the spreading pattern is unknown either are unexplored or simply resist explanation. ... Some areas of the ocean floor show no magnetic anomalies.

Menard¹⁵ has observed that on the bottom of the Pacific and North Atlantic the magnetic patterns are sometimes garbled and that the Great Magnetic Bight in the North Pacific seems to have required impossible forms of sea-floor spreading and plate movement. McKenzie and Selater¹⁶, in exploration of the Indian Ocean, in attempting to determine plate movement in the area noted that:

The principal difficulty is that no magnetic lineations have yet been discovered on the older part of the floor of the Indian Ocean between the continents.

So, magnetic lineations, stripes or bands, may not be due to reversals of the earth's field in conjunction with ocean floor movement away from ridge area. The cause could be the result of something not yet thought of. Maybe the earth's magnetic field only acts as a "trigger" or "energizer", not the determiner of the orientation of the field of the magnetic stripes.

The magneto-hydrodynamic theory regarding the main axial dipole magnetic field has not been proven although it has been shown to account for some effects observed. Barnes¹⁷ has shown, with excellent mathematical rigor, in taking

some clues from theoretical work by Sir Horace Lamb, some extensive observational data, assumed a reasonable constraint of the upper limit of the earth's magnetic field, and the laws of electromagnetism to arrive at an age of the earth's magnet of less than 10,000 years. Since there is no known geophysical means for starting up such a huge magnet in the earth within that period, one also concludes that the age of the earth itself is less than 10,000 years.

Since the earth's magnetic field is decaying at such a rapid rate, the various magnetic reversals observed in the rocks cannot be on the order of millions of years old but must have been produced rapidly in the last few thousand years.

A computer analysis of these data has shown that the decay is an exponential one, as expected from the physics, and that the half-life of the *magnetic moment* is 1,400 years. Because the energy is proportional to the square of the magnet moment, the half-life of the magnetic *energy* is only half of this time, namely 700 years. This is perhaps the most meaningful value, 700 year half-life for the energy, because the energy supply is the most fundamental quantity¹⁸.

In addition to the earth's main field there are smaller magnetic effects: solar flares and associated auroral displays and cosmic rays, as well as transient effects of lightning and of earthquakes. These smaller effects appear, at least for the present, not to have any effect upon the permanent magnetism of the earth's crustal rocks or the floor of the ocean.

Sedimentation

It can be assumed that as the several continents moved away from each other and new oceans came into existence sedimentation on these new ocean floors would take place. This sedimentation would be thickest near shore, thinning farther out and absent or nearly so near the center of the ocean. If the geologic time scale is anywhere nearly correct one would expect that the oldest sediments to be close to the continents and youngest toward the center.

Menard¹⁹ states that "in many places the age of the oldest sediment is about the same as the volcanic layer on which it lies." Does not this imply that the ocean came into being rapidly for how could the sediment be as old as the floor (basalt) over large expanses if the ocean floor were generated slowly? Sediment²⁰ on the oceanic crust also stops increasing in thickness at depths where the calcareous ooze dissolves. It is strange that sedimentation would stop even if allowances are made for dissolution of calcium carbonate.

Camping²¹ shows that the amount of sediment expected on the ocean floor should be on the order of at least 600m over the entire floor if the concept of geologic time is correct. Instead, there are many places

where the sediment layer is much thinner or even absent. It has been reported²² that the clay mineralogy of the ocean floor has remained unchanged in the Atlantic Ocean even though the environmental conditions have changed.

The notion that geologic time extends over many millions of year would seem to suggest that diagenesis of rock would also take long periods of time as they harden from sediments. But, this is not the case, for cementation of the clasts of sediments by either silicon dioxide or calcium carbonate can be rather brief. It has been reported that²³:

in certain places in the Mediterranean, especially, there are hard rocky sea beds formed by recent underwater cementation of carbonate sediments . . . One proof that they are recent is that fragments of pottery are found in them, cemented by . . . high-Mg calcite within the lithified algal framework . . . It is concluded that . . . the lithification must accordingly be a recent process which most likely is still taking place . . . the formation of sedimentary rock from loose, unconsolidated sediments need not take long periods of time, but can be accomplished quickly.

It is recognized that the ocean floor has and is currently being subducted into the mantle of the earth along ocean trenches. However, it has been observed in some locations in trenches that the sediments are horizontal which implies that subduction there is not taking place. Nevins²⁴ reports that about 2.75 billion tons of sediment per year are being destroyed by sea floor spreading (subduction). This rate is only one tenth of the modern rate of addition of sediments to the ocean. Stated another way, ocean sediments are forming today at a rate ten times faster than they are being destroyed by sea floor spreading. Does not this indicate that motion of crustal plates must be nearly stopped or at least that it was very much faster in the past than at present? It is hard to believe that erosion rates are 10 times faster now than in the past.

Geologic Time

It is generally assumed that the amount of time needed for geologic events is enormous. That deposition of sedimentary strata, the formation of various beds, and the generation of fossils and oil takes, so it is said, millions, 10's of millions, 100's of millions, and even billions of years. However, there are many evidences that show that this cannot be the case. Most earth surface changes which occur in the present take place very rapidly. Things tend to remain stable for long periods and then a fire, flood, earthquake, slide, seismic sea wave, or volcanism will change the landscape in time spans of a few seconds to a few days or month, not thousands, millions or billions of years. Ager²⁴ states.

"The hurricane, the flood, or the tsunami may do more in an hour or a day than the ordinary processes of nature have achieved in a thousand years."

The evidence shows stability to be the rule in the present but the facts observed in the geologic column indicate that events took place rapidly. Any period of stability that may have been left hardly a trace.

In the measurement of time, present or past, two things must be taken into account: (1) the RATE(S) at which process(es) take place and (2) the amount of time between events—the HIATUS(ES). Neither of these two things is known with certainty. The geologic past and the amount of time assigned is generally no more than a calculated guess based upon unsubstantiated assumptions generated by a belief that the earth is geologically old. It can be shown that many processes of the geologic past must have taken place rapidly, although perhaps an exact time scale cannot be set up, certainly they did not take long periods of time; and the amount of time between events can also be shown to be much shorter than commonly assumed. The result of this time-shortening is to reduce the time required for the Pangaea breakup and up to the present by five orders of magnitude, or to about one 100,000th of the former value. The geologic column is a continuous record, with many rapid events, separated by short hiatuses.

About what happened between the various sedimentary layers—when sedimentary events were not taking place—we can know nothing. Nothing was recorded in the book of the rocks. Morris²⁶ believes that the geologic column is a single set of catastrophes—each stratum being produced rapidly. He states:

... everything we can actually see in the geologic strata is the product of catastrophe. . . . the “unconformities” between formations were either a period of erosion or inactivity. . . . that we cannot really see the evidences of the ages between the various catastrophes, then it is legitimate to ask how we know such ages really occurred. There is nothing remaining to measure!

Consider the formation of fossils. When an organism dies or some footprint or raindrop impression is made, its remains are only ephemeral. In the present world, decay and destruction rapidly remove all trace before any chance of burial. Nearly everything found fossilized would, under ordinary circumstances, exist only briefly before all trace would be erased. Isn't it remarkable the number of fossils is essentially uncoun-
table? Fossils range in size from coccolithophorids (smaller than a human red blood cell) to the giant whale. Each and every one of the fossils, regardless of size, place of discovery, or depth in the rocks, required *BURIAL*. Destruction of the object to be fossilized had to be stopped—mostly by preventing scavengers from eating the remains. Also decay or damage by winds or currents must be prevented; and the mechanism is virtually always *rapid burial*. Uncounted millions and billions buried rapidly.

Whales²⁷, polystrate trees²⁸, etc., are *prima facie* evidence for rapid burial, as is the nearly universal presence of clastic inclusions and plant/tree/coal debris in the cyclothem sandstones. “Log casts, carbonized plant debris, and shale fragments are locally abundant in the sandstones²⁹.” It would seem that the geologic dating in a relative sense shows that the amount of time necessary to produce the geologic column is short, although the number of years is not known.

With the advent of radio-nuclear chronologies it was believed that the *ABSOLUTE* age of strata, fossils, and

events could be determined. Various assumptions were made and calculations done to show the “age” von Fange³⁰ has shown that radiometric dating to be unreliable for he found such things as:

1. Bones dated at 30,000 years old overlying wood dated at 16,000 years.
2. Mortar from Oxford Castle in England built in 1190 dated at 7,370 years.
3. C-14 analysis of Gulf oil showed it to be just thousands of years old, not millions.
4. Petroleum thought to be 300,000,000 years old was dated 6–7,000 years old
5. Lava formed in 1800—1 was dated 160,000,000 to 3 billion years old.

Morris³¹ reports that:

Two samples of carbonized plant remains found in these strata (Clen Rose formation) provide the only real physical data for establishing a firm date according to uniformitarian assumptions. They were dated by the Carbon-14 dating method. The calculated ages were 38,000 to 39,000 years before present even though they were found in strata thought to be 100,000,000 years old.

The nuclear clock apparently doesn't run at a steady rate. DeYoung³² in a study of nuclear decay rates discovered:

... 57 isotopes with more than 10% variation in measured half-life between researchers, and 35 isotopes with more than a 100% difference in published $t_{1/2}$ values.

Radiometric absolute dates are not to be trusted. If nuclear dating methods were accurate they would agree with each other and with the relative dating methods. The fact they don't means that the time scale must be wrong.

In large areas on the floors of the deepest ocean basins are vast numbers of manganese nodules. It is believed that it takes many millions of years to produce these nodules. Radiometric analysis would seem to indicate that there is extremely slow growth but according to Lewis³³:

How fast it takes for (manganese) nodules to form is another unanswered question. In general, it's thought that they grow very slowly. Radioactive dating analysis of samples reveals growth rates as slow as 1 mm per million years. On the other hand, nodules growing around artillery shell fragments, sparkplugs and other recently produced objects, indicate considerably faster formation.

Strange that what was once thought to take long periods of time to produce turns out to be of recent origin and is produced rapidly.

The evidence is overwhelming that the geologic record is one that preserves effects of processes which occur rapidly, and events which (may) occur between processes are not preserved. Polystrate fossils show that beds were laid down in a continuous fashion with no long intervals between depositions. No erosion and apparently no quiescence either. The interface between layers does not represent a hiatus of any significant time span. Not thousands of years and certainly not millions. The sedimentary record is one continuous story without

interruption. Morris³⁴ says:

... the strata themselves show evidence of being a complex of interconnected and continuous regional catastrophes combining to comprise a global cataclysm. ... every formation grades somewhere up into another formation continuously without a time break. ... the entire geologic column was formed continuously and rapidly in a worldwide interconnected complex of catastrophes.

The fossils speak of rapid burial, the strata speak of rapid formation. The time breaks in the local sedimentary record can be shown to be short or non-existent. All of this leads to the conclusion that the entire geologic column was laid down in a relatively brief time just a few thousand years ago.

Pangaea

Pangaea (all land) is the term applied to the one single supercontinent that existed in the past. Earth scientists came to believe in Pangaea during the mid-1960's when several lines of evidence converged to point to such a notion. Scripture also indicated a single landmass for in Genesis 1:9-10, we read:

And God said, Let the waters under the heaven be gathered together unto one place, and let the dry land appear: and it was so. And God called the dry land Earth; and the gathering together of the waters called the seas: and God saw that it was good.

The evidence for a single large landmass has come from all geosciences. These sciences show that the several continents of the present were once juxtaposed. Ordinary persons have long noted that the bulge of South America looked as if it might fit into the bight of Africa across the South Atlantic. Later it has been shown that opposite sides of the Red Sea, the Gulf of Aden, and the Gulf of California and others can be made to fit as if the separate pieces were part of a large jigsaw puzzle.

In studies to confirm that South America and Africa were once joined together Hurley³⁵ proves the case for: work on both sides (of the Atlantic) found no incompatibilities in the age of many geological provinces. ... structural trends of the rocks also agree. ... Minerals characteristic of individual belts of rocks are also found in juxtaposition on both sides; ... manganese, iron ore, gold and tin seem to follow a matching pattern where the coasts once joined.

This remarkable fit can best be made between Africa and South America if, rather than taking the shoreline, the 2,000m isobath is used. This 2,000m isobath more accurately shows the edge of the continent and continental rocks. When this boundary is used the fit is in error by no more than one degree over most of the boundary³⁶. Other computer fits have been made between North America, Africa and Europe and elsewhere.

Paleontology has shown a remarkable tie with Africa and South America for the fossil *Mesosaurus* has been discovered in both. Hallem⁴⁰ says:

Strata that contain fossils of *Mesosaurus* are found only in Brazil and South Africa. This small, snaggle-toothed, aquatic reptile, measuring some 18 inches from snout to tip of tail, was evidently

aquatic. It could have hardly have been able to swim very far, however, without having diffused into many part of the world.

Hurley⁴¹ reports that the Gondwana succession of the southern hemisphere shows tillites, the same sequences of horizontal bedding with identical plant species of *Glossopteris* and *Gangamopteris* in Africa, India, Antarctica, Australia, and Madagascar. The only possible way in which these evidences could be rectified was to have all of these land masses joined during the time of their formation. No other explanation is as satisfactory.

While it is possible to show that the various continents were once joined the mechanism and the time span to move the continents to their present positions is not known. The crust of the earth is made, not of continents and ocean basins, but is part of a more fundamental structure, the lithosphere. The lithosphere is composed of a small number of crustal plates which move over the asthenosphere. Crustal plates are (generally) several thousand kilometers across and not more than 250 kilometers thick. The larger ones are named for the continent imbedded in them (six large ones plus the Pacific plate). The crustal plates interact with each other along their boundaries. Plate borders are delineated by such geologic activity as: earthquakes, volcanism, mountain building, and oceanic trenches. The interiors of crustal plates are mostly quiescent.

Crustal plates have three types of boundaries or junctures. Divergent junctures along mid-ocean ridges where new simatic crust is being implanted; shear junctures where plates are sliding past each other and crust is not being created or consumed; and convergent junctures, along the oceanic trenches where two plates overlap, with one plate subducting and being consumed. The interactions of the plate border at the present time is taking place at a very slow rate. For example; during the San Fernando earthquake of 1971 the Pacific Plate was pushed about 1 meter toward the North American Plate. Along the San Andreas fault in central California the movement is shear between the Pacific Plate and the North American Plate on the order of about 5 centimeters per year. Icelandic studies on the mid-Atlantic ridge show that it is moving apart a few centimeters per year.

There is no proven driving force or mechanism for the motion of crustal plates across the surface of the earth. The most often postulated mechanism involves convection currents in the Earth mantle. However, belief is not proof; for McKenzie⁴² states:

Although the large-scale circulation can now be accurately described, and *almost* certainly represents a form of thermal convection in the earth's upper mantle, there is still *no satisfactory theory* explaining how the circulation is maintained for tens of millions of years (emphasis added).

Burke and Wilson⁴³ also indicate something similar for: The (convection of the mantle) currents may actually drive the plate movements, but too little is known about convection in the mantle to warrant firm conclusions.

The present velocities of the rigid crustal plates are

known, the driving force remains unknown. Speculation even permits an influx of water to “weaken” or “lubricate” the underlying asthenosphere. The source of this water might have been from the “deep that is beneath”⁴⁴. If this is so, the crustal plates carrying the continents would have had little difficulty in traveling the distances observed during historic times since the Flood—not the long geologic ages as required by evolutionary uniformitarianism. What is now seen at the present time is the final slowing and stopping phase of crustal movement. The actual time span for crustal movement could be short rather than long.

Morris⁴⁵ commenting on the short age vs. long ages: Nevertheless, all things considered, it seems that the lower ages are likely, on the whole, to be more accurate than the higher ones. This conclusion follows from the obvious facts that: (1) they are less likely to have been affected by initial concentrations or positions other than “zero”; (2) the assumption that the system was a “closed system” is more likely to be valid for a short time than for a long time; and (3) the assumption that the process rate was constant is also more likely to be valid for a short time than for a long time.

The longer the time span the more likely it is to be inaccurate for rates or processes. There is physical evidence of movement and interaction of the crustal plates but this evidence does not indicate the rate in the past.

The magnetic zebra stripes on the floor of the oceans may not give the age of the ocean floor because: in spite of the fact they are apparently the “footprints” of the continents⁴⁶ it is doubtful that the magnetic anomalies have been successfully dated. Wesson⁴⁷ says:

that potassium-argon dating when correctly interpreted shows no evidence of increasing age with distance from the ridge system. The greater argon content (given older apparent age) of ocean basalt on the flanks of the ocean ridges can be explained easily by the greater depth and pressure at the time of solidification incorporating the original magmatic argon.

There are similar sequences of rocks—ophiolites—in mountain ranges around the world. This similarity shows that the processes and origins for these mountain chains are similar but “age” is not the common characteristic.

Ophiolites have three distinguishing characteristics: . . . a particular sedimentary sequence incorporating bedded cherts, . . . characteristic of deep-ocean sedimentary deposition. . . pillow basalts: igneous rocks of lumpy form that are typical of basaltic lava extruded under water, as at spreading ridges . . . dense, dark rocks low in silicon dioxide known as ultramafics . . . thought to be typical of the mantle. Ophiolites are interpreted as being a slice of the oceanic crust and upper mantle; accordingly their presence implies the former existence of an ocean basin⁴⁸.

When crustal plates converge the intervening ocean basin must eventually close.

It is suggested that the following sequence of events took place during and following the Flood:

1. A single supercontinent existed before the Flood (not Pangaea). The “Great Fountains of the Deep” breakup resulted in the fracturing of this supercontinent and subsequent collisions created several mountain ranges such as the Rocky Mountains, Appalachian Mountains and the Ural Mountains. These mountain ranges are different from others in that they are interior and not on the edge of crustal plates.
2. At the end of the Flood a single large supercontinent existed—Pangaea.
3. About a century after Babel and during the lifetime of Peleg Pangaea began to breakup. This breakup is as described in current geologic literature—only the time scale is much shortened. The time from the Flood to the middle life of Peleg would allow for the repopulation of the earth by man, animals and the growth of plants. The breakup of Pangaea was necessary to prevent man from forming a one-world government. The current distribution of living organisms on the earth can be related to the breakup of Pangaea.
4. The next major event will be the cleavage of the Mt. of Olives.

According to Scripture (Zechariah 14:4) there will be a cleavage (rift) between the Dead Sea and the Mediterranean Sea and through the Mount of Olives. It is

Table 1: PLATE TECTONIC TIME FRAME (dates approximate)

One Land	6,000 years ago	Genesis 1:9-10
Flood Deluge	4,400 years ago	Genesis 7:17-18
Babel	4,300 years ago	Genesis 11:7
Peleg's Division	4,200 years ago	Genesis 10:25
Abraham	4,000 years ago	Genesis 11:27ff.
Mt. of Olives Cleaves	Soon	Zechariah 14:4

Dates are based on Morris, Reference 35.

Table 2: PANGAEA BREAKUP—MAJOR EVENTS—RELATIVE TIME FRAME. See also Reference 36.

LAURASIA (Northern Hemisphere)	GONDWANALAND (Southern Hemisphere)
North America and Africa begin to separate	Africa and India begin to separate from each other and from Australia-Antarctica
North America and Eurasia separate	South America and Madagascar begin to separate from Africa
Greenland and Norway begin to separate	Antarctica and Australia begin to separate
Arctic Ocean opens	India in collision with Eurasia
Beginning of Iceland	Opening of the Red Sea
Sea-floor spreading in eastern Pacific changes direction	Gulf of Aden opens
Baja California separates from Mexico	Rift from Mediterranean to Dead Sea opens.
	(Zechariah 14:4 & 8.)

reasonable to suppose that this rift will be great enough to allow waters from the Mediterranean to pass through to the Dead Sea as Scripture indicates that the waters of Arabah (Dead Sea) will be healed. The density of marine water is much less than the saturated brine of the Dead Sea so it will therefore flow (float) on top of the deadly brine. As indicated in Ezekiel 47:8-10, there will be a multitude of fishes, as in the Great Sea (Mediterranean).

An earthquake beneath Messiah's tread will divide Syria, making from Jerusalem to Azal a valley which will admit the ocean waters from the west to the Dead Sea. The waters will rush down the valley of Arabah, the old bed of the Jordan, clean away the sanddrift of 4,000 years, and cause the commerce of Petra and Tyre to center in the holy city⁴⁹. If the above is correct, Jerusalem will become an ocean port and will be situated much as San Francisco is today.

Conclusions

The concept of plate tectonics is a valid one, but the time scale is longer than is necessary by a factor of at least 100,000 times. Geologic dating has been shown to be unreliable because neither rates of processes can be accurately known, even approximately, nor can the amount of time between events be known. Thus to assume the shortest possible time that would allow for the events would seem most reasonable. Sedimentation and diagenesis can be rapid and the radiometric and fossil "dating" methods appear to be faulty.

Instead of crustal plates moving at rates of a few centimeters per year the rate soon after the flood may have been a few kilometers per year. Since most of the tectonic activity takes place on plate borders, the central parts away from them would probably be unaffected by the plate motions, the earthquakes, or volcanic activity.

The breakup of Pangaea probably occurred much as supposed in traditional geology, but in a short time. This breakup came after Babel, and mostly ended before the Christian era, so there has been approximately 2,000 years for the continents to arrive at their present positions. The glaciers, the flooding, and other cataclysms could easily be accommodated in the short time frame. This short time frame seems to be supported by the evidence of paleontology, ethnology, sedimentation, and other earth sciences when properly interpreted.

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(Continued on page 83)

INSIDE THE ARK—A MINIATURE WORLD

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The Genesis account of the Deluge is extremely brief. Therefore, it requires an enormous amount of deep and painstaking study to grasp the true significance of many of the statements it contains. Much piecing together and checking and rechecking to ensure that all statements are satisfied are also required. At the same time, extreme care must be exercised to refrain from reading into it something that it does not say, because this sort of thing invariably creates unsurmountable problems in our concept of conditions inside and outside the ark.

For example, in Genesis 6:21 we read in God's instructions to Noah concerning food for the creatures in the ark, "And take thou unto thee of all food that is eaten, and it shall be for food for thee and for them." This passage is usually understood to mean that Noah and his family were required to store in the ark, prior to the beginning of the Deluge, every bite of food that all the occupants of the ark would require for a period of a year and ten days. If we apply a little clear thinking to this assumption, however, we find that it would have been an impossibility; many of the creatures inside the ark ate fresh meat only. Even today, it would be next to impossible, if not actually so, to store a supply of fresh meat adequate to feed all those creatures for that length of time.

Another point that is usually overlooked concerning the food supply in the ark, is that many species of the insects and possibly some of the smaller animals depend upon growing vegetation for food. In order, therefore, for Noah to have complied with the full requirement of Genesis 6:21, some provision for growing vegetation inside the ark had to be supplied.

Yet another requirement that is usually overlooked is that for providing a supply of topsoil in the ark. There are numerous organisms that would have been destroyed by the waters of the Deluge, that actually survive by eating the humus contained in topsoil. Noah was required to provide for their sustenance in the ark.

When we consider all of these requirements, those utopian pictures that we are so accustomed to seeing, of Noah's wife and daughters-in-law milking cows, goats, etc., and feeding the milk to tigers and leopards become a trifle inadequate for depicting the way that Noah fed all the creatures in the ark.

Those who would detract from or discredit the Genesis account of the Deluge invariably point to these requirements for food as being impossible to meet in the narrow confines of the ark. We who have the good sense to believe God's word, have tried several ways to counter this objection; but, in all cases, we have been forced to leave serious gaps in our proposed solutions to the food problem inside the ark.

On the one hand, some have suggested that the specimens that entered the ark immediately assumed a comatose state, such as hibernation or estivation, that

lasted throughout the voyage of the ark and, therefore, required little or no food for the entire time that they were inside the ark. While this might conceivably provide a solution to the food problem for most of the larger animals and birds that have life spans greater than the length of time they spent in the ark, it would not do for those that have life spans of a few days or a few hours. It would be especially disastrous for those small organisms that depend upon the manure from larger forms of life for their food and the environment in which to live and reproduce.

Others have tried to show that the carnivores became herbivores during their stay inside the ark, and ate dried vegetation. While this does remove the requirement for storing fresh meat, it increases the burden of providing adequate space to store all the extra hay and fodder that would be required.

Another possibility, usually presented by those who make movies and write fictitious articles about the Deluge, is that all the larger carnivores were fed milk from the cattle with the women inside the ark doing the milking and feeding. This produces an idyllic effect to be sure, but requires too much of a departure from the norm for the animals involved.

In addition to the objections already stated to these "solutions" to the food situation in the ark, the greatest objection is that there is no support for any of them in the Genesis account. There is not a single word in the entire Genesis account of the Deluge that even implies that the behavior of the creatures occupying the ark differed in any way from their behavior while roaming free in the antediluvian world. One exception, of course, is that their movements were limited to the narrow confines of the ark. So, once more man has built a snare for himself by departing from the truth of God's word and using his own imagination as to what it might mean but does not say.

If we allow the creatures in the ark to behave normally, of course, all of these manmade "solutions" to the food situation in the ark collapse. But when we stop to consider what God told Noah to do, we must realize that there existed inside the ark a miniature replica of the antediluvian world. Therefore, the only possible solution to the food problem, the only way that the episode of the ark could have succeeded, was to allow *all* the creatures inside the ark to behave normally and eat the food that they had always eaten. This means that all the creatures continued to breed and bear young just as they had in the antediluvian world. In cases where certain creatures fed on others, they continued to do so while in the ark, but under controlled conditions in which there would be no waste.

One might argue that there would be an imbalance in numbers that would very quickly drive certain species extinct in such a system. The God that set up the system inside the ark, however, is the same God that set up the system at Creation and possibly altered it at the time of

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the fall of man. It is certain that He knew how to provide the proper quantities of all species to maintain a supply of them throughout the voyage of the ark. In Genesis 7:2-3 we find Him instructing Noah to take in seven pairs of all clean beasts and all birds. In the case of the birds especially, this is a good start toward an adequate meat supply for the large carnivores. No other reason for this multiplicity of pairs has presented itself to date.

As mentioned earlier, many species of insects and birds, and even of smaller animals, depend upon the manure from other creatures for their food and an environment in which to live. Some people have put forth the objection that it would have been impossible for eight people to remove all the manure from the ark. That is possibly true; but it would also have been a major disaster if it had been removed. Removing the manure would have broken the cycle of the system, and a large number of the species would have died of starvation and become extinct. As each species disappeared, those species that depended upon it for food would also be subjected to starvation and death, and would soon follow it into oblivion. This in turn would destroy the food supply for one or more additional species. This process of progressive starvation could have conceivably continued until only the herbivores and man remained alive in the ark.

On the other hand, with the manure left in the ark it would have been broken down by the insects, birds, and other organisms that fed on it, and would have been quickly reduced in volume and converted into fertile topsoil. This could have been easily added to the topsoil that Noah must have placed in the ark before the Deluge for providing food for organisms that required it

and for growing green plants for those species that ate only green plants. In this manner, the manure was reintroduced into the system and did not need to be carted away. Incidentally, the upper storey of the ark is the most likely location for the "garden." According to comparatively recent accounts of sightings of the ark on Ararat, there was not just a single window in the ark but a system of windows running down the entire length of the ark on both sides near the top or at the top. These would have provided the required light for growing plants and also would have provided access to water.

The preceding hypothesis leaves us with only the few species (if any) that depend entirely upon marine life for food, and the herbivores, to provide food for. I can provide no solution to the food problem for the former; the latter presents no problem. With the necessity to store vast quantities of meat removed, there would have been plenty of space to store adequate quantities of dried vegetation and grain to feed all the animals and birds that required them for food. By careful rationing, this could have been limited to the equivalent of a few railroad carloads at the most.

Of course, this approach to the conditions inside the ark precludes the possibility that, in all cases, the specimens that left the ark at the end of its voyage were the same ones that had entered the ark a year and ten days previously. As we have seen, this was an impossibility to begin with because of the short life spans of many of the species. The Genesis account of the Deluge does not state that the same specimens that entered the ark prior to the Flood left the ark at the end of the flood. That is another of man's assumptions that has no basis in fact.

THE DISPERSION FROM THE HOMESTEAD OF THE RACE OF MAN

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In this article the archaeological dates ascribed to ancient settlements in the country around Ararat are used with data from the Bible to establish something about the migration and dispersion of mankind from that vicinity, in which the human race got its second start, after the Flood.

The subject of this paper is the original migration of the descendants of Noah from the Ark, which barge we are going to call "The Homestead of the Race of Man." In order to simplify the subject we shall turn our thoughts to the first wave of migration from the Homestead. That wave was made up of the farmer, the hunter, the gatherer, and the adventurer.

We are dealing here with prehistoric events (except for what is recorded in Genesis); thus any additional information must come from the archaeologist, rather

than from the historian. As Fagan tells us: "Prehistoric archaeology involves the systematic study of archaeological sites and of the artifacts found in them as a means of reconstructing life in the past."¹

Concerning the Ages Quoted Here

The ages quoted in this paper are mostly those assigned by archeologists, on the basis of carbon 14 or otherwise. Some readers may consider them inflated. However, my purpose here is to trace the order of events, rather than exactly when they happened. It seems that these figures will be valid as relative ages. So

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they will be quoted; and the question, whether they can be reduced by better understanding about carbon 14 for instance; or whether gaps should be admitted in the genealogies in Genesis, will not be discussed here. Incidentally, many of these dates can be found in the *Archaeological Atlas of the World*.² They are uncorrected dates according to carbon 14; and so they will be used with lower case letters thus: b.c..

Of the Biblical references which will be quoted, some seem to correlate in time, others to refer to events which at the time were yet to come.

Problems to be Solved in a New Beginning

When the great keel of the Ark sank into the mud of that valley in what is now called Anatolia, it established the site of the Homestead of the post-Diluvian race of Man.³ Noah's descendants would have to populate the Earth from this location. Noah would therefore become the father of all; and no doubt he set up a form of government: paternalism.

Noah in so doing reacted, we can believe as a modern man would to the problems. He found it necessary to organize and to teach; and the teaching would include the following:

1. Instruction in the spiritual meaning of life.
2. a. How to farm with available equipment.
b. How to make tools and weapons of stone.
c. How to search for and recognize food in field and forest.
d. How to hunt and fish.

All these subjects may seem elementary—to anyone who has never had to depend on them to survive. Then, in order to survive it was necessary to master them all. Life before the Flood, it must not be forgotten, may have been vastly different.

We can imagine that as the young people—Noah's grandchildren and later great-grandchildren—grew up to the age of say 18 or 20, Noah would organize them into groups, so that as a group they could meet the problems of obtaining food and of building shelters—in other words, solve the problems of existence under the rather difficult conditions which existed then. Indeed, those conditions, under which Noah had to farm and to raise domestic animals, must, especially at first, have been extremely difficult, in comparison with the wonderful soil and weather of the antediluvian period.

The Beginning of the Dispersion

The road to full control over the lands of the Mediterranean—and beyond—was to be a long, hard road, taking the people millenia to traverse. The migrants could not travel quickly, for they were dependent on the food which they themselves raised or gathered; nor were they mentally capable of travelling quickly. It was a different race, in attitudes and capabilities, from the one which built the Ark.

For example, Breasted tells us that prehistoric people discovered metal about 5000 b.c.. "But it was to be many centuries before the Egyptians (for example) learned how valuable this new material was. They continued to use stone tools and weapons, and employed

copper chiefly for ornament. After the discovery of copper it was possibly nearly 2,000 years before tools and weapons of copper came into use."⁴

So there was much time occupied. Indeed, from the map we can see that the early migrations of Shem, Ham, and Japheth required most of the seventh, eighth, and part of the ninth millennium b.c.. These people were not moving quickly.

Topography Soon After the Flood

Whitcomb and Morris, in *The Genesis Flood*, state: "Although the flood subsided enough so that Noah and the animals could disembark from the ark after one year the profoundly disturbed and altered hydrological and isostatic balance of the earth undoubtedly continued to manifest themselves in what might be called residual catastrophism for many centuries at least."⁵

In other words, the problems created by the Flood on the surface of the Earth were so great that millennia would be required for natural processes to correct the devastating destruction of the Flood.

Thus, the early migrations of Japheth, Shem, and Ham—and their children—were all on what is now high ground. Japheth followed the Taurus Mountains, across southern Anatolia; and Shem the Zagros Mountains. See the map, where the arrows indicate these routes. Both of these ranges of mountains radiate like the spokes of a wheel from the high ground in Anatolia known as the plateau of Ararat, in what was at one time the kingdom of Ararat. On this plateau the twin peaks, now commonly called Ararat, are located. A large part of Anatolia is over 5,000 feet in altitude.

The Zagros Mountains are just east of the Mesopotamian plain. They rise to between 3,280 and 5,570 feet in altitude, and consist of numerous parallel folds enclosing valleys 3 to 60 miles long and 6 to 12 miles wide. There valleys should prove to be fertile fields for the archaeologist; for here, it is believed, is where the descendants of Shem first settled before they travelled westward into the Mesopotamian plain.^{6,7}

The reason why these first migrants travelled in the mountains is quite evident: the flood-waters of the world ocean still covered much of the Earth. For example, the migration of Shem's people was during the seventh and eighth millennia b.c.. At that time the north Mesopotamian plains were not occupied, maybe being still under water. The southern plains were not occupied until the fifth millennium b.c..

The dropping of the water level of the ocean was slow. The islands of the Mediterranean were not occupied by farmers until the fifth millennium b.c., we are told.

The fall of the water level had to be slow for two very important reasons:

- a. To retain as much as possible of the topsoil in place until vegetation could grow root systems to help to control erosion.
- b. To control the migrations of the race of man until grass and forests would have had a chance to grow to maturity. For man is a destructive creature.

We can be sure that man observed the movement of

the level of the ocean with fear and respect for many centuries after the Flood.

Slow Migrations and Faster Adventures

It has been estimated that the rate of spreading of population in these migrations was about one kilometer per year.⁸ Thus, the migration which started from eastern Anatolia during the ninth millennium b.c. reached the Atlantic coast about the fourth.

The movement of the farming population west—or east—was, then, slow. There were people, however, who did not wish to be tied to the slow-moving farmers, and who set out by themselves to see what was on the other side of the hill. These were the hunters and the adventurers, who reached the Atlantic coast of Europe long before organized groups of farmers arrived there.

A Side-Light on the Building of the Tower of Babel

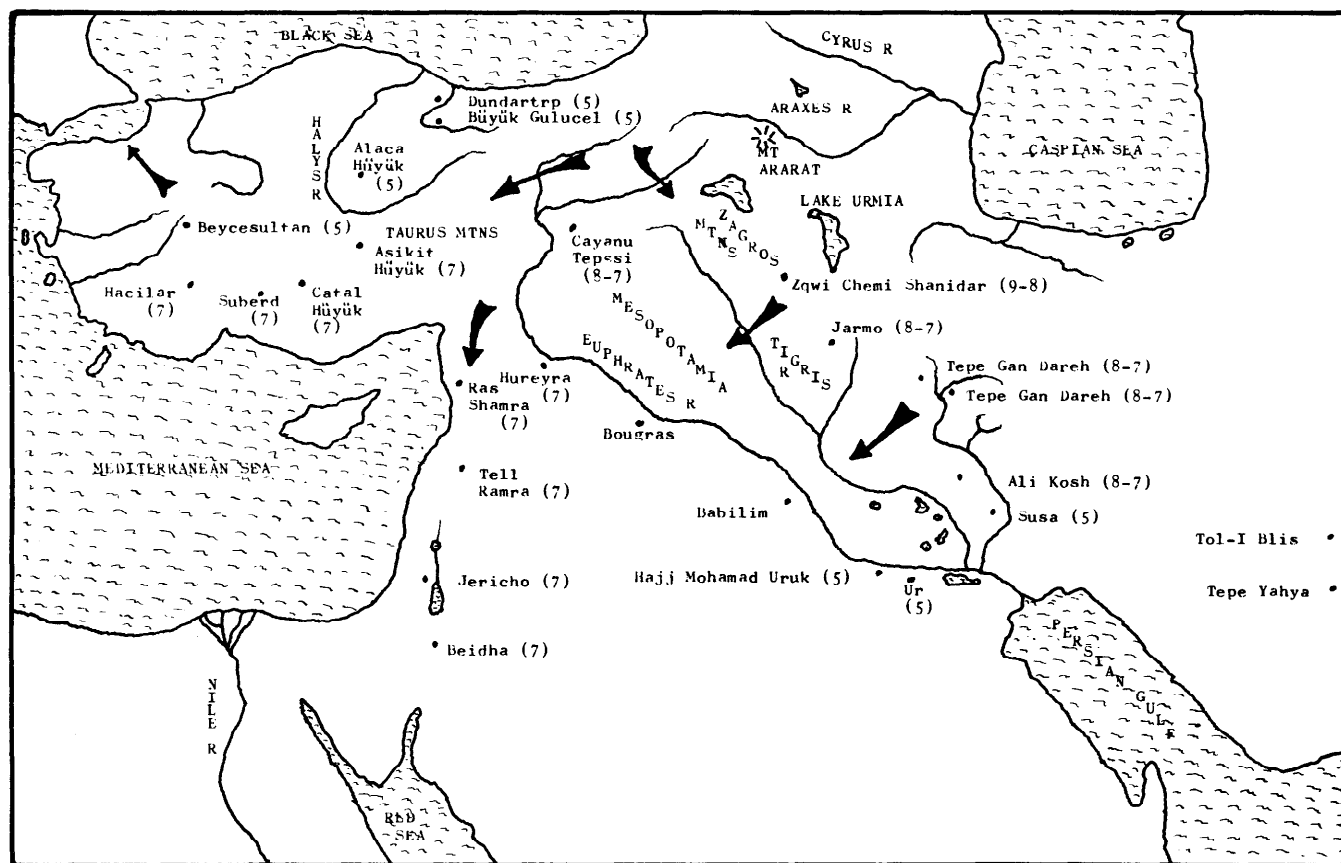
The people of Japheth, who travelled westward into Europe, certainly were not involved in this project. Nor could the people of Ham, who migrated southward (see the map) along the Levant, the name applied to the east shore of the Mediterranean, have assisted either. To have done so, they would have had to cross the desert, or else retrace their steps along the Fertile Crescent to Babylon. So the people of Shem must have been the ones involved.

Prophecy Fulfilled

Let us now refer back to Adam. The fulfillment of Genesis 3:17-19 was experienced by him in a limited way, chiefly in that he was driven out of the Garden of Eden, where he had had the luxury of being able to obtain food and shelter without much effort on his part, and at the same time to enjoy the beautiful surroundings. In the world outside he had to work hard, both physically and mentally, to obtain food and other needs.

However, his situation was likely still not all that bad. The complete fulfillment of Genesis 3:17-19, I believe, did not occur until the descendants of Noah began their migrations and found that they had to face a very hostile Earth indeed. Some lived by hunting and by gathering wild food. "Despite the advantages of food production over a hunting and gathering economy, non-farming communities survived in all parts of western Asia until 6000 b.c..."⁹

As Fagan remarked in his book *In the Beginning*, gathering and agriculture are two major means of prehistoric subsistence.¹⁰ He agrees with the Bible, perhaps without realizing so, in stating: "Whatever the ultimate inspiration or intermediate cause, it was by their hands that the early Europeans dragged themselves out of the primeval mist of savagery, strug-



This map, of Asia Minor and the surrounding country, illustrates some of the things discussed in the article. Names of natural features are in all capitals, of settlements and archaeological sites, in capital and small letters. The numbers in brackets with settlements show the millennia b.c. to which the archaeologists ascribe them. The arrows show the routes which the various groups of Noah's descendants took, as discussed in the text.

gled up the long slope of barbarism, and ultimately obtained some kind of civilized existence."¹¹

Fagan, I suppose, did not realize that he was actually writing about the fulfillment of the prophecy applied to Japheth, whose descendants left the Old Homestead, travelled west and north-west, occupied the Isles of the Gentiles, as in Genesis 10:1-5, and so founded the nations of Europe.

Now let us investigate what can be learned by archaeology about the conditions which these early farmers faced.

Agriculture Soon After the Flood

The following quotations will show some of the conclusions reached through archaeology:

"The earliest experiments in food production anywhere in the world took place in western Asia, in the area extending eastward from the Mediterranean Sea to the Zagros Mountains and northward from the Red Sea and the Persian Gulf to Anatolia. These experiments may have begun as early as 10000 b.c."¹²

"It is in Western Asia that two of the greatest advances in the history of man are believed to have originated: First, the transition from an economy based on hunting and gathering to one based on cultivation of crops and the breeding of animals, sometimes called the Neolithic or food production revolution, and second, the revolution of urban civilization, sometimes called the Urban Revolution."

"We can distinguish three main phases through which the farming economy developed in Western Asia.

First: The development of farming began with a stage of incipient food production before 7000 b.c., on the Zagros flanks, in the Levant, and in southern Anatolia. These communities had domesticated plants, einkorn and emmer wheats, barley, and some leguminous crops. Some of them also reared domesticated sheep, or goats, or both; but not at this stage cattle or swine. They all depended to varying degrees on wild foods. The early farming economies at this stage were clearly viable alternatives to the traditional hunting and gathering economies, but initially not noticeably superior; strictly hunting and gathering communities survived alongside the new farming communities.

Second: The first stage had developed imperceptibly into one of settled village farming, initially in the area of incipient food production, but occurring throughout much of Western Asia by 5000 b.c.. These communities possessed domesticated plants and animals, but they concentrated on the production of cereals by dry farming. Cattle and some swine had been added to the list of domestic animals, and they had improved strains of wheat and barley. By this stage the superiority of the farming economy had become apparent; and the role of hunting and gathering diminished sharply.

Third: After 5000 b.c. the dry farming of stage 2 was replaced in many places by agriculture with the help of irrigation."¹³

Migration in Other Directions

We find that there is much less archaeological evidence of migration directly north of Anatolia, or to

the east, or to the south through Africa. The little information which is available from these parts of the world shows the same chronological progression. The same time was taken to advance in those directions as in the directions about which there is more evidence. Indeed, except for India there does not seem to be a place for the rest of Asia in this picture, except in a negative sense.

Africa is important in secular history, as well as that of Judaism and Christianity, especially because of Egypt. The north coast is of some importance in the history of Christianity.

As for the rest of Africa, the picture there, too, is mostly a negative one—no information. (Ethiopia might provide some exception). As for the role which Africa may play in the future, only time will tell.

Where Did The Ark Land?

Much has been written about the landing-place of the Ark. Marsh, in his book *Life, Man, and Time*, suggests the following:

"The Ark grounded and finally discharged its precious burden in the mountains of Ararat, near the head-waters of the Tigris and Euphrates rivers, in Asia Minor."¹⁴

This sagacious selection of the landing-place of the Ark is a very practical one, in comparison with what is often supposed, and what has commonly been assumed in searches for this historic vessel. For it is commonly assumed that the Ark is now on top of a mountain. Marsh's suggestion, on the other hand, is not only a practical one, but also it is appropriate in view of the way history proceeded, and of the development of the Jewish church, the Christian church, and, indeed, the Bible.

Headwaters of the Rivers—and of the Modern World

Not only did two rivers of water flow south from this vicinity, but also in the country which they water—and to the west—the beginning of secular history, as we know it, was played out. Moreover, Judaism and Christianity originated and developed in the regions mentioned. And in them were written the Old Testament, and much of the New.

Also from the same location, as well as two streams of water, three streams of humanity flowed out, to people the world, and to enact history. Moreover, they provided the men to make the history written history, by recording it in scrolls and books, for the instruction of future generations. Each of these three streams of humanity had a different function.

Two of the streams flowed southward, and contributed to the enactment of secular history, and of the history recorded in the Bible. One of them, especially, carried the line of chronology which would extend from Noah to Christ.

The third stream of humanity, the one which moved to the west and north-west, formed the pagan nations of Europe. These nations later became fertile ground for the seed planted by the apostles and missionaries; and in time they became the great Christian force which spread the Gospel throughout the world. Some of them

also provided the setting for a considerable part of the New Testament.

The Landing-Place of the Ark as an Archaeological Site

Most searches for the Ark have concentrated on one object: the Ark itself. But where the Ark landed there must have developed, through those early years, a large settlement of people. This fact, as far as I know, has never been considered.

There might now be nothing left of the Ark, except, perhaps, a deposit, about 300 feet long and 20 feet wide, of ballast stones. There might also be bits of metal: nails and plates used to reinforce the hull. (Although if such things were made of iron, they might have rusted away long ago.) There might be other artifacts among the stones; for it is a well known fact that many objects find their way down into the hold of a ship.

At this site, under the upper layers of earth, there could be found evidence of this settlement, from which Noah drew the people to make up the various waves of migration. There might still be remains of the altar on which Noah made that very important sacrifice (Genesis 8:20.) It would not be surprising, although it is not mentioned in the Bible, if there should be a memorial. It might be the same as the altar, as in Joshua 22:26-29; but no sacrifices would ever have been made on it.

One important difference between this archaeological site and others, somewhat later but still from the early millennia after the Flood, would be that metal objects should be found in it. For the antediluvian people knew of metal (Genesis 4:22). Indeed, the very construction of the Ark could be evidence that they knew how to use metal.

Noah, we can assume, took on board the Ark a large supply of tools made of metal. Later, when they were worn out they were discarded; also, no doubt, some good ones were lost by accident. There could be broken pottery, household utensils, tools, and objects of all

kinds. In other words, the site at which the Ark landed would be a small island, having archaeological objects different from those from surrounding sites from later millennia. Such a find alone should serve as evidence that the site was indeed that at which the Ark landed.

In conclusion, let me say that I am at a loss to find words to express adequately the importance of that settlement somewhere near the head-waters of the Tigris and Euphrates rivers, in the ancient kingdom of Ararat.

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QUOTABLE QUOTE

"... though we christen effects by their most sensible and nearest Causes, yet is God the true and infallible Cause of all; whose concurrence, though it be general, yet doth divide itself into the particular Actions of every thing, and is that Spirit, by which each singular Essence not only subsists, but performs its operation."

Sir Thomas Browne, *Religio Medici*.

CONTROVERSY ABOUT ICE AGES

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The concept of a glacial period after the flood, which has been proposed by several creationists, is examined in this article. The slowness of glacial erosion, and the scale of the effects which have been attributed to ice erosion, such as the rock basins of the Great Lakes, are not favorable to the idea of a short glacial period. The erosional effects of the currents of the flood waters can account for much of the work which has been attributed to ice erosion, and the drift can be explained by rock disintegration in place. Thus there is no need for a glacial period in creationist geology.

Introduction

The idea of an ice age following the deluge has been supported by several creationists, perhaps because the glacial theory is so persuasive. However, questions

about the duration of the ice age, and the date of the flood as indicated in the biblical chronologies, have aroused doubts about the glacial theory in the minds of some.

The glacial theory has seemed so compelling that it has been suggested that chronologies in the Bible may be stretched or extended, on the assumption that not all

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names in the lines of descent are recorded. Thus it is supposed that an ice period of a few thousand years duration may be fitted in.

Another suggestion is that the ice age was much shorter than generally believed, and that the conventional four major divisions of the glacial period may be condensed to one. The evidence for glaciation in Precambrian and Paleozoic rocks is believed capable of another interpretation.

The writer has developed a new explanation of the drift, which accounts for many of the features believed to have been caused by ice sheets in terms of the flood. Disintegration of surface rocks due to decrease in pressure as the crust of the earth was elevated from the flood waters can account for the formation of drift *in situ*.

This alternate explanation was developed from physical principles believed consistent with past conditions which existed during the flood. The writer's objections to the glacial theory are derived from the recognition of anomalous characteristics of the drift, when interpreted in terms of the glacial theory.¹

Part of the work involved in presenting a new theory is to show that there is indeed a need for it, so it is pertinent to point out problems and inconsistencies in the glacial theory, and in the suggestion by some creationists that an ice age could have followed the biblical flood.

Limitations of Ice Erosion

In the glacial interpretation of the drift, it is supposed that the ice sheets broke up bedrock, rounded the stones during transport, and redeposited the debris as it is found today. The erosional action of ice is invoked to explain fiords, deep lake basins, and mountain valleys.

Erosion by ice sheets is accomplished by the mechanisms of quarrying and abrasion, which would need to have been active over a considerable period of time to account for the scale of existing landforms.

The erosional power of ice cannot be invoked beyond limits, as there are several facts which tend to indicate that ice sheets would be rather ineffective as erosional agents.

Quarrying is active as ice slides over a rough bedrock surface. Protuberances may be removed by the shearing stress caused by the moving ice. The quarrying process would be less effective once the bedrock was worn smooth, as noted by Whillans: "Although some as yet undescribed mechanism can perhaps create new protuberances, the existence of smoothed terrain where glaciers have been active argues against the continuous creation of such bed roughness in many places. Quarrying and the abrasion mechanism . . . in time, destroy the bedrock protuberances which are necessary for the quarrying mechanism to work most effectively."²

Whillans showed that abrasion, too, must be limited. The existence of tools, derived from the quarrying process, would be necessary for abrasion to occur.

Abrasion could occur only within a narrow range of conditions in the ice sheets. If there was too much debris in the sole of the glacier, deposition would occur which would protect the bedrock surface from further abra-

sion. If there were too little debris, the tools would be forced up into the ice and would do no work on the bed. Whillans stated:

The abrasion mechanism may depend on a delicate balance between the mechanisms that determine the density of glacial debris, and so may be efficacious in a rather narrow range of subglacial environments.³

Each of these processes is dependent upon the velocity of the ice sheet. In regions where there is no downhill slope, or where the glacier is supposed to have moved uphill, (which presumably would have occurred more slowly) these erosional mechanisms would be less effective.

Origin of Lake Basins

It is commonly stated in text books that the ice sheets eroded the rock basins of the Great Lakes, but this concept has been disputed. A leading glacialist, H.L. Fairchild, argued that it would be physically impossible for an ice sheet to erode deep basins in rock.⁴

Fairchild noted that ice in deep rock basins would be stagnant, and would act as a bridge over which the upper layers of the ice sheet would flow. He wrote:

Shearing of the upper and more rapidly moving layers of the glacier ice over the lower, basal, and laggard layers seems to be established by observation. To whatever degree this factor is active it diminishes the velocity factor at the bottom of the ice and antagonizes erosion . . . It argues specially against the flow of ice at the bottom of basins, and implies that the ice resting in a basin is likely to form a bridge over which the upper ice can travel. This is an important fact with reference to the assumed glacial origin of lake basins.⁵

Since several of the Great Lakes basins reach depths well below sea level, a considerable amount of erosion would be required at the base of the glaciers. Fairchild claimed that once charged with debris, the ice becomes less effective as a grinding agent, since the rock burden slows down its movement.

The polishing action of ice also hinders the erosion process, and the rock flour acts as a lubricant, preventing abrasion. Fairchild pointed out that ice sheets cannot deepen valleys without widening them, and he showed from observations of existing glaciers that the action of ice as an eroding agent is relatively ineffective.

Glacial erosion of lake basins, Fairchild claimed, is founded in analogy and is almost wholly inferential—it is merely assumed, since no other cause has been discovered. He stated:

Some physiographers appeal to glacial action and postulate a thousand feet of cutting by ice because their rules and principles of topographic evolution do not immediately explain the peculiarity of the topography.⁶

The idea of deepening of the Great Lakes basins by glacial scour was also discredited by J.W. Spencer, who thought that crustal warping was a major factor in the formation of the basins. Spencer stated:

At the present time in the investigation this subject can be quickly dismissed. The question whether

glaciers can erode great lake-basins is hardly pertinent, for nowhere about the lakes is the glaciation parallel to the shores or vertical escarpments which are associated with the lakes.⁷

This observation is no less true today, negating any suggestion that the Great Lakes basins furnish evidence for glacial action.

In the theory of glacial erosion of the Great Lakes basins, it is assumed that pre-glacial valleys were present in which the ice became channeled. Vast time periods are assumed by uniformitarian geologists, in which this erosion could occur. But the extended time would tend to result in filling up the rock basins with sediments from rivers, rather than excavating them to depths well below sea level.

Some investigators have supposed that pre-glacial rivers which flowed along channels now buried in drift could have excavated the Great Lakes basins. This is inconsistent with the fact that the deepest lake is Lake Superior, most distant from the ocean. The lake reaches a depth of 223 meters below sea level.

The depth of these buried valleys is insufficient to account for the deep lake basins by river erosion. Thwaites stated:

Although a large part of the lake shores are in glacial drift, enough wells have been drilled to prove that even were all the drift removed, (i.e. at the outlets), the levels of the lakes would not fall more than 300 feet.⁸

Recent investigations on the local character of the drift tend to dispute the glacial erosion of lake basins, since material would have to be carried enormous distances for the erosion of the basins of the Great Lakes.

Whillans noted that the feldspar content of the drift, and the composition of the drift compared with bedrock, show only very limited transport of the drift could have occurred. He suggested that breakup of bedrock was mostly a pre-glacial process, and that transport of material occurred by a freezing on of debris at the base of the moving ice. This could not explain the erosion of the lake basins, however, and he suggested "Some other mechanism must be invoked for the removal of material from the Great Lakes."⁹

Escarpments a Barrier to Ice Motion

The glacial theory is unable to account for the deep lake basins, and neither does it account for the great escarpments in the Great Lakes region. It is believed the escarpments were formed by uniformitarian processes during the supposed millions of years before the glacial period.

The Niagara Escarpment presents an enormous difficulty for the glacial theory. Throughout its entire length, this escarpment would form a barrier to the motion of the ice sheets. It stretches from central New York, through southern Ontario, Lake Huron, northern Michigan, to Minnesota and Wisconsin, where the uplifted Niagara formation forms the western shore of Lake Michigan. It is associated with three of the Great Lakes basins: Lake Ontario, Lake Huron, and Lake Michigan.

The escarpment consists of a long line of cliffs and bluffs, with deep valleys and indentations. It is concentric with the Michigan Basin of Paleozoic sediments, and the boundary of the Paleozoic rocks and the Canadian Shield.

Geologists believe the Niagara Escarpment was formed by subaerial erosion in pre-glacial time. According to W.M. Tovell, the erosion of the escarpment took some 300 million years. Tovell wrote: "By the time the first glaciers advanced a million years ago, the escarpment looked essentially the way it does today."¹⁰

If this were true, the escarpment would have been a major barrier to the motion of the ice. Flow would have to be from the lower side to the higher, since orientation of the drumlins near the escarpment shows this direction of motion. These are believed to have been caused by ice sheets, in the glacial theory.

At Cabot Head, on the Bruce Peninsula, Ontario, the escarpment drops away steeply to depths of more than 400 feet in Georgian Bay. It would present an immense wall of rock against the ice sheet sliding across the floor of the bay from the Canadian Shield on the eastern shore. How the ice could have overcome this barrier, and continued its movement across the Bruce Peninsula, to excavate the basin of Lake Huron, is difficult to conceive.

On the top of the escarpment in the Bruce Peninsula, the rock contains deep crevices in places and seems to have not been affected by the ice sheet. Coleman suggested the ice sheet missed these places:

On the Bruce Peninsula between Lake Huron and Georgian Bay the tableland rising 400 to 1,000 feet above the water shows only Precambrian boulders and a greatly weathered surface of Niagara limestone, while at low levels there is fresh boulder clay with beautifully polished and striated limestone pebbles, indicating that the Wisconsin ice lobe was thin and failed to sweep over the highland.¹¹

However, drumlins are present on the peninsula and on Manitoulin Island. It could be asked, if the ice sheet was thin, how could it flow up out of the bay and form these drumlins? How could it deposit granite boulders on top of the escarpment?

Another immense barrier to the ice movement occurs within Lake Huron. From North Point, Michigan, to Clark Point, Ontario, an underwater ridge runs across the bottom of the lake. On the northeast face it slopes very steeply to a great depth, below sea level in one place. On the southwest side the ridge slopes away more gently. At one point the ridge is only 36 feet below the level of the lake.¹²

The Niagara Escarpment and this submerged escarpment both constitute immense barriers to the supposed glacial erosion of the Great Lakes basins, suggesting another agent of erosion was the cause of these basins.

Flowerpot Island and the Glacier

Flowerpot Island is a small wooded island four miles from the end of the Bruce Peninsula, in the waters of Georgian Bay, Ontario. It is one of the islands of the Georgian Bay Islands National Park. The island is part of the Niagara Escarpment, which in the region is

submerged, and continues below the waters, emerging again at Manitoulin Island.

On the eastern side of the island are two stacks or pillars of rock, their bases at wave level, one 50 feet high and the other 30 feet high. These are composed of the rock of the escarpment, and were left behind by the erosion of the escarpment. The stacks are shown in Figure 1, and on the front cover.

Several facts indicate the rate of wearing away of the rock along the shores of the island is negligible. Caves high in the cliffs behind the stacks seem to have been there since the formation of the escarpment. An immense rounded boulder on a ledge near the larger flowerpot suggests no significant retreat of the escarpment since its emplacement.

The stacks would have been destroyed, however, if ice sheets a couple of miles thick had scraped over the region. They are located on the side of the island that would have received the greatest thrust from the hypothetical ice sheets that are believed to have filled and eroded the basins of the Great Lakes.

It seems paradoxical that the ice sheets capable of eroding the deep rock basin of Georgian Bay would leave behind such fragile and unstable pillars in a posi-

tion that would have received the maximum wear and tear from the ice.

Other pinnacles occur along the escarpment, one at Cabot Head, others at the Blue Mountains near Collingwood, and at Mount Nemo. Each of these present objections to the theory of an ice sheet flowing up and over the escarpment, since they would have been easily destroyed.

Limestone crags at Rockwood, Ontario, a region of numerous caves and potholes, also seem to have escaped the effects of glaciation. Coleman noted that this region was unglaciated,¹³ yet it lies in close proximity to large bedrock drumlins!

Visitors to the Rockwood conservation area are notified by signs that the potholes were caused by meltwaters from the ice sheets, but this is paradoxical, since the drumlins are believed to have been caused by the movement of the ice sheet. Meltwater could not have poured down upon one spot long enough to erode the deep potholes.

Glaciers and Rock Sheet Overthrusts

The suggestion by some creationists that the glacial period was a short one, seems to require even more erosive power must be attributed to the hypothetical ice sheet than is imagined possible by even the most extreme glacialists.

The ice sheets of the past have been compared with overthrust folds or nappes in that a mysterious power of movement is attributed to both rock sheets and the ice sheets. H. Ramberg tried to discover a mechanism by which thin rock sheets could have been able to slide for hundreds of kilometres,¹⁴ by studying the motions of the Pleistocene ice sheets.

Many creationists have questioned the concept of these rock sheet overthrusts over great distances, since no physical evidence for the motion exists at the thrust plane in some instances. It might be added, no cause for the movement is known either, and similarly the movement attributed to ice sheets of the past, in particular uphill movement, suggests there is indeed much in common between these concepts.

Erosion of the Great Lakes basins by glacial scour was suggested in 1863 by W.E. Logan, first director of the Geological Survey of Canada. He noted grooves and striations disappearing into the waters, which he attributed to glacial action.

Striations, however, may have other explanations. Early geologists thought these may have been caused by diluvial currents. The writer has suggested that striations may have been caused by movements of the drift, caused by expansion of the sand and gravel over its original volume, upon disintegration of rocks as pressure was released during uplift of the continents from the flood waters.

The disintegration product in some places may have been removed by the currents of the flood waters, leaving the striated bedrock exposed.

Striations an Objection to Erosion

Fairchild pointed out that the striations are evidence against significant erosion by ice sheets, since the cross-



Figure 1. This shows the smaller flowerpot on Flowerpot Island, in Georgian Bay, Ontario, with the larger one in the distance. Parts of the stacks have been shored up by man. The Niagara Escarpment and Great Lakes basins may have been caused by erosion of unconsolidated sediments by flood waters during rapid uplift of the Shield area. Disintegration due to the rapid release of pressure caused caves on Flowerpot Island, and many of the features of the Niagara Escarpment. Stacks may have been left intact as the currents eroded the softer sediments that surrounded them.

ing paths show no erosion of the rock occurred since the first set of scratches was produced. He wrote:

The removal of rock by the slow process of glacial abrasion is so ineffective that it is practically a negligible factor in ice erosion. The smoothing, polishing, or sandpapering of rock surfaces is rather an argument against deep erosion, as it is such a slow process that it is inconsistent with great excavation . . .

The glacial striae themselves supply one of the clearest proofs of the slow and ineffective character of abrasion. Cross-striae are very common phenomena, and may indicate different movements of the ice-body and not merely varying currents. This certainly proves the weakness of the later abrasion, for if general abrasion were such an effective process as to cut hundreds of feet into crystalline rocks during the Pleistocene period the rock should be removed so rapidly that double sets of striae would be rare phenomena.¹⁵

For creationists who suppose a glacial age followed the flood, the slowness of the rates of glacial erosion is a problem. Since the glacial theory is a uniformitarian one, it is possible to test the postulated effects of the ice sheets by comparison with the characteristics of existing glaciers. To do so is very unfavorable for the glacial theory, and suggests there is no way the ice age could be limited to a few thousand years, as suggested by those who propose an ice age following the flood.

One of the problems with this concept is that the rates of supposed glacial action must be greatly exaggerated, to account for the effects assigned to glaciation within a short period of time. Instead of one or two million years in which the ice sheets grew and did their work, creationists can afford only at most one or two thousand years, without straining the biblical account. As a result of the necessary acceleration of the rates of glacial erosion, events that seem somewhat plausible in terms of uniformitarian time scales seem highly improbable without sufficient time.

The Duration of the Glacial Period

As an example, consider the rate of accumulation of the postulated ice sheets. If the ice was thick enough for significant flow to occur, it must have been about two miles thick at the center, and one would think that amount of ice would take a rather long time to accumulate.

Suppose the rate of accumulation was similar to that in the Antarctic today. Over most of the continent, accumulation is about 5 cm of ice per year, but the rates are greater near the perimeter of the ice sheet.¹⁶

Suppose an accumulation rate of 15 cm of ice per year for the hypothetical ice sheet in North America, thought to have covered about 4,000,000 square miles. The growth of this ice sheet would have taken something like 20,000 years, which is clearly incompatible with the time scales being seriously discussed in creationist literature.

Another calculation reveals the rate of flow of the ice sheets would have been too slow for the necessary

amount of rock transport that has been attributed to the Pleistocene ice.

For example, supposing an ice sheet with a diameter of 2,000 km, with a parabolic profile, and a mass balance of 15 cm of ice per year, we are informed "a particle of ice would take 75,000 years to travel from $X = 50$ km to the edge of the ice sheet. About 60% of this time would be spent in reaching $X = 300$ km."¹⁷

The rate of flow of the ice sheet, if it was comparable to the ice in existing ice sheets, was limited by its viscosity, and if it is supposed the ice moved any faster than physical principles would indicate, the possibility of heating due to internal friction should be taken into account. Perhaps the ice sheet would melt due to the extra heat!

I suggest incorporating the glacial theory in creationist reconstructions of earth history creates many difficulties and contradictions, and an alternate theory would be desirable. The glacial theory has provided a pattern for the interpretation of certain facts, but it is wise to view theories as tentative, and be willing to consider alternate explanations when they come along.

The Disintegration Theory of the Drift

Many of the phenomena that are believed to show the former existence of continental ice sheets may be explained in other ways, so a creationist has no need for the problematic glacial period after the flood. Drift deposits commonly exhibit the pattern of cross stratification, which may be an effect of shattering and disintegration of rocks, rather than of sedimentary deposition.¹⁸

This shattering was caused by the rapid release of pressure on rocks, as overlying sediments were removed by erosion, or by decreasing pressure of flood waters.

The disintegration could affect either primitive (Precambrian) rocks, or sedimentary rocks deposited during the deluge, that were lithified as pressure decreased.

The presence of fossils in cross stratified rocks and sands shows their sedimentary origin, but the pattern of cross stratification may be due to another secondary cause, or metamorphism of the rock following its deposition as a sediment. The fossils in these formations do not negate the possibility of this disintegration origin of the pattern of cross stratification.

With the new concept, the drift can be considered a product of rock disintegration in place. Kames and eskers may be explained as expansion effects, resulting from the disintegration at the time of the flood, rather than deposits of former ice sheets.¹⁹

Striations on bedrock under the drift may have been caused by movements due to expansion. Where the striations are found on bare rocks, it is possible these rocks once had a drift cover formed by disintegration, which has been eroded by the currents of the flood waters, leaving a striated pavement. Polish on rock surfaces below the drift may also be due to a disintegration effect.

Erratics in the drift may have been formed in place, by concretionary development, as precipitates from solid solutions in the rock. Precipitation would result from the rapid change in pressure. These became peb-

bles and boulders as the matrix around them was shattered and changed into sand.

Some very large erratics, left behind on bedrock, may have been formed in this way, and become isolated when the sand and smaller stones were washed away by the currents of flood waters.

Examples of rocks transitional between limestone and a crystalline rock are common in areas with limestone bedrock. Many of the boulders in the drift exhibit a concentric internal structure, or contain pebbles or concretions inside, or in other ways reveal their concretionary origin.

Benjamin Tappan suggested an *in situ* origin of the crystalline erratics found in Ohio, shrewdly drawing the analogy of the transition of quartzite into sandstone.²⁰

After several generations of the glacial theory, an *in situ* interpretation of erratics is difficult for some to grasp, but it is not proposed without reason. The drift is generally similar to the bedrock from which it was derived. Shattered pebbles occur in the drift which could not have been rounded by abrasion in ice sheets or rolled around in the beds of streams.

Explanations of how the stones became rounded are vague and unsatisfactory in the glacial theory. If it is said the stones were rounded during transport in the ice, there must have been some kind of wonderful milling action within the glaciers, unlike any ice sheets existing today, which deposit angular rocks.

The stones are not less rounded at the center of the postulated ice sheets, but even in the region where the ice is believed to have originated, the stones have been found rounded and scratched.²¹

If the rounding of stones is attributed to fluvial action after deposition, how is it that the striations on their surfaces were not obliterated?

The variety of composition of stones in the drift has long been cited as evidence for its transportation by ice, but the variation itself is a difficulty for the glacial theory. The variety of limestone boulders in the drift in southern Ontario far exceeds the variety of possible Paleozoic sources.

The range in composition of boulders is well explained by the concretionary development followed by disintegration. The difficulty of explaining the variety of stones in drift is noted in the following comment by Price:

Unfortunately, the wide variations, in terms of petrology, lithology, and sedimentology, that occur in glacial sediments make interpretation and generalization very difficult, suggesting that glacial environments are very complicated and produce highly variable sediments.²²

These facts which are problems in the glacial theory are actually evidence for the disintegration explanation.

High Shorelines and the Flood

The idea of a glacial period after the flood, lasting until fairly recent times, requires that another extensive flood must be invoked to explain the series of raised shorelines present in many parts of the world. Around the Great Lakes of North America, and in Scandinavia,

these are attributed to the glacial lakes assumed to have been formed by ice lobes blocking valleys as the ice melted away.

In places like Hudson Bay, where the shorelines are unquestionably marine, there must have been a depression of the crust of the earth to about 1,000 feet or more below sea level, and these events point clearly to major flooding after the formation of the drift, since the shorelines are frequently formed in drift.

One is tempted to identify the elevated shorelines with some of the last effects of the deluge, as many have done, since they are geologically recent. This is a reasonable conclusion, as the writer has shown elsewhere,²³ if the theory of an ice age is set aside. The disintegration theory of the drift fits in well with the explanation of the raised shorelines as the effects of the retreating waters of the flood.

Erosion by Flood Waters

It is not suggested that the disintegration process can explain all the effects which have been attributed to the ice sheets. There has been a great deal of erosion and sediment transport, excavation of lake basins, the formation of escarpments, which have been attributed to the work of glaciers and the effects of long ages of subaerial erosion before the glacial period.

Early American geologists observed the tilted sedimentary formations around the Great Lakes and concluded that immense quantities of rock had been removed. The Niagara Escarpment, for example, is a remnant of a sedimentary formation that once extended out over the basin where Lake Ontario is now found. Due to some immense erosional action, the strata are now missing. George F. Hayes, of Buffalo wrote:

There can be no doubt that the rock strata in the western part of New York, have been disintegrated and removed, from extensive tracts north of their present limits. It would be absurd to suppose they were once deposited in such ridges, with steep escarpments, as we now find them . . .

That these rocks were deposited at the bottom of an ocean, is evinced by their fossil contents; that they have been elevated from its watery bed, requires no additional evidence other than their present altitude above its permanent level. If we seek for the cause of this gigantic phenomenon, and trace the ascending strata in a direction opposite their dip, we invariably come to primitive rocks . . .

This fact implies differential uplift of the basement has caused the tilt of the sedimentary rocks. But has this occurred rapidly, or was it slow, taking millions of years?

From the point of view of the uniformitarian geologists, the removal of such a vast amount of rock is evidence for the passing of great ages of time. With the assumption of evolution, the Paleozoic rocks are dated as hundreds of millions of years old. There was time for a considerable amount of erosion since the deposition of the sediments, time that is not available to creationists.

The alternate explanation in terms of the flood is that the sediments were eroded by currents generated by a rapid uplift of the continents from the depths. The

sediments may have been unconsolidated, so would be easily removed by the currents, and transported far to the south and redeposited as the speed of the currents decreased.

The effects of currents during the flood have been veiled by the ice age concept, but the evidence for denudation and excavation of lake basins were attributed to diluvial action by the early geologists.

It happened that in America diluvialism was encouraged by the presence of the Great Lakes, particularly as for each great lake there were hundreds of minor lakes, all seemingly pointing towards a former general inundation of the continental interior. It is not surprising that many of the early American geological descriptions incorporated the idea of a flood or of a galaxy of major lakes.²⁵

In some of these explanations, striations on rocks and the distribution of erratics were attributed to the power and violence of the diluvial currents. Others invoked icebergs for the transport of rock debris, and striated rock surfaces were attributed to the grinding action of icebergs which became grounded during a slow emergence of the land.

Sir J.W. Dawson opposed the glacial explanation of the drift, and argued for its deposition by icebergs during a prolonged submergence of the continent. He suggested the rock basins of the Great Lakes had been excavated by cold Arctic currents sweeping down over the continent from the northeast during this period of submergence.²⁶

During the deluge, the scale of the currents would have been immensely greater and more effective as erosional agents than any uniformitarian mechanism. Sediments deposited in an earlier, tranquil stage of the flood may have been unconsolidated as uplift of the crust occurred. Some formations may have lithified earlier than others, making them more resistant to erosion by the currents initiated by the rapid uplifts of the crust.

The Great Lakes basins, and similar effects of erosion on a grand scale, such as the Niagara Escarpment and the Finger Lakes of New York, may well have been formed by the erosional action of rapid currents of the flood waters. The degree of erosion in the lower Great Lakes may indicate that some of the Paleozoic formations were in an unconsolidated condition at the time of excavation of the lake basins.

Erosion Aided by Disintegration

Rock disintegration may have been active at the time of uplift and erosion of the sedimentary formations, conditions that would favor rapid lowering of pressures on the rocks. Deep lake basins in Precambrian rocks can be explained as the result of this process, followed by the excavation of the disintegration product by the currents.

The basin of Lake Superior, deepest of the Great Lakes, is formed in Precambrian rock. If sediments were deposited here, they were completely removed. Deep parallel channels and ridges at the eastern end of the lake may have been caused by the disintegration of rock in the vicinity of faults, and scouring by the cur-

rents of the flood waters. The rugged floor of the lake in this region could hardly be the result of glacial scour.

Deep lakes in the Canadian Shield, often long and narrow, may have been formed in a similar way. Pockets of drift, such as occurs at the southern end of Lake Mazinaw, may have been left intact, in places sheltered from the currents.

Canyons and valleys, such as Agawa Canyon, east of Lake Superior, may have been formed by rock disintegration in the vicinity of faults or structural weaknesses, and excavation of much of the drift by currents of the flood waters.

Some geologists believe thousands of feet of sedimentary rock have been removed from the Canadian Shield. W.A. White noted that outliers of Paleozoic rock have been found in many parts of the Canadian Shield, indicating sediments once covered the region. He supposed these had been stripped off by the ice sheets. "Before the ice sheet eroded most of its cover, central Canada seems to have resembled the central United States."²⁷

White's argument for great glacial erosion near the center of the ice sheet was refuted by C.P. Gravenor, who argued that an ice sheet would be inactive in its central parts, and claimed the Shield had been exposed from the beginning of the glacial period.²⁸

The exhumation of the Shield regions by rapidly flowing currents of flood waters, which removed unconsolidated sediments, is consistent with the conditions proposed for the excavation of the Great Lakes basins. The power of these currents would be determined by the rate of crustal uplift, so the erosion could be effective in the central parts of the Shield as well as at the perimeter.

The basins of the lower Great Lakes are eroded in weaker rocks, but the process of disintegration may have been active as well, as suggested by the drift layers on the floors of the lakes.²⁹

Conclusion

The Pleistocene drift includes some of the best known and most accessible phenomena, but its interpretation has long been a subject of controversy. For creationists, the glacial interpretation seems to make more difficulties than it solves.

The alternative in terms of disintegration due to decrease of pressure due to rapid uplifts of the earth's crust helps to eliminate some of the difficulties. Not only was the flood responsible for the deposition of sediments, but also for extensive erosion in some areas.

The tilt of the sedimentary strata in the Great Lakes region, the corresponding warping of shorelines, and the evidence for great erosion in the lake basins and the removal of sediments from the Shield, all point to the rapid uplift of the earth's crust from the flood waters as the cause of a variety of phenomena. Currents were due to a differential uplift, centered in the Shield regions. Disintegration of rocks accompanying this rapid uplift aided the excavation of deep lake basins by the currents.

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UPDATE ON THE SEARCH FOR NOAH'S ARK

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The search for Noah's Ark is and has been at a virtual standstill for the last several years. To the author's knowledge there have been no strictly legal expeditions since 1973, and those that have climbed have produced minimal results. Efforts to launch an expedition for the summer of 1979 under the sponsorship of the Institute for Creation Research are in progress; and prospects are brighter now than in the past. The present government of Turkey is much more favorable to scientific research and foreign involvement than the previous one; but current internal political instabilities cloud the picture.

To most observers, the historical evidence that has been compiled is sufficient to conclude that a large, wooden structure has been preserved near the top of Mt. Ararat but more evidence is piling up. In the past few years several possible new reports have been uncovered, although some past accounts have come into question. Firm proof of the existence of Noah's Ark is still lack-

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This is a general view of Mt. Ararat from the north.

ing; and that includes the elusive military photographs, which are reported to exist, but are not yet available to researchers.

TO MEMBERS AND SUBSCRIBERS

It is our aim, as much as possible, to have copies of the *Quarterly* arrive during the month in which it is nominally issued. Copies which go overseas are, of course, likely to take longer.

However, we must sometimes beg indulgence, when there are delays. For instance, the issue of December may be delayed, because of the very great amount of

mail being handled at that time.

If a receipt, acknowledging membership or subscription, has been received, it is highly likely that the *Quarterly* will arrive, even though with some delay. Thus, it is usually not necessary to write to the Membership Secretary in case the *Quarterly* may not have arrived quite on time. We suggest waiting until the end of the month following the month in which the *Quarterly* was issued. For delivery overseas, it is reasonable to allow proportionately longer.

A RAPID POST-FLOOD ICE AGE

MICHAEL J. OARD*

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A mechanism for a post-flood rapid ice age of about 500 years is presented. It depends upon cooling over mid and high latitude continents caused by volcanic dust trapped in the atmosphere and by a widespread snow and ice cover. These strong cooling effects are balanced by a strong warming mechanism over mid and high latitude oceans. It also depends upon extra moisture provided by strong evaporation from a universally warm ocean. The resulting accumulation of ice at maximum glaciation is approximately 30% of that postulated by uniformitarian scientists. The present distribution of ice on Greenland and Antarctica is shown to be quite possible from a rapid ice age and the present climate in the time frame allowed by the Bible. As soon as the warm ocean cooled to near its present average, the present climate would begin to set in causing fairly rapid melting of all the Northern Hemispheric ice sheets except Greenland.

The so-called ice age has always been a problem for Creationists. Some Creationists have postulated that the ice age was contemporaneous with the Flood¹, but most feel it followed the Flood². Some Creationists do not believe there was an ice age^{3,4}. Burdick gives one reason for this concern over the ice age: "Some Creationists have doubted whether there ever was a glacial age, since they find it hard to see how it could fit in with an Earth as young as Scripture would indicate."⁵ Although much has been done, much more needs to be done on the geological and atmospheric ramifications of a universal Flood in order to include an ice age in a Flood model.

Some uniformitarian scientists feel that an ice age makes a global Flood impossible: "The catastrophist idea of the Noachian debacle was finally laid to rest when Louis Agassiz showed that his glacial theory could explain erratics, striations, till, fluvioglacial features, and so on. Old ideas die hard, however, and catastrophist absurdities still appear in the literature of the early 1900's (as they do even today)."⁶ However the exact details of the ice age as well as its causes have not been worked out. New scientific information indicates that different interpretations of supposed glacial features is possible: "A good deal of uncertainty, however, prevails with respect to many so-called tillites. Difficulty arises because mechanisms other than glacial ice produce massive, more or less structureless deposits with an overwhelming clay matrix that contains a scattering of embedded phenoclasts."⁷ In view of Creationist uncertainty of how the ice age relates to the Flood, and considering the dogmatism shown in the face of unknown causes and uncertain interpretation of the data by some scientists who do not appreciate the historical accuracy of Scripture, it is important to formulate a Creationist model of the ice age.

Without defending the evidence for an ice age, the author proposes a mechanism for generating a rapid ice age on a time scale of several hundred years following the Genesis Flood. The author favors the Flood model of Whitcomb and Morris in *the Genesis Flood* because it makes the most sense Scripturally and scientifically. I will not dwell on many aspects of their Flood model, the details of which can be found in *The Genesis Flood*² or in many other books and articles. Throughout this paper the term "post-Flood", for instance in post-Flood

climate and post-Flood ice age, will be used to refer to the events within several hundred years following the Flood.

II. Requirements For A Rapid Ice Age

It is claimed that cool wet summers are needed for an ice age.⁸ However, it would take thousands of years, and the summers would have to be quite cool to build deep continental ice sheets in the present climate. Besides cool wet summers, wet but not necessarily cold winters are important to the build up of ice sheets.⁹ This is especially true for a rapid ice age. In other words, a cooling mechanism, especially for the summer, and an abundant source of moisture, not currently provided by the present climate, are required. The author feels both are supplied in the aftermath of the Genesis Flood by strong post-Flood cooling over mid and high latitude continents and an abundant source of moisture from a universally warm ocean. Post-Flood cooling mechanisms have been discussed many times before by Creationists. Only one of these will be discussed in this paper, as well as one I have not found in Creationist literature. I will also discuss at length a strong mid and high latitude warming mechanism, which has not been considered by Creationists, as far as this author knows. A link between the ice age and warm polar oceans has only been hinted at by Clark¹⁰ and by Whitcomb and Morris¹¹, but no details have been given.

III. Cooling Mechanisms

Whitcomb and Morris list several cooling mechanisms that would operate after the flood. These are: 1) the removal of the thermal vapor blanket during the flood, 2) the probable dense accumulation of volcanic dust particles in the atmosphere, 3) the newly uplifted mountains, and 4) the essentially barren topography of the denuded lands.¹² Besides these, one other cooling mechanism would be significant: greater reflection of solar radiation back to space and insulation from the warm ground due to a snow cover. There is no doubt that the removal of a pre-flood vapor canopy and the post-flood higher terrain would cause significant cooling from a pre-flood world over mid and high latitude continents. These factors have already been accounted for in the present climate, which is unable to support continental ice sheets, except of course for Greenland and Antarctica. Barren topography however can be heated better by the sun

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than vegetation-covered land, as well as cooled better by terrestrial radiation. This effect would probably be slight in the post-flood climate on a worldwide scale, but might be significant for different continental latitude belts, causing a cooling effect at high latitude and a warming effect at low latitude.

A. Volcanic Dust

There may be some doubt as to the effect of volcanic dust. However, recent scientific information has shown that volcanic dust in the stratosphere is a significant cooling mechanism. This effect has been adequately discussed by Clark¹³ and Coffin.¹⁴ Some recent articles document the cooling effect of stratospheric volcanic dust.^{15,16,17,18} It is no wonder that Steven Schneider, a researcher in climate change, could say at the 1978 Annual Meeting of the AAAS: "The effects of various types of dust and aerosols (cooling versus warming) are still in heavy debate, *but at least volcanic dust is known to cool* (italics mine)."¹⁹ The greatest response to this cooling effect would be over continents since volcanic dust decreases the solar radiation reaching the surface, while over the oceans the effect would be small, since the oceanic air doesn't depend as much upon radiation to heat or cool it.

During the flood it is believed that a great amount of volcanic activity occurred from the eruption of all the fountains of the great deep.^{20,21} As a result a large cloud of volcanic dust would be left over in the atmosphere at the end of the Flood. The geological record indicates much volcanic activity during geological time, which would be compressed into a one-year flood and a period of especially strong post-flood volcanism in the flood model.^{22,23} Researchers in climate change do not feel the volcanic activity is significant enough to cause major glaciation because of the long periods of time they allow for the geological record. However they do recognize that an increase in volcanic activity over that of the present would cause continental glaciation: "... volcanic explosions would need to be an order of magnitude more numerous than during the past 160 years to result in continental glaciation equivalent to the Wisconsin glacial episode."²⁴ The cooling effect of volcanic dust deposited into the atmosphere during the Flood would last 2 years in the tropics, but 12 or more years in the higher latitudes, especially contributing to cooler summers.²⁵ With the addition of more volcanic dust into the atmosphere from strong post-flood volcanism^{22,23}, the resultant cooling effect would last much longer. Because of the short residence time of volcanic dust, the tropics would be affected least and would probably settle down to nearly the present climate in only a relatively short time after the flood. However the higher latitude continents would be dramatically affected by flood and post-flood volcanism for perhaps a few hundred years.

B. A Snow Cover

Another cooling mechanism that would be operating on the earth soon after the flood is a widespread snow cover. The initial cooling below the freezing point over mid and high latitude continents needed for snow ac-

cumulation would be provided by the cooling mechanisms already mentioned. Cooling of these areas would begin as soon as the land emerged from the flood waters. In the present climate it takes only a few weeks in early autumn for the interior of Canada and Siberia to fall below the freezing point from the warmth of summer. Since volcanic dust would be an additional strong cooling factor in the post-flood climate, one would expect that freezing temperatures for these areas would be reached soon upon exposure from the flood waters, possibly even if it were summer. Since wind speed is proportional to horizontal temperature changes, the wind would pick up and become strong at the end of the flood as more and more land became exposed and as it cooled. (This is probably the reason wind is mentioned in Genesis 8:1 as the water receded.)

The moisture for snow would be provided by the abundant evaporation from warm polar oceans, which would be strongest near the coldest continents.^{26,27} This moisture source for snow will be discussed further in Section VI. Residual atmospheric moisture from the Flood and evaporation of wet ground would also be secondary moisture sources immediately after the flood. A snow cover would be established over high latitude continents and appropriate areas of mid latitudes soon after the flood. Once a snow cover is established a positive feedback cooling mechanism would be set up.^{28,29} A positive feedback mechanism acts to amplify the value or anomaly of the interacting element (snow cover in this case), while a negative feedback mechanism dampens it.³⁰ The positive feedback cooling of a snow cover is caused by the increased albedo (reflectivity of solar radiation) of the snow surface, which is about 85% for freshly fallen snow. This compares to the present average albedo for the earth of 35 to 37%.³¹ Hence most of the solar radiation falling on the snow surface would be reflected back to space, and therefore would not be available to heat the air. Furthermore, snow is a good insulator and will insulate the air from the warmer ground. The effect of a snow cover is dramatized by the following hypothetical example: "Thus, if snow and ice covered the whole surface of the Earth even for a short time, its mean temperature (equal now to 15 degrees C) would be reduced by approximately 100 degrees C. This estimate shows what an enormous effect snow cover can exert on the thermal regime."³² Once a snow cover is established over appropriate areas of mid and high latitude continents soon after the flood, the air would be further chilled, more so than if the snow cover were not there.

IV. A Warming Mechanism

The cooling mechanisms in Section III are fairly strong and the temperature would be extremely cold during winter over the higher latitude continents soon after the Flood, if it were not for a strong warming mechanism over the oceans. This mechanism exists today, but is not as strong as it would be in the post-flood climate. Immediately following the Flood, the water of the oceans would be uniformly warm from pole to pole and from top to bottom. There are two reasons for this. First, a pre-flood water vapor canopy would not only cause a uniformly warm climate,³³ but also a fairly

warm ocean. Geology attests to a uniformly warm climate for most of geological time, the cause of which is unknown. The evidence of this is found in the fossil record, which corresponds to the pre-flood world. Second, according to the flood model of Whitcomb and Morris, much of the water of the present oceans came from deep within the earth during the Flood: "Presumably great portions of the waters were entrapped below the crust . . ." ³⁴ This water from the "deep" would necessarily be quite warm, probably some of it hot, depending upon the depth of origin. It would be a large amount of water because the flood waters rose above the pre-flood mountains, and the water from the deep is by far the primary source for the flood (the collapse of the vapor canopy adding only a comparatively small amount ^{35,36}). From the chaos of a global flood, this warm water from the "deep" would be well mixed with any cold water that might have existed in the pre-flood ocean. Following the flood, the warm ocean, including the Arctic Ocean, would give off much heat to the air at mid and high latitudes, exerting a profound influence on the climate.

The heat would be released into the air from the warm oceans by two processes: 1) conduction due to cooler air in contact with warm water, and 2) latent heat of condensation, which is proportional to the evaporation from the ocean. These two processes are expressed by the following equations for the energy flux from the ocean surface: ³⁷

$$E = \rho C_E (Q_s - Q_{10}) U_{10} \quad (1)$$

$$S = \rho C_H C_P (T_s - T_{12}) U_{10} \quad (2)$$

Where E and S are the averages of the exchange between the air and the ocean for water vapor and sensible heat (feelable heat), ρ is the air density, C_E and C_H are the empirically derived exchange coefficients for water vapor and sensible heat, U_{10} is the average wind speed at 10 meters above the ocean (ship anemometer level), Q_s and Q_{10} are averages of the mixing ratios for air in contact with salt water and at 10 meters, and T_s and T_{10} are average temperatures of the sea surface and the air at 10 meters. In terms of heat, E represents about 590 cal of heat added to the air from the ocean for every gram of water evaporated. ³⁸ The mixing ratio is the actual amount of water vapor present in the air per unit mass, usually expressed in grams of water vapor per kilogram of dry air. Q_s is the saturation mixing ratio for the sea-surface temperature and is proportional to temperature at a constant pressure. Equations (1) and (2) show that the amount of heat added to the air from the ocean is proportional to the wind speed, the air-sea surface temperature difference, and the air-sea surface mixing ratio difference. E and S will be especially strong in regions where cold dry continental air blows strongly over warm ocean water.

A relationship not directly indicated in equation (1), but nevertheless contained in it is that E is proportional to the sea-surface temperature. The higher the sea-surface temperature the higher the evaporation and heating of the air. For example, an air-sea temperature difference of 10 degrees C, when the sea-surface temperature is 24 degrees C, gives a mixing ratio difference ($Q_s - Q_{10}$) of 9 gms/kg. But if the sea-surface

temperature is 0 degrees C, the mixing ratio difference is only 2.1 gms/kg. Therefore evaporation with a sea-surface temperature of 24 degrees C is more than 4 times as strong as when it is 0 degrees C for the same air-sea temperature difference.

To estimate the heat liberated by the post-flood warm oceans and the strength of the warming mechanism, two assumptions will be made, which are necessarily speculative due to the nature of the problem. However, I feel the assumptions here and in other sections of this paper are reasonable within a Creationist framework. First, an estimate for the average temperature of the ocean following the flood is needed. Second, an approximation for the ocean surface area responsible for a net heat loss from the ocean is required. I will assume a pleasantly warm average ocean temperature immediately following the flood of 24 degrees C. The average temperature of the oceans today is 4 degrees C. This is a reduction of 20 degrees C. The volume of the ocean is estimated ³⁹ to be 1.4 billion Km³. Since the density of sea water is close to 1 gm/cm³, an average cooling of 20 degrees C would release a total of 2.8×10^{28} cal of heat to the atmosphere.

The ocean surface at mid and high latitudes would be responsible for the net heat loss of the whole ocean. This is because the heat lost from the low latitude ocean due to the processes represented by equations (1) and (2) is more than balanced by the radiative heat gain. With cold mid and high latitude continents and adjacent warm oceans, E and S would be quite high, much higher than presently. This heat loss will only be partially balanced by the radiative heat gain and other processes (see equation (3) and the calculations that follow) resulting in a net cooling of the oceans. As a rough estimate for the area of net oceanic cooling, I will assume the boundary between cooling and no cooling to be 35 degrees north and 55 degrees south (the boundary is farther south in the Southern Hemisphere because the continental cold air source is at the pole and much smaller than in the Northern Hemisphere). Therefore the mid and high latitude ocean surface responsible for the net cooling of the oceans for both hemispheres ⁴⁰ is 85.56×10^6 Km². Dividing the total cooling by the total area, the heat liberated to the atmosphere from a unit area of ocean surface is 3.3×10^4 Kcal/cm².

The significance of this much heat can be appreciated by comparing it to the yearly average radiative heat gain in the tropics (30 degrees north to 30 degrees south), which not only warms the tropical atmosphere, but also adds heat to the higher latitudes by various transport processes. The tropical average is 108 Kcal/cm²-yr. ⁴¹ The heat gain of the post-flood higher latitude oceanic air is 300 times this value, and therefore is a large quantity of heat.

A good estimate for the heating rate of the post-flood mid and high latitude oceanic atmosphere from the warm oceans is 108 Kcal/cm²-yr. This heating rate would not result in tropical air temperatures over higher latitude oceans because much of this heat would be mixed with the cold continental air, resulting in more mild temperatures for both land and ocean. At this heating rate, the ocean would cool to its present

average in 300 years. This will also be the time for a rapid ice age to reach maximum glaciation.

V. The Post-Flood Climate

Several unique features of the post-flood climate as they relate to a rapid ice age will be explored, as far as possible, in this section. The horizontal change in temperature between warm oceanic air and cold continental air would be the strongest near the coast, the isotherms generally lying parallel to the shoreline (see figures 3 and 4). In meteorology, this is a zone for storm

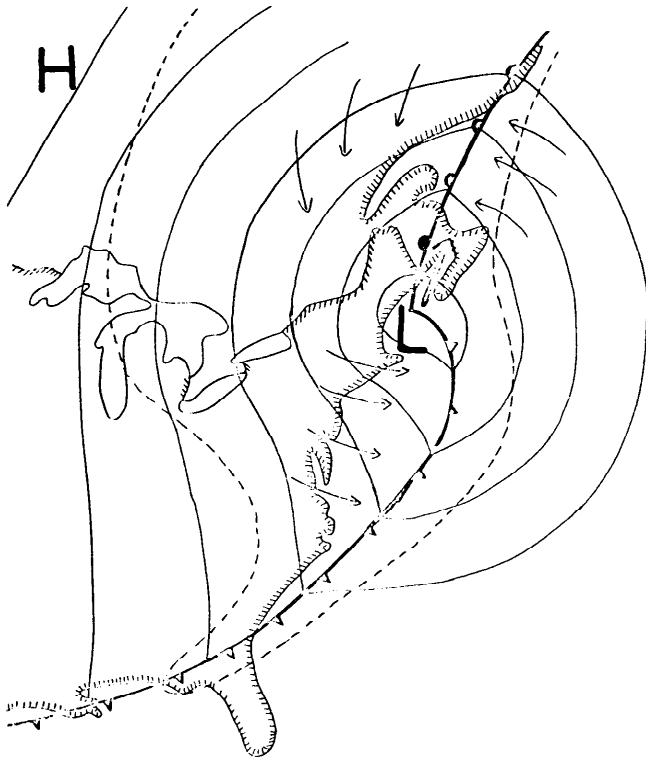


Figure 1. A storm off the coast of Maine moving northeast along the coast (heavy arrow). The lines with teeth and semicircles are cold and warm fronts respectively. The solid arrows are wind directions. The lines around the storm center (L) are isobars. The dashed line encloses the usual precipitation area in modern-day storms.

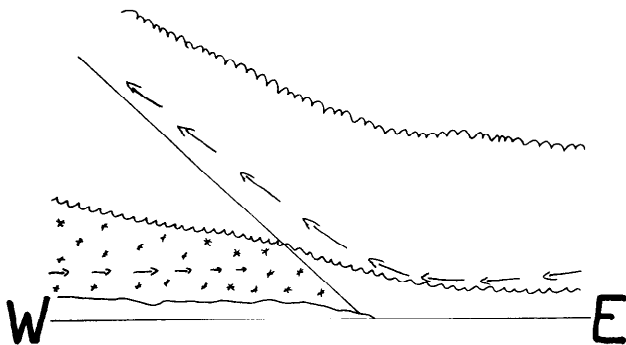


Figure 2. An east-west cross-section through the warm front north of the storm center of Figure 1. The horizontal straight line is sea-level. The irregular horizontal line is the land surface. The arrows are east-west wind components. The sloping straight line is the upper warm front (vertical scale greatly exaggerated). The scalloped lines represent the top and bottom of clouds. The asterisks indicate snow.

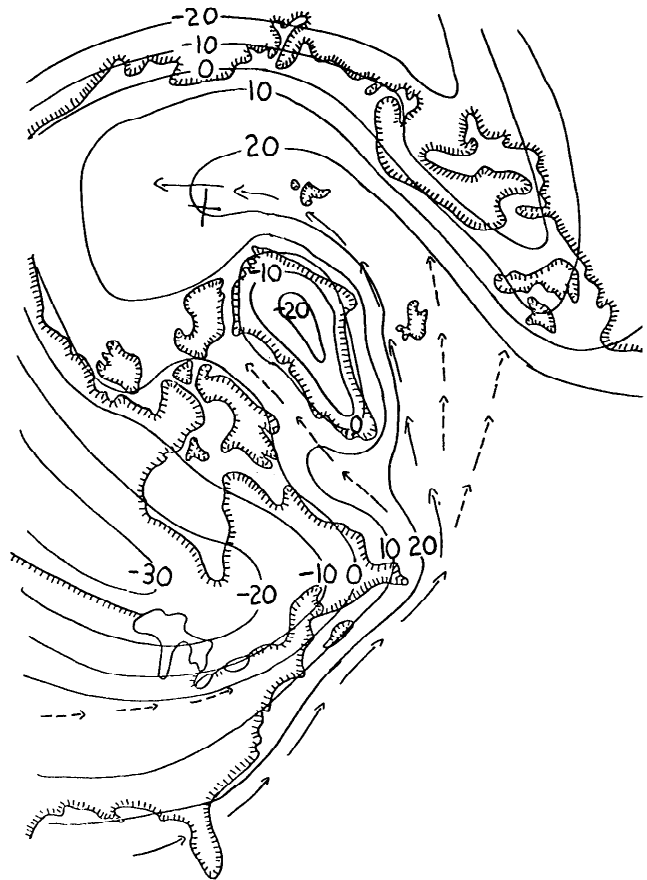


Figure 3. Postulated storm tracks and average isotherms in degrees centigrade for the post-flood climate of the Atlantic Ocean. The solid arrows represent the major storm track. The dashed arrows represent minor storm tracks.

development. By the thermal wind equation⁴², the horizontal temperature change causes an increase in wind speed with height, increasing until a level of no change is encountered. This wind aloft would generally blow parallel to the vertically averaged isotherms, the coldest air being on the left in the Northern Hemisphere, and vice versa in the Southern Hemisphere. The wind aloft acts as a guide to storms, and in the post-flood climate will cause the storm tracks to follow the east coasts of continents in the Northern Hemisphere and the coastline of Antarctica in the Southern Hemisphere. For example, the average wind aloft over the East Coast of North America would generally be from the southwest. Storms would likely develop in the Gulf of Mexico or in the Atlantic Ocean off the southeast coast and move northeastward along the shoreline. This storm track is represented in Figure 3 by the solid arrows. Postulated minor storm tracks are indicated by dash arrows.

In these coastal storms, cold air would be drawn off the continents and over warm ocean water. This air would be heated rapidly, becoming quite moist in the process. Figure 1 illustrates this situation southwest of a storm center off the coast of Maine. The ocean surface water in contact with the cold air would be cooled and sink, being replaced by warmer water from below and from lower latitudes. An ocean circulation would

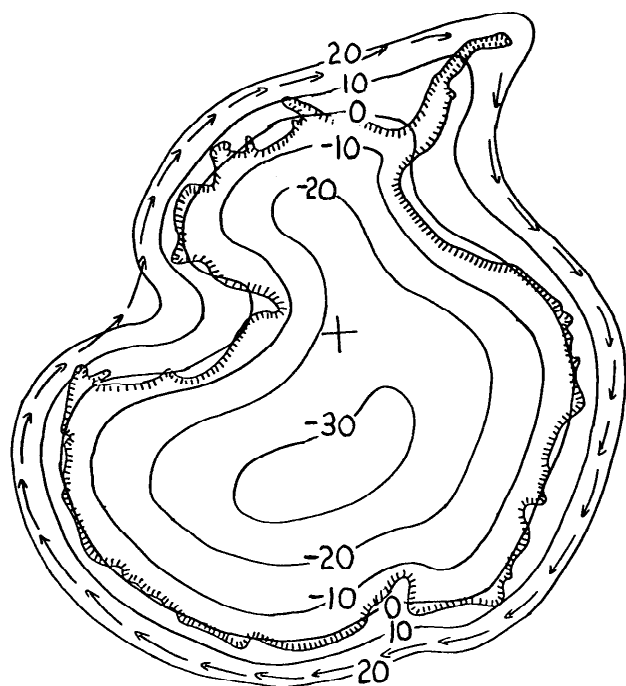


Figure 4. Postulated storm track and average isotherms in degrees centigrade for the post-flood climate of Antarctica.

develop soon after the flood and become quite strong with time, ensuring a continuous supply of warm surface water at high latitudes. The cooler water that sinks would form a layer of cool "bottom water" that would spread out over the whole ocean bottom, becoming colder and thicker with time. To the north of the storm center in Figure 1, warm moist oceanic air would blow inland. However because of the greater density of the cold continental air, it would be forced up and over the colder air. This is a potent mechanism for heavy snowfall. Figure 2 illustrates this concept.

The stormiest conditions with the most snowfall in the post-flood climate would likely be soon after the flood and taper off gradually as the oceans cooled. This is because the horizontal temperature contrast between land and ocean due to the unique post-flood warming and cooling agents should be a maximum soon after the flood. The heat given off by the oceans would act as a regulator or a negative feedback mechanism to ensure that all processes proceed at a fairly constant rate. For instance, if too much heat is released to the atmosphere at one time, it will cause the cold air to be warmer as a result of mixing. If the continental air is not as cold, it will not draw as much heat from the warm ocean, hence, dampening the original heat anomaly.

To visualize the consequences of this unique climate, I will use the storm depicted in Figure 1 to estimate the snow accumulation over appropriate areas of North America for a 300 year long period. This storm is not unlike the Northeasters that clobber the East Coast every winter (actually the storms of the post-flood climate would be much more extensive with heavier snow since they would carry as much as 4 times more water vapor). Since the East Coast of North America would be a favorable storm track (see Figure 3), I will

assume that one storm a week forms near Florida and travels northeast, ending up either in the Norwegian Sea or the ice-free Arctic Ocean. A modern-day Northeaster drops about 1 inch of precipitation along the Eastern Seaboard. Assuming this conservative snowfall in the post-flood climate and that no ablation of snow or ice occurs, about 440 meters of ice would accumulate in locations that are cold enough.

In the Southern Hemisphere, the storm track would generally follow the coastline of Antarctica. This is illustrated in Figure 4 with postulated average isotherms. In the present day winter-type storms, most of the precipitation falls in the colder air portion of the storm. Thus, most of the precipitation from storms would fall over the Antarctic continent in the post-flood climate. Similarly to the example of the East Coast storm, if an average of one storm a week passed by any one point near the coast, and if 1 inch of precipitation in the form of snow fell inland for several hundred miles, then about 440 meters of ice would accumulate over Antarctica in a 300 year period.

VI. The Abundant Source of Moisture

If glaciation is to occur at mid and high latitudes, something more than just cooling for a few hundred years is required. An abundant source of moisture is also needed, especially if the ice age is rapid, which it must be in the time frame the Bible allows.^{43,44} "From the comparisons given, it would appear that precipitation, in regions already cold enough to support glaciers, is more critical than temperature in initiating glaciation."⁴⁵ The problem of adequate moisture has always been acute for uniformitarian scientists because the water vapor content of the air, which is proportional to temperature, is very small in cold regions. Winter-time precipitation in these regions is usually quite light. In fact, the interior of Antarctica, a large part of which receives less than 5 cm of precipitation annually, is one of the driest places in the world.⁴⁶ The uniformitarian scientist must appeal to long ages in order to accumulate enough snowfall for an ice age from some perturbing mechanism.

In the post-flood climate, there would actually be two primary sources of moisture for a rapid ice age. The major source would be from strong evaporation off the warm post-flood ocean at mid and high latitudes (called M1), and the other source would be the net poleward movement of moisture from low latitudes by the atmospheric circulation (called M2). The first is operating today, but on a much smaller scale, and the second should be similar to that of present climate. The author feels the first source is the key to a rapid ice age because it provides the additional moisture at mid and high latitudes that the present climate cannot, and without it, there would be no rapid ice age at all.

A. Effects of a universally warm ocean

As already stated, the post-flood climate would be characterized by cold continental air blowing out over warm ocean water, especially during storms. This feature would be strongest along the east coasts of cold continents and along the shoreline of Antarctica. To

estimate this effect, E and S from Equations (1) and (2) for stormy conditions will be found using reasonable assumptions. Assuming the water temperature averages 24 degrees C, the air temperature 10 meters above the ocean averages 4 degrees C, the average relative humidity of the air is 50%, and the wind speed at 10 meters averages 15 meters/sec, E equals .59 gms/m²-sec and S equals 136 cal/m²-sec. (C_E is 1.84×10^{-3} for the above conditions⁴⁷ and C_H is 1.46×10^{-3} for very unstable air.⁴⁸) The latent heat liberated by this value of E is 348 cal/m²-sec. The total heat liberated is 484 cal/m²-sec. It is readily seen from this calculation that evaporation is three times stronger than conduction in cooling the oceans. Therefore three-fourths of the total heat loss of the mid and high latitude ocean would come through the agency of water vapor added to the air.

Stormy conditions near continents are not the only situations in which water is evaporated into the air over the oceans, but they are certainly the strongest. If the above stormy conditions occurred over the whole ocean poleward of 35 degrees north and 55 degrees south, the ocean would cool to its present average of 4 degrees C in only 21.5 years. This is, of course, a hypothetical case, but it illustrates the efficiency of storms in not only cooling the oceans, but also in adding abundant amounts of water to the air.

A modern day example of the evaporative potential of cold air blowing over much warmer water is provided by the Great Lakes area during the cold winter of 1976-77. "For most of the country, clearing skies are expected after the passage of a winter cold front, but near the Great Lakes the opposite is true. The cold Arctic air spreading over the lakes picks up heat and moisture which produces clouds and snow squalls that stream inland as far as 100 miles (161 km)."⁴⁹ This effect has been known to dump up to 102 inches of snow in 5 days just east of the Great Lakes. Even though the Eastern U.S. was drier than normal during the winter of 1976-77, the colder-than normal weather patterns caused tremendous snowfall downwind of the Great Lakes. Fifty-one days of lake-effect snowfall produced as much as 466.9 inches of snow at Hooker, New York.⁵⁰ Extend these conditions to whole continents and large areas of the ocean, where sea-surface temperature averages 24 degrees C instead of about 0 degrees C, for a 300 year long winter, and one can visualize how a rapid ice age can happen in the unique post-flood climate.

B. The Available Moisture

The net cooling of the post-flood ocean would be partially offset by radiative effects, namely the radiative heat gain at mid and high latitudes, and the net poleward transport by ocean currents of heat gained by radiation in the lower latitudes. (Other effects, like the conduction of heat from the earth to the water, are small and shall not be considered.) This complicates an otherwise simple calculation to find M1, but it can be found using an estimate of the oceanic cooling rate and the equation for the heat budget of the ocean. The equation for the oceanic heat budget is used to find a better estimate of the total time to cool the oceans (300 years was only a rough estimate) which takes into considera-

tion the above mentioned radiative effects. Multiplying the cooling time by the rate of evaporative cooling gives M1.

The oceanic heat budget equation is:⁵¹

$$Q_s - Q_b - Q_h - Q_e = 0 \quad (3)$$

where Q_s is the absorption of radiation from the sun and sky, Q_b is the infrared radiation from the sea surface, Q_h is the conduction of sensible heat to the atmosphere, and Q_e is the latent heat due to evaporation. Equation (3) is for a long-term average or steady state, but in the post-flood ocean another term, Q_n , the yearly average net heating of the ocean, is needed. Equation (3) then becomes:

$$Q_s - Q_b - Q_h - Q_e = Q_n \quad (4)$$

This equation is the same as the equation for the total energy exchange at the ocean surface.⁵² Q_n equals -2.8×10^{25} cal/T, where T is the total cooling time of the oceans in years. To solve this equation for T , I will divide the volume of the ocean into tropical and polar volumes, the dividing lines in the post-flood ocean being 35 degrees north and 55 degrees south. Equation (4) now becomes:

$$(Q_s - Q_b - Q_h - Q_e)_{Tr} + (Q_s - Q_b)_p - (Q_h)_p - (Q_e)_p = -2.8 \times 10^{25} \text{ cal/T} \quad (5)$$

where Tr means tropical and p means polar. $(Q_e)_p$ is the evaporational cooling rate needed to find M1. The reason for dividing equation (4) into two volumes is because the tropical portion is equivalent to the poleward oceanic transport of heat from the lower latitudes and is easier to estimate in this form. $(Q_s - Q_b)_p$ is the radiative heat gain at higher latitudes.

$(Q_s - Q_b - Q_h - Q_e)_{Tr}$ and $(Q_s - Q_b)_p$ can be found by using the data for different latitude belts of the present climate provided by Budyko⁴¹ and Lamb.⁴⁰ $(Q_s - Q_b - Q_h - Q_e)_{Tr}$ is 1.04×10^{22} cal/yr. and $(Q_s - Q_b)_p$ is 2.68×10^{22} cal/yr. The present tropical climate would be a good representation for the average post-flood tropical climate. However, $(Q_s - Q_b)_p$ would be less in the post-flood climate than in the present due to the presence of atmospheric volcanic dust and warmer sea-surface temperatures. In calculating the post-flood value, there were no radiative data north of 70 degrees north and south of 60 degrees south. This is because $(Q_s - Q_b)_p$ poleward of these latitudes is nearly zero at the present ocean surface due to sea ice. The post-flood climate would have no sea ice, except towards the end of the oceanic cooling off period. Consequently, the value for the 60-70 degree south latitude belt was made equal to the 60-70 degree north value, while poleward of 70 degrees, $(Q_s - Q_b)_p$ was assumed zero in the post-flood climate. Actually the value poleward of 70 degrees would have increased $(Q_s - Q_b)_p$, which partially compensates for the lessening effect of volcanic dust and warm sea-surface temperatures.

From the calculations in section VI A, $(Q_h)_p$ is equal to $\frac{1}{3} (Q_e)_p$. This relationship was also found by Bunker off the East Coast of the U.S.⁵³ This area provides a good model for estimating $(Q_e)_p$ in the post-flood climate because, during winter, cold dry continental air streams eastward over the warm Gulf Stream, particularly dur-

ing storms. The largest amount of oceanic evaporation anywhere in the world takes place here. From ship observations in this area, Bunker found an average winter-time heat loss from evaporation of approximately 400 watts/m² or 95.6 cal/m²-sec. This is probably a good average value near cold continents in the post-flood climate, but is much too high further out in the ocean where air-sea differences would be much less. To calculate the total amount of cooling for the area under consideration, I will assume the cooling rate is zero far from the cold continents and 400 watts/m² near them. Therefore only the cooling rate near the continents need be considered. For the Southern Hemisphere, this smaller area was assumed to be the ocean south of 65 degrees south. In the Northern Hemisphere, the strong cooling area follows the profile of mid and high latitude continents and is therefore irregular, so it was assumed to be equivalent to the ocean area north of 50 degrees north. The total area of strong evaporation for both hemispheres⁴⁰ is $28.22 \times 10^6 \text{ Km}^2$. Therefore the total yearly cooling rate for the polar ocean area of both hemispheres is $11.5 \times 10^{22} \text{ cal/yr}$. Substituting all values into Equation (5) gives $1.04 \times 10^{22} \text{ cal/yr} + 2.68 \times 10^{22} \text{ cal/yr} - (4/3)(11.5 \times 10^{22} \text{ cal/yr}) = (-2.8 \times 10^{25} \text{ cal})/T$. So T comes out to be 242 years.

To find $M1$, $(Q_e)_p$ must be multiplied by T , and then divided by the latent heat of evaporation (590 cal/gm) in order to convert latent heat to its evaporational water equivalent. Therefore, $M1$ equals 4.72×10^{22} grams. $M2$ can be found by multiplying the total poleward transport of latent heat in the present atmosphere, which is about $8 \times 10^{19} \text{ cal/day}$ for both hemispheres,⁵⁴ by T , and dividing by the latent heat of evaporation. The present atmosphere is a good approximation to the post-flood climate because the moisture source is the lower latitudes, which should be nearly the same in both climates. $M2$ equals 1.20×10^{22} grams. Therefore the total moisture available for a rapid ice age is 5.92×10^{22} grams.

VII. The Rapid Ice Age

Not all of the available water vapor north of 35 degrees north and south of 55 degrees south would end up as snow for continental ice sheets. Some of it would fall over the oceans and on unglaciated land surfaces. Since the strongest evaporation would occur close to the shoreline, it is reasonable to expect more precipitation near the coasts than far from the coasts of higher latitude continents. However, as a conservative first guess, I will assume that precipitation was evenly distributed throughout the area under consideration. Since little moisture exchange occurs between hemispheres of the present climate and because of the different proportions of land and ocean, each hemisphere will be evaluated separately. Assuming evaporation is proportional to the ocean surface south of 55 degrees south and north of 35 degrees north, 1.79×10^{22} grams is available for precipitation in the Southern Hemisphere and 2.93×10^{22} grams is available in the Northern Hemisphere from the contribution of $M1$. Since $M2$ originates from lower latitudes, I will assume the value for each hemisphere is proportional to

the ocean surface between 0-55 degrees south and 0-35 degrees north. This makes $M2$ equal to 0.76×10^{22} grams for the Southern Hemisphere and 0.44×10^{22} grams for the Northern Hemisphere. Therefore, the available moisture in the Northern Hemisphere would be 3.37×10^{22} grams, and in the Southern Hemisphere, it would be 2.55×10^{22} grams.

In the Southern Hemisphere south of 55 degrees south, $32.23 \times 10^6 \text{ Km}^2$ is ocean and $14.18 \times 10^6 \text{ Km}^2$ is land. With an even distribution of precipitation, Antarctica would receive 7.9×10^{21} grams of water. Using a density of ice of 0.9 gm/cm^3 , this much water would end up as $8.8 \times 10^{21} \text{ cm}^3$ of snow at an average depth of 702 meters. The estimated volume of the Antarctic ice sheet presently and during the ice age is $23.45 \times 10^{21} \text{ cm}^3$ with an average depth of 1.88 km.⁵⁵ The post-flood rapid ice age, therefore, only accounts for about $1/3$ of the Antarctic ice sheet.

In the Northern Hemisphere north of 35 degrees north, $53.33 \times 10^6 \text{ Km}^2$ is ocean and $55.83 \times 10^6 \text{ Km}^2$ is land. Therefore the land would receive 1.71×10^{22} grams of moisture. The estimated area of glaciation, assuming it is correct, is $29.92 \times 10^6 \text{ Km}^2$.⁵⁵ This is 54% of the land north of 35 degrees North, which means that 0.92×10^{22} grams would end up on continental ice sheets. However, the situation in the Northern Hemisphere is more complicated because 0.79×10^{22} grams of precipitation falls over non-glaciated areas, contrary to the case in the Southern Hemisphere, and hence some of it would be re-evaporated and deposited on the ice sheets. In the present atmosphere, the evaporation from the land between 30 degrees and 50 degrees north is 65% of the precipitation.⁵⁶ Assuming the same percent in the post-flood climate, and that 50% of the re-evaporated moisture from the land ends up further north on the ice sheets, an additional 0.24×10^{22} grams of moisture would be available. This makes a total of 1.16×10^{22} grams or $1.29 \times 10^{22} \text{ Cm}^3$ of ice for continental glaciation. Using the standard area assumed for the last ice age, the above volume of ice would pile up to an average depth of 431 meters. This compares to an estimated volume of $5.1 \times 10^{22} \text{ cm}^3$ and an average depth of 1.7 Km postulated by uniformitarian scientists.⁵⁵ This is about 4 times the amount calculated here for a rapid ice age.

There are two ways of viewing the above figures, both of which could easily be correct. First, the estimate for a post-flood rapid ice age, which is dependent upon a number of assumptions, nevertheless can be off in either direction by a significant amount. These figures are only intended to be a rough estimate. Secondly, the uniformitarian scientists, who also depend on assumptions, could have over-estimated the thicknesses of ice sheets that no longer exist. Flint candidly admits: "A greater potential error lies in the estimation of average thicknesses and volumes of glaciers, particularly ice sheets that no longer exist. Thus far the profiles of such glaciers have been reconstructed by analogy with those of existing ice sheets, which for one reason or another may not be truly analogous."⁵⁷ In other words, the thicknesses of ice sheets that no longer exist have been estimated in the uniformitarian way by using present

examples, and these present examples, according to Flint, may not be very good.

VIII. The Present Continental Ice Sheets

The figures presented here for the volumes and thicknesses of a rapid ice age are about 30% of the present estimated values for Greenland and Antarctica. How then can these ice sheets be accounted for? One likely possibility is that these ice sheets increased by a significant amount in the present climate. Since ablation through iceberg calving is more-or-less proportional to the volume of ice on the Greenland and Antarctic ice sheets, the present average precipitation would be enough to cause relatively fast growth when they were much smaller. The yearly average precipitation of Greenland ranges from 15 cm in the northern interior to more than 90 cm along the southern edge.⁵⁸ This represents an average of about 30 cm/yr. Antarctica has a yearly average precipitation of 17 cm.⁵⁹ At first, practically all of this precipitation would represent accumulation, but as time went on and the ice sheets grew larger and larger, more and more accumulation would be lost through ablation. If an average of 10 cm/yr of ice was added to the Antarctic ice sheet for the first 3,000 years after the maximum of the rapid ice age, and none thereafter to the present day, 300 meters would be added to the 702 meters already estimated for a rapid ice age. Similarly, at a rate of 20 cm/yr for 3,000 years, Greenland would add 600 meters to its rapid ice age total of 431 meters. This illustrates that a good proportion of the Greenland and Antarctic ice sheets probably built up as a result of the present climate.

In a rapid ice age, a maximum average ice thickness of 431 meters was calculated for the Northern Hemisphere. However, this average would certainly have large anomalies. Above-average thicknesses are expected over continental areas near the warm ocean and near the main storm track. Greenland satisfies both of these conditions and therefore more than 431 meters of ice would be expected at the maximum of a rapid ice age. How much more is, of course, uncertain.

In calculating the average ice thicknesses in a rapid ice age for both hemispheres, the assumption of an even distribution of precipitation north of 35 degrees north and south of 55 degrees south was used. However, this is probably not a good assumption because of the unique characteristics of the post-flood climate. As discussed already, favorable areas for most of the precipitation would border the storm tracks. The interior of continents should accumulate lesser amounts of precipitation while the oceans far from land should receive little. The unevenness of precipitation would especially affect the distribution in the Southern Hemisphere. Since the storm belt would encircle the shoreline of the Antarctic continent, and since most precipitation from winter-type storms would fall south of the storm track, Antarctica would accumulate more precipitation than the oceans. I will indicate the possibilities with a few calculations. If Antarctica were to receive all the precipitation, 2260 meters of ice would result. This is, of course, hypothetical, but it shows how crucial the

assumption of an even distribution of precipitation is. A more reasonable possibility is that Antarctica received twice as much precipitation as the average of the surrounding oceans. In this case, Antarctica would accumulate 1060 meters by the end of a rapid ice age, leaving the normal climate the task of building the ice sheet up to its present thickness.

To sum it all up, it is quite possible that a rapid ice age followed by the modern day climate can account for the thicknesses of ice sheets on Greenland and Antarctica within the time allowed by the Bible.

The Melting of the Northern Hemispheric Ice Sheets

No discussion of a mechanism for a rapid ice age would be complete without a brief mention of why the ice sheets would melt and how long it would take. This section does not include the Greenland and Antarctic ice sheets, since very little melting would take place on them. There are no historical accounts of ice sheets over areas now devoid of ice, and the Bible does not leave much time for an ice age. Therefore, it is expected that the ice from a rapid ice age would melt in a short time compared with the uniformitarian time scale.

At the end of the 242 year period of oceanic cooling, the evaporation from the oceans would be much less. Also, the heating of the oceanic air would also be much less. The storm tracks would no longer favor the shoreline of the mid and high latitude continents, but would follow something more like a modern-day distribution. Presumably, the volcanic activity from the Flood and immediately after the Flood would have settled down by this time so that fewer dust particles would be suspended in the atmosphere. The presence of ice sheets at higher latitudes would keep temperatures below the present average (see Section III B). Consequently, sea-surface temperatures at mid and high latitudes would also be below average causing evaporation to be below the present average. The net affect of this climate change is that much drier conditions with more sunshine would prevail, particularly over ice sheets in winter. Temperatures would be below the present normal at mid and high latitudes, but probably much warmer during summers than in the post-flood climate. The ice sheets would not accumulate very much snow during the colder months, and would significantly melt during the warmer months, particularly along the southern terminus.

Recent ice-age climate simulation experiments⁶⁰ using high speed computers can shed some light on conditions at ice age maximum. Using assumed uniformitarian conditions for the postulated Wisconsin glacial maximum, the supposed July ice age climate was simulated. The main difference in boundary conditions between the computer model and the post-Flood ice age maximum is the height of the ice sheets. A thinner ice sheet in the post-Flood case would result in warmer and drier conditions than in the uniformitarian case. It was found in the computer simulation that the temperatures over non-glaciated areas would average about 5 degrees C cooler than the present. The average worldwide atmospheric water vapor content would be 30% less, cloudiness would average about 8% less precipitation

would be down 15% from the present, and the poleward transport of moisture would be less by 30%. The overall result would be cooler, drier conditions, with more sunshine. The melting of snow and ice is hastened by more sunshine,⁶¹ which should nearly compensate for the cooler temperatures. Therefore the climate at maximum glaciation should result in rapid melting of continental ice sheets in the summer. The computer simulation results bring up an interesting problem for uniformitarian scientists. How could an ice sheet grow to the postulated maximum under uniformitarian conditions, when climatic conditions at maximum would greatly favor melting?

A rough estimate of the melting time for the post-flood rapid ice age can be found by comparing it to the melting of present day glaciers and mountain snow fields, recognizing there are limitations in comparing a relatively small scale phenomenon to the large scale melting of continental ice sheets. During the early part of this century, the climate of the earth has been calculated to be a little warmer and drier than normal. Under these conditions, Flint showed that a portion of the Vatna Glacier on Iceland decreased in thickness by about 100 meters in 46 years between 1890 and 1936.⁶² If the post-flood continental ice sheets of the Northern Hemisphere decreased at the same rate, even though the climatic warming was much greater in this case, they would melt in about 200 years.

Another modern-day comparison would be the melting of the winter-time snow accumulation in the Cascade Mountains of the Pacific Northwest. These mountains accumulate about 2 meters of water by mid spring. With cool summer temperatures and a fair amount of cloudiness, this accumulation manages to melt by early fall. Summer temperatures on the post-flood ice sheets during the melting period would be cool, so the Cascade Mountains should provide a good model. Since very little winter precipitation would accumulate on the ice sheets, an average decrease of 2 meters a year would be a good estimate. At this rate, it would take 236 years to melt the ice sheets of the post-flood rapid ice age. Therefore, the total length of the ice age from the end of the flood to the melting of the ice sheets is on the order of 500 years, and that is rapid compared to uniformitarian estimates.

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BIOGEOGRAPHY FROM A CREATIONIST PERSPECTIVE I: TAXONOMY, GEOGRAPHY, AND PLATE TECTONICS IN RELATION TO CREATED KINDS OF ANGIOSPERMS

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Biogeographical theories in the past have been based solely on the evolutionary model. One of these evolution theories is discussed (the Theory of Generic Cycles). The data of classification and distribution (as published by Ronald Good) for families, genera, and species of angiosperms are reinterpreted here from the creationist perspective. The average family is judged too large and diverse to represent a created kind. But since the typical angiosperm genus is narrow and coherent, this category may regularly represent the monophyletic product of a created kind. Certain problems of plant disjunction are neatly solved under the assumption that there has been a breakup of one original land mass in conjunction with the Flood.

A. Introduction

Certain biogeographers have maintained that their subject can be interpreted only in terms of the general evolution theory. Ronald Good, a leading botanist, has put it boldly:

"The short history of the study of plant geography in the Introduction is enough to show the enormous influence that evolutionary conceptions have had on the development of the subject, and it is no exaggeration to say that its whole background has become an evolutionary one, as, indeed, is true of any biological subject. Evolution is, as it were, the medium in which the picture of plant distribution is painted."¹

In another passage, Good affirmed that evolution must be understood as a gradualistic process lest it come to resemble special creationism too closely:

"If there is no theoretical limit to the magnitude of evolutionary change there must be visualized the possibility of some new form, widely different from anything hitherto existing, arising quite suddenly and unheralded, and there would be considerable difficulty in divorcing this kind of origin from the suggestion of an act of special creation. It was all-important rather, to show that evolution was an orderly process as opposed to the condition of arbitrariness, which must in one sense at least be inherent in the conception of special creation."²

Yet such wholesale espousal of evolutionism and disavowal of special creation as "arbitrary" is somewhat surprising in face of the fact that the main problem of plant geography is as far from solution today as it was during the days of Charles Darwin, concerning which Schuster has commented:

"The general conclusion we must arrive at, however, as Darwin (1903) stated in a celebrated letter to Hooker, is that from a biogeographic point of view the origin and early history of flowering plants remain largely an 'abominable mystery.'"³

Botanists have come to realize that there are very few evidences to support the idea that plant groups are related, as noted in this clear statement written by G. H. M. Lawrence:

"Within the conifers it has become increasingly

clear that the several families are of a more remote relationship to one another than was formerly believed and that the family Pinaceae of older works deserves to be treated taxonomically as an order or suborder, and its tribes raised to the family level. No ancestors are known for the Gnetales, Welwitschiales, or Ephedrales, and none of these orders is closely allied to other gymnosperms. Like the ferns, the gymnosperms are certainly of polyphyletic origin, and there is no evidence to suggest a common ancestor for the cycads, ginkgo, taxads, and the conifers. Similarly, there is no evidence to suggest phyletic relationships between the pteridophytes and the gymnosperms; the available evidence suggests that the latter are not derived from the vascular cryptogams."⁴

Thus the plant world presents an array of unrelated types—a picture that fits the creationist predictions accurately. The evolutionist, however, is left with a feeling of dismay upon viewing the botanical data:

"The subject of the phylogeny of vascular plants is not one to give the student a sense of satisfaction, for neither a cursory nor an exploratory study of it engenders the feeling of having grasped or comprehended a segment of scientific knowledge. This regrettable sense of insecurity is due in part to the speculative nature of many of its findings or conclusions, speculations by many botanists—based on the same or different evidence—and of great diversity."⁵

The logical fallacies in the evolutionary mindset become obvious in the following statement with its glaring internal conflict:

"There also can be no doubt that the Angiosperms arose, by the processes of organic evolution, from some pre-existing group of plants, although what kinds of plants these ancestors were is uncertain."⁶

It is not apparent how a scientist can be "certain" that flowering plants arose by evolution from earlier plant ancestors when it is at the same time impossible to identify those ancestors! The following statement by an evolutionist portrays evolution as a "master-factor" which takes on a metaphysical rather than a scientific character:

"It is necessary here, therefore, only to emphasize once again the degree to which the evolutionary factor is, as it were, a master-factor, determining in

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one way or another the operations and results of all those others that have now to be reviewed. Evolutionary factors may be regarded as inherent or predisposing factors.”⁷

In the face of such attitudes, it is extremely important for creationist biologists to undertake the systematic study of biogeography as well as all other fields in the life sciences.

Plant geography is exceedingly broad and involved since it impinges on these numerous fields and many more: taxonomy, morphology, ecology, physiology, paleontology, geophysics, soil science, meteorology, climatology, plate tectonics, and human history. To cover the subject properly from the creationist vantage would require at least a full book, a complete lifetime of research experience, and a broad reading knowledge in most of the fields mentioned. This paper is therefore not a comprehensive treatise but rather an attempt to initiate a series of creationist inquiries into the vast field of biogeography.

The following topics are among those which will be crucial to explaining plant geography from the perspective of scientific creationism:

1. The taxonomy and geography of plants today.
2. Post-Flood plate tectonics and effects on the distribution of living plants.
3. Post-Flood plate tectonics and effects on the distribution of fossil plants.
4. The survival, dispersal, and variation of plants after the Flood.
5. The geographical distribution of plants in the pre-Flood world.
6. The original geographical distribution of plant kinds at the time of creation.

Only a cursory introduction to the first two topics can be undertaken in this paper. It is hoped that the author and other creationist biologists will address themselves to these topics—perhaps in a series of individual papers or even letters to the editor in subsequent issues of *C.R.S.Q.*

Certain corollary biological topics will constantly come under consideration when creationists begin to forge a comprehensive alternative to evolutionary biogeography:

1. What categories and taxa of today correspond most closely to the kinds that were originally created?
2. What types of changes has the Creator employed with the kinds since the time of Creation and what means has He used to enact such modifications?

B. The Taxonomy and Geography of Plants Today

Plant taxonomy is by no means an exact science since it is constantly subject to interpretation, reinterpretation, and wholesale revision. The degree of objectivity and scientific reliability decreases with ascending order in the taxonomic hierarchy from species upward. Although biologists frequently disagree regarding the criteria for defining a species, this group is the most readily identifiable category and the one most directly subject to scientific analysis. But designating orders or even families involves subjective philosophy and personal judgment in addition to scientific standards. The

categories have decreasing reliability in the following order: species, genus, family, order, class, and division. (The “division” is the botanical counterpart of the zoologists’s “phylum”.)

1. Plant Families.

a. Taxonomy of families. Good has estimated that there are approximately 435 plant families if one draws the boundaries in the narrower sense. The word “plant” here and elsewhere in the paper is used to designate angiosperms or flowering plants unless otherwise indicated. Since there are about 225,000 species, in Good’s judgement, the average plant family contains about 29 genera and about 600 species. Frequent use will be made of Good’s exhaustive treatise on plant geography. He has written on a global basis and has shown unusual breadth and objectivity in discussing most problems.

The leading family, as regards number of genera among the monocots⁸ is the Orchidaceae which contains approximately 600 genera. The dicot⁹ family with the most genera is the Asteraceae (sunflower family) with about 1000 genera or 20,000 species. There are 20 other flowering plant families that have 2000 or more species (see list on p. 50 of Good). From the standpoint of number of taxa included, the typical plant family appears broad and polyphyletic.

b. Geography of families. Numerous plant families can be called “cosmopolitan” in the sense that one or more of their genera are represented on most major land masses or in most aquatic habitats. For example, of the 435 plant families, approximately 215 (50%) could be designated “widespread” to the extent that they are either cosmopolitan, subcosmopolitan, or at least pan-tropical (see Table 1.)

Only 124 of the 435 families (28%) are limited to one continent (endemic) and 96 or (22%) have a “disjunct” distribution—being represented on only a few widely separated land masses.

Thus families can be described as “widespread” in geographical terms and as broad taxonomically. The created kinds of angiosperms in most instances appear to have been narrower than present families. To the creation minded botanist the characteristics of the family then are above the created kind and may represent a “trademark” or set of traits incorporated into several kinds at the time of their formation. Accordingly, at the onset several separately created groups of plants were

Table 1. Patterns of geographic distribution among angiosperm categories. This table is based on numerical counts and/or estimates published by Ronald Good, Reference 1.

The asterisks indicate per cents not actually published by Good, but easily calculated from the numerical data which he has given.

Category	Total number within angiosperms	Number and per cent having widespread distribution	Number and per cent having endemic distribution	Number and per cent having discontinuous distribution
Family	435	215 (50%)*	124 (28%)*	96 (22%)*
Genus	12,500	475 (4%)*	10,000 (80%)*	765 (6%)*
Species	225,000		202,500 (90%)*	

given the same cluster of common traits which presently identify the bean family (Fabaceae), for example. The hallmarks of a family or higher taxonomic category such as an order, class, or division do not spring from organic descent but from an originally created imprint. Such activity on the part of the Creator would not be "disorderly" or "arbitrary" as Good implied but would be in close keeping with the concepts of outline and economy in manufacturing design as practiced by man himself.

Wherever monogeneric families exist, on the other hand, such groups may be created kinds themselves, this matter deserving further study.

In animal taxonomy or among non-flowering plants, the taxonomic boundaries of the created kinds may be somewhat different than with the angiosperms. From an analysis of taxonomy among the pigs (*Sus* and *Potamochoerus*) Lammerts has asserted that zoologists have generally been much narrower in delineating families and genera than have the botanists.¹⁰ In fact, after an exhaustive study of Bible lists and animal taxa, Jones concluded that "... in vertebrates the *min* [kinds] of the Mosaic food lists generally lie at the family level in current classification systems."¹¹ From this assumption, Jones concluded in a later paper that, "... biological arguments against a universal Flood are invalid, and ... the number of animals under Noah's care probably did not exceed 2,000."¹² Thus it may well be that the family is indeed the created kind in the animal world as the families of zoology are so narrow that they stand as counterparts to plant genera—but zoologists will have to speak further to this question in later reports.

2. Plant Genera

a. Taxonomy of genera. Angiosperm genera present a different picture than do the families as regards both taxonomy and geography. Good computed that there are about 12,500 genera into which flowering plants have been subdivided (pp. 84-86). He estimated that one third of all these genera are monotypic (containing only one species in the genus) and about one eighth of the genera consist of only two species. Concerning such genera with low numbers of constituent species, Good wrote "... the two may account for one half of the total."¹³

A moment's reflection from the creationist's vantage suggests that these genera which have only one or two species (half of all angiosperm genera!) may very well represent monophyletic units or kinds in the Creation model. However we must recall that genera of today are plant groups that have emerged from the Flood and the assumed continental rift and may have undergone some creative change (either by natural selection, speciation, polyploidy, or other means). Thus our judgment that the genus is frequently the created kind in angiosperm botany should be considered tentative. It is of great interest, however, that very low species numbers are the rule, rather than the exception, among plant genera.

But what may be said concerning species numbers among the other half or so of the established plant genera? The number of constituent species varies from

three on up to thousands. Good tallied 14 genera which are subdivided into 100 or more species. The genus with the highest number of species is *Astragalus* (a member of the bean family) having 1800. *Ficus* (the fig genus) is estimated to contain more than 1000 species.

Concerning the others, Good wrote, "For the rest there are genera of almost every species number down to the extreme condition of monotypy."¹⁴ 470 genera contain 100 species or more per genus.

b. Geography of genera. Good considered genera "endemic" if they are limited to one of 37 floristic regions into which he divided the world (see Plate 5 opposite p. 80 of Good). For example, the North American continent is divided into 8 such zones and South America into 6. Accordingly, a genus had to have a much narrower distribution to be classed as endemic by Good than did a family. On page 132 Good concluded that 10,000 of the 12,500 (80%) of all angiosperm genera are endemic. It is important to emphasize here that while genera have much smaller taxonomic scope than families, they also have a narrower geographic distribution on the average than do plant families.

The most widespread land plant genus noted by Good was *Senecio* of the sunflower family (p. 87). There are about 50 other genera that are designated as "more or less cosmopolitan" (p. 86). If these 50 are added together with the genera designated as widespread tropical, widespread temperate, or southern distribution, a grand total of only 475 plant genera emerge out of the 12,500 (4%) as being somewhat widely distributed—as compared to 50% of all flowering plant families that are widespread (see Table 1). Genera that are widespread in the tropics and other genera that have a broad distribution in the north temperate regions may hark back to a vast pre-flood and early post-flood distribution as part of a vegetational carpet which was dissected later by climatic and geographical changes. In the creationist view, endemism may have arisen as a result of shrinking ranges after the Flood and glaciation or as a result of sweepstakes survival and dispersal after the Flood.

To account for the existence of widespread, endemic, and discontinuous taxa along evolutionary lines, Good defended the "Theory of Generic Cycles." In this view a species starts in one limited locality and is thus endemic at its onset. A "juvenile stage" comes first during which the taxon is "establishing itself and gradually extending its range from nothing to a maximum determined by various environmental conditions."¹⁵

A second or "maturity" stage follows when the species will attain and hold its maximum range. Next, "In the third stage the species is passing into obscurity ... For a time it may maintain its range, but sooner or later this must tend to decrease."¹⁶ Good assumed that disjunction of genera or species occurs during and was a result of this third stage when the group is passing into obscurity but disappearing "... earlier in some places than in others."¹⁷ During the fourth and final stage the taxon vanishes and as a result will appear to be endemic at the very end.

Since the taxon will be endemic once again at the end of the Cycle, "... for some time before final extinction

the size of its range will be indistinguishable at sight from that of a species but newly formed.”¹⁸ In terms of this theory it would be impossible to tell whether a particular endemic species is “coming” or “going”!

Reflecting on the implications of such a view, one might expect to find various genera at all stages of the cycle with approximately equal numbers or at least generous representation for each of the various stages. But why are 80% of all genera (and even a higher percentage of all species) endemic? Where are all the genera and species that should generously exemplify the supposed second and third stages of this particular scheme? Such paucity of intermediates is an inherent weakness in the Theory of Generic Cycles as is also the fact that it would be impossible to tell nascent taxa from vanishing ones. Certainly then this theory does not preclude alternatives from the special creation vantage.

Good has undertaken to prepare and revise a list of discontinuous genera which encompasses an amazing array of discontinuities (pp. 439-444). The list contains discontinuities of 5 different types. A total of 765 discontinuous genera is enumerated which accounts for about 6% of all angiosperm genera as opposed to 22% of the angiosperm families that are discontinuous. The Fabaceae (bean family) has the largest number of discontinuous genera with the sunflower and euphorb families next in sequence.

3. Plant Species.

a. Taxonomy of species. Concerning both the taxonomic and geographic aspects of flowering plant species, Good made the following significant statement:

“That many genera consisted of but one species, and that the ranges of others are but the sums of their superimposed ranges of their constituent species, are enough indication that there is no real difference between the distribution of species and that of genera, except, of course, that the latter are usually more extensive.”¹⁹

As stated earlier, there are about 225,000 flowering plant species and this averages 18 per genus. Plant species were originally distinguished from each other on morphological grounds but in more recent years such considerations as chromosome number, hybridization, microscopic anatomy, and other data have been taken into consideration. The trend in general has been to reduce the number of species in a particular genus by taxonomic revision.

There have been, of course, both “splitters” and “lumpers” among botanical taxonomists. Considerable revision should be undertaken in plant taxonomy to broaden the species groups so that each includes all those types which will interbreed. This genetic concept of species has been applied by Jens Clausen in erecting what he called “cenospecies”—aggregates of all the species in a subgenus that would allow any type of genetic exchange among themselves.²⁰ Perhaps a continuation of such research will demonstrate that the number of plant species can be reduced significantly.

Taxonomic creationists could also well undertake wholesale revision of the genus category. Perhaps a

genus that contains such great numbers of species is actually too broad to be classed as a genus and would be best broken down into many genera along the lines of its existing subgenera.

b. Distribution of species. Good noted that four kinds of rather widespread species include the following types:

- a. freshwater aquatics (example is cattail).
- b. temperate species introduced into the tropics (examples are temperate weeds introduced throughout the tropics.)
- c. tropical species introduced into the temperate zone (example Bermuda grass.)
- d. halophytes (example Russian thistle or as it is also called—tumbleweed.)

In terms of the Theory of Generic Cycles, Good reminded the reader that the locality which contains numerous species of one genus is not necessarily the point of geographic origin for that genus. It could rather be the place where specialization took place and the actual point of origin may lie somewhere off to the side of its range.

Patterns of distribution among the species even in one genus may vary quite widely so that a particular genus may contain both widespread and endemic species (Good p. 162). In some genera like *Juncus* (the rush) about half of the species are widespread and half endemic. In other genera like *Begonia* most of the species are wide, only a few being endemic. But in still other genera like *Dioscorea* (the yam) there are only a few widespread species—most being endemic.

On the basis of certain assumptions, Good placed the percentage of endemic species at 90%—even 10% higher than that of endemic genera (p. 189—Good and Table 1 this paper).

Concerning discontinuous species, Good gave no exact numbers but did indicate on p. 226 that “. . . the detailed account that has already been given of discontinuous genera applies in outline almost equally well to species. Indeed, genera often owe their discontinuity to that of one or more of their constituent species.”²¹ As a general rule, one could say, as the genera go, so go the species. This type of evidence causes the present author to suggest that creationists take the genus, in many instances, as representing the modern counterpart of the created kinds among angiosperms.

Endemic species may be relicts of species that were at one time more widespread. It is known as an end result of this sequence that species may actually undergo extinction. A narrowly restricted species may consist of as few as one individual (p. 234, Good)! The subsequent extinction of a particular flower plant species may or may not signify the extinction of a Genesis kind.

In other cases, narrowly distributed or endemic species may be the Creator’s product (by means of natural selection or some other process) from the genus stock to meet the demands of a changing post-Flood environment. For example, polyploidy may have been frequently used to derive certain species within a created kind—a matter that will be analyzed to a greater extent in a subsequent paper.

C. Post-Flood Continental Rift and Its Plant Geographical Implications

Some controversy in both evolutionary and creationist quarters still surrounds the reality and mechanism of continental drift. For the purposes of this review, however, it will be assumed that a rapid continental drift (rift) took place in early post-flood times and that before the rift the earth had but one main land mass (see paper by Mark Tippetts in this same Annual Issue of C.R.S.Q. in which is found a coherent statement favoring continental rift from creationist vantage.) Lawrence commented that the major reticence of scientists in adopting the theory of continental rift was the lack of an adequate mechanism.²²

It is reasonable to assume that after the Flood different floras appeared in various regions of Laurasia and Gondwanaland. When the continents divided, separating land areas that had been adjacent, these post-flood floras were also split providing the basis for some of the disjunction seen among genera and species—without recourse to the evolutionary Theory of Generic Cycles. A brief listing follows of some of the known discontinuities which are readily explained if we assume that Pangaea divided along the lines usually suggested:

1. The flora of Patagonia (South America) has a close relationship to that of New Zealand (Good, p. 222).
2. Many discontinuous species exist in North America, Europe, and Siberia (an example of an earlier Laurasian distribution modified by the rift.) Example here is *Ostrya virginica* (a member of the birch family) which presently occurs in North America and East Asia—Good, p. 226.)
3. Some species and genera show a disjunction correlating with the ancient Gondwanaland—South America, Australia, and New Zealand, e.g. *Nertera depressa* which is called the bead plant and is a member of the madder family—Good, p. 228).
4. An Asian and African link exists between many species and genera. *Asparagus racemosus* was one of many examples listed by Good, p. 228.)
5. There is a major affinity between the flora of Australia and that of South Africa. For example the genus *Restio* has a species in South America as well as Madagascar and Australia—Good, p. 250.)
6. There is an Antarctic element in the flora of Australia. Discussing this antarctic element, Good wrote:

“Not only so but this ‘Antarctic’ element is characteristic also of Tasmania and New Zealand, which, since they are the only other appreciable southern lands at the same latitude, may be thought of as natural neighbours, being linked together by the presence of an attenuated version of the same element throughout the South Temperate Oceanic Islands, which to-day represent what there is good reason to believe was once a more direct connection across the present Antarctica.”²³

7. There is a floristic problem as regards the flora of Australia and that of New Guinea being in such close proximity and having such widely diverse affinities. Good described the problem as follows:

“Putting the problem in its simplest terms the reason for this anomaly is that the flora of Australia differs from that of New Guinea to a degree which many people find inexplicable if the gulf between the two has never been more than the hundred miles of very shallow sea, thickly strewn with islands, that it comprises to-day. The question is, therefore, whether they have always been so placed, and, more particularly, whether Australia and New Guinea are as would appear at first sight and is commonly assumed, parts of one and the same great land-mass or not.”²⁴

Good continued by asserting that the foregoing problem is now somewhat artificial and outmoded because originally people assumed the continents were immobile. While he admitted that continental drift does not automatically solve the problem of why the Australian flora and the nearby New Guinean flora are so vastly different, he made the following assertion:

“This concept of continental movement certainly helps to resolve the anomaly of the position of the Australian flora, because it allows that it may have moved . . . biologists are generally agreed that the peculiar features of the Australian biota (and some of the zoological facts are even more striking than the botanical) can only be explained on the supposition that they have developed under conditions of great and prolonged geographical isolation, and thus those who do not accept continental drift in this dilemma . . . find themselves in the untenable position of maintaining that the present isolation of Australia . . . is sufficient to account for the facts.”²⁵

Good, of course, goes on to suggest that possibly Australia and New Guinea have been parts of different land masses and that they may thus be in close proximity now and yet have been widely separated during history.

Schuster has written a chapter on plate tectonics and angiosperm dispersal in a recent symposium. Schuster concluded from his studies that angiosperm families and often genera were present before the breakup of the Australian complex.²⁶ This, of course, would fit with the creationist assertion of recency for the entire history of the earth. He affirmed, as Good had done, that the rifting of continents caused old coherent floras to separate and new juxtapositions of diverse floras to occur. For example, he discussed the way in which the Indian plate had juxtaposed a Gondwanalandic flora next to a Laurasian flora—the Winteraceae family, for example, being brought very close in its range to Laurasian families such as the Magnoliaceae in the region of Australia versus New Guinea that was previously discussed.²⁷

Much of Schuster's treatment centers on mosses, gymnosperms, and fossil plants—subjects which deserve separate discussion in later papers.

D. Some Creationist Speculations about The Relationship of Present Floras to The Flood

Cretaceous fossil remains of flowering plants demonstrate a broad geographic extension of tropical

and temperate life much farther north and south than at present. In that regard, Good wrote:

"Regarding the constitution of Cretaceous floras in general, Berry (59, 61) has emphasized the fact that they contain a mixture of what would be called today tropical and temperate genera such as is now found in southern Chile, south Japan and New Zealand. That is to say, they may be described as indicating the occurrence in their time of a warm-temperate or sub-tropical climate."²⁸

The same description of broad temperate and tropical floras applies to the distribution of Eocene fossils (Good, p. 319).

It is generally believed that before the Flood climates were more moderate. At that time many of the created kinds were distributed widely. Such a pattern would still be reflected in the many pan-tropical or cosmopolitan species and genera presently existing.

After the Flood there would be widespread survival and dispersal of plants. Plant life may have produced a carpet of vegetation somewhat similar to the original floral distribution. There would, however, be a decrease in geographic ranges for many taxa because of post-Flood changes in soil and climate. Such changes would have been intensified as glaciation occurred and furthermore, glaciation would have brought with it widespread changes in plant geography:

"In short, if these suppositions be correct, the effect of the Ice Ages on the Flowering Plants was completely to upset, over much of their range, the balance between plant and habitat. Since there has not been, in the time which has elapsed since the fourth glaciation, any appreciable restoration of the long-term pre-glacial conditions, the botanists of today are studying a world vegetation but lately subjected to a devastating disaster. The study of the geography of the Flowering Plants, is peculiarly the study of the consequences of this disaster, and this being so, the outstanding importance of the Pleistocene in relation to the general story can scarcely be overestimated."²⁹

Apparently this writer has unwittingly paid tribute to the Flood itself and not just glaciation when suggesting that plant geography manifests the after-effects of a great catastrophe!

The high degree of endemism found among genera and species of today may in various instances be the result of:

1. limited survival and dispersal after the Flood
2. decrease in range of plants after the Flood as a result of glaciation
3. formation of new taxa (subspecies or even species) within the Genesis kind to meet the needs of a diversified habit with new niches.

Disjunction in survival and dispersal after the Flood

may account for the disjunct distribution of certain genera and species today. Schuster has noted that disjunct ranges arise more frequently from extinctions across major section of an earlier, larger range than they do by long distance dispersal.³⁰ However, a certain number of disjunct patterns today may be attributable to the sweepstakes survival and chance dispersal following the Flood.

In post-Flood times a characteristically southern flora may have reinhabited the lower region of Pangaea (Gondwanaland) while a northern (Laurasian) assemblage of plants prevailed above. A shifting of continents in post-Flood times could then account for many of the strange disjunctions and bizarre juxtapositions of diverse floral assemblages found today.

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- ⁴Lawrence, George H. M. 1951. Taxonomy of vascular plants. The Macmillan Company, N. Y. pp. 102-103.
- ⁵*Ibid.*, p. 107.
- ⁶Good, *Op. cit.*, p. 315.
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- ⁸The "monocots" (short for the subclass name Monocotyledonae) include all the flowering plants that have leaf veins parallel to the mid-vein, single seed leaf or "cotyledon" in the embryo, conducting bundles scattered throughout the cross sectional area of the stem, and flower parts in 3's or multiples of 3.
- ⁹the "dicots" (short for the subclass name Dicotyledonae) include all flowering plants that have netted veins, two cotyledons in the embryo, conducting bundles arranged in a peripheral ring, and flower parts in 4's, 5's, multiples of 4 or 5, or in great numbers.
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NOAH AND THE FLOOD: THE APOCRYPHAL TRADITIONS

MARCUS VON WELLNITZ*

Noah and the Flood are mentioned in many apocryphal books and traditions; and in this article some of the statements are collected. It is not maintained, of course, that apocryphal works are inspired, as Scripture is. But they may well contain valid traditions. For instance, the tradition, mentioned here, that it was very cold in the Ark, may provide a clue to the connection, so much debated by Creationists, between the Flood and the ice age. At the least, these excerpts may be of interest in showing what devout men were thinking about these matters a long time ago.

The centuries before the flood were known for their extreme wickedness and perversion so that God felt compelled to remove the population from off the face of the earth. That way the billions who were still to come had a fair chance to choose between good and evil rather than being exposed solely to the continual vice and iniquity of the antediluvian society.

Idolatry was the order of the day and the people worshipped their own gods of wood and stone.¹ Men and women alike painted their faces, wore flimsy clothing, danced wild dances to ravishing music with a strong beat and consumed wine to excess.² It became a common occurrence to kill for fun and for material gain.³ Wife swapping was their pastime activity and many people seem to have been walking about naked and to have conducted their orgies unashamedly in public.⁴ To prevent unwanted pregnancies the women of those times consumed drinks made from herbs which rendered them infertile; thereby, they could continue in their sexual practices without losing their appealing figures and shapes.⁵ Their sexual perversions even included the animals, and it became fashionable to marry and commit transgressions with them. Actual wedding ceremonies were performed, and it became legal to have a cow, a dog or a horse for a spouse.⁶ Consequently, the world of the animals and birds became also corrupted and began to mate outside their species.⁷

People robbed and plundered one another's property and abducted the poor and the helpless for their own pleasure or as slaves.⁸ There also developed a craze for astronomy and astrology; and man used the insights gained thus to predict and alter the course of the future.⁹ With zealous fervor they indulged in magic and all manner of witchcraft.¹⁰

To warn and scare the people, God repeatedly sent some plagues in the form of droughts and floods throughout the regions of the earth.¹¹ But these calamities had little or no effect on the behavior of the inhabitants. Therefore, God finally decided to annihilate life on the planet. He had the choice of permitting the continuance of evil and perversion or destroying his creations. Either alternative was a sad and heartbreaking decision but it had to be made. For the sake of future generations who need a fair chance, God decided to make a clean sweep and remove mankind and animals from the land and start afresh once more.¹²

Yet, in his mercy the Lord still gave mankind an advance warning of the oncoming calamity. He had selected Noah and his family to preach repentance to the people and to survive the flood because they were among the few who had not indulged in the wickedness

of their age or had adopted an unrighteous way of life.¹³ It is said that in this world of ungratefulness, he was one who took care of his parents and grandparents.¹⁴ Noah was also known as an inventor who had first manufactured the hoe and the plough and other tools for working the ground which made agriculture easier for the farmers.¹⁵

Thus, when the call went out to Noah to preach, God gave his creation a reprieve of 120 years before the great destruction would take place.¹⁶ Together with his grandfather, Methuselah, the newly named prophet went out and called the population of the earth to repentance.¹⁷ However, their warnings seem to have gone largely unheeded. The bulk of the people either ignored their preaching or thought of them as madmen.¹⁸ Because of the longevity of the antediluvians, they saw no need to rush into changing their ways. People who anticipated to live several more centuries thought of themselves as virtually immortal.¹⁹ Because of their refusal to repent over a period of 120 years, the Lord eventually shortened the life-span of men to 120 years to remind them always of their neglect.²⁰

Besides declaring penitence to his contemporaries, Noah also used the time in preparation for the flood. He planted trees for the construction of the ark and large plantations for the food supplies needed in the enterprise.²¹ The building of the ark is variously given as having taken either five, fifty-two, or one hundred years.²² According to the ancient texts, Noah worked very slowly, for he wanted to allow the people more time to repent, and hoped to avert the whole destruction after all.²³ Apparently he did employ workers to help him with the construction of this rather large vessel. Another interesting facet is added with the assertion that the ark was built twice. It seems that Noah's wife did not like to see it finished at all and burned the construction to the ground so that a second ark had hurriedly to be launched.²⁴ These 120 years of preparation for the calamity were periods full of anxieties and activities for the aging patriarch, and not a leisure time waiting for the miracle to happen. The preaching, the gardening and construction, and the knowledge of the impending destruction wore heavily on Noah and caused him to lose much sleep and peace of mind.

It required a great amount of wisdom, knowledge, and instruction to build a structure such as the ark.²⁵ It is therefore not surprising to find in the ancient texts that God Himself was very much involved while the vessel was erected. He consulted often with Noah and even drew the different plans with His own finger.²⁶ Other legends assert that different angels were assigned by God either to aid in the construction with advice and information, or else they delivered a book to Noah in

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which all the knowledge necessary for the building of an ark had been recorded.²⁷

Most writings mention that the ark contained three floors, but they differ as to the number of rooms or compartments on each level. The figures provided range from 360 to 366 and 606 up to 900.²⁸ In some sources, the first level was assigned to animals, the second to the birds and reptiles, and the third for Noah and his family.²⁹ But other records designate the bottom floor for the garbage and refuse, while the middle floor was to harbor the family and the clean animals, and the top level housed the unclean creatures.³⁰ There were chutes along the walls through which the waste could be thrown down to the first level from the other stories.³¹ Receptacles for water and pipes to carry it to the different rooms were provided, as well as some twenty rooms for food storage on each level.³² To provide light on the ark Noah received some precious stones, or in some texts a pearl, which would shine and illuminate the otherwise dark interior.³³

Finally it was time for the animals to board the vessel. In some apocryphal versions they assembled on their own by instinct while in other sources Noah blew a trumpet to gather the various species around the ark.³⁴ Apparently the prophet also received instructions as to which of the many beasts were to be admitted into the shelter. If an animal crouched before the patriarch when it approached the door; it was to be selected; if it remained standing in the presence of Noah, he was to reject it.³⁵ Likewise, if a male chased a female, they could enter the vessel; but if a female ran after a male, they were to be excluded.³⁶ In all, some thirty-two species of birds and 365 species of reptiles found refuge in the ark.³⁷ Males and females were to be kept strictly separate during the voyage in order that they could not mate and bear offspring.³⁸ Interesting is the legend that the preserved body of Adam was also taken aboard, as Adam himself had requested before he died.³⁹

During the years preceding the great catastrophe the small number of righteous people on the earth besides Noah's family were taken by God so that they did not have to experience the agonies of witnessing the earth devastated.⁴⁰ The last one to die before the commencement of the flood was Noah's grandfather, Methuselah. Following his death there was a seven day mourning period which was also a time of last reprieve for the population to repent.⁴¹ There was no reaction from the people; and, after the wickedness and idolatry had been endured for so long the flood finally began on Noah's six hundredth birthday in the year 1656 of the mortal period.⁴² (I.e., from the creation of Adam.)

The water started to pour down and sweep over the land. Accompanying the rains were severe lightning and thunder. The sun and the moon gave no light so that the earth was covered with darkness.⁴³ Earthquakes shook the land as the foundations of the world raged and the planet moved about violently.⁴⁴ Some 700,000 people surrounded the ark and demanded to enter. They shouted that they were ready to repent and wanted to receive safety. However, it was too late; and when they began to tear at the ark and tried to topple it, God sent wild beasts which diverted their attention by

attacking the scared masses.⁴⁵ According to some stories, the water which poured down from the skies and also the waters from the deep was extremely hot and burned the flesh from off the bodies of the wicked.⁴⁶ It was like fire coming from heaven, and it dissolved the land.⁴⁷ Thus, millions of humans died as well as the animals and birds.⁴⁸

While the commotions continued, the ark was lifted up from its resting-place and tossed to and fro in the turbulent waters. The animals began to howl and roar with terrifying noises; and also Noah and his family were terrified. They stood embracing and clinging to one another and wept out of fear as the ark shook heavily and bounced from side to side. In answer to their fervent prayers the Lord quieted the waters and the violent movements subsided and the inhabitants of the vessel slowly gained their composure.⁴⁹

Gradually life adjusted to a normal routine as everyone became accustomed to the conditions. Noah was in charge of the wild animals; Shem cared for the domestic ones; Ham for the birds; and Japheth tended the reptiles.⁵⁰ It appears that most all the animals were rather tame during the voyage as everyone was able to walk even among the snakes and scorpions without having to be afraid.⁵¹ The foremost problem facing the family concerned the feeding of the animals since there were so many of them and each required a different type of food at different times of the day and even at night.⁵² The eight humans did not receive much rest for the next year as they ran about day and night to provide care for their charges.⁵³ Once Noah was injured by an upset lion which had been angered by waiting for his food for a long time. Another version mentions that an elephant hurt Noah when he accidentally sat down on Noah's leg one night.⁵⁴

A further problem facing the animals and humans was the bitter cold on the ark. Many suffered greatly and Noah himself coughed blood because of the freezing temperatures.⁵⁵ It was also a time of mourning and everyone remembered daily the death of so many people because of their stubbornness. For this reason, sexual relationships were apparently forbidden while in the ark.⁵⁶ Light was provided by the stones or the pearl. When it was light outside they would shine dimly and brighten up when it was night-time. Thus, the days and nights were indicated and the inhabitants of the ark knew how much time had passed and could also feed the animals at the proper times.⁵⁷

Finally, after one year and eleven days, the flood ended when strong winds scattered the waters and they slowly receded and disappeared.⁵⁸ The deluge had been universal and the ark seems to have floated far away from Noah's native country and to have landed in a new and strange place on the other side of the earth.⁵⁹ The destruction which greeted the survivors upon disembarkation was total. They were horrified and wept bitterly when they saw the results of the flood.⁶⁰ The Lord had to console them and promised with an oath that there would never be another deluge. As a sign of his covenant, the rainbow was set in the sky which was to be seen only in times of wickedness to remind mankind of the flood and the oath.⁶¹ After offering a

sacrifice on an altar, Noah blessed his children and they proceeded to once more populate the earth and find a new home. In later times, Noah was hailed as the "preserver of the race,"^{61a} "the founder of the new universe,"^{61b} and even "the last and the first."⁶²

As the descendants of Noah multiplied and grew, they populated the land and then spread out into "the four quarters of the earth."⁶³ When the earth was "divided" at the time of Peleg (Genesis 10:25), an apocryphal writing maintains that it did not refer to a physical separation of the land masses but rather that Noah assigned each of his sons and their children a part of the earth in order to avoid future strifes and quarrels for the land.⁶⁴ By the time the old patriarch died, 350 years after the flood, it is said that his descendants numbered already in the millions.⁶⁵

Within a few generations, however, Noah saw that a great number of his posterity were apostatizing and sliding back into corruption and wickedness. The stories about the tower of Babel speak for themselves; and his greatgrandson, Nimrod, introduced idolatry again and ruled the world by force.⁶⁶ The aging patriarch therefore undertook to write a book about his experiences before and after the flood; a voice of warning for his descendants so that they could learn from the tribulations and the accumulative wisdom of their progenitors.⁶⁷ Yet, very little heed was given to the instructions and admonitions contained therein. Included also was Noah's insight and knowledge about medicine and cures for the prevailing illnesses of the times. Angels had told him the healing secrets of the many herbs and plants which were to be used as remedies for injuries and sickness among the children of the patriarch.⁶⁸

Noah's memory remained alive not only in the scriptures of Jews and Christians but also in the legends of the ancient East. He was immortalized in Mesopotamia as *Utnapishtim*, in Palestine as *Leviathan* and finally in Greece as the great *Deucalion*.⁶⁹ Thus remains the legacy of one of the pillars among men in the course of human history at the time of the greatest wickedness and the most destructive catastrophe on this planet.

References

- ¹Jasher 2:4-5; *Book of Adam and Eve*, II, ch. 13, 17; *Midrash Rabba: Bereshith*, 23.
²*Book of Adam and Eve*, II, ch. 20ff.
³*Midrash Rabba: Bereshith* 34:14.
⁴Ben Gurion, *Sagen der Juden*, 191-193; *Pirke de Rabbi Eliezer*, 22; *Midrash Rabba: Bereshith*, 31:6; 2. Enoch 34.
⁵Ginzberg, *Legends of the Jews*, I, 158; *Jasher* 2:20-22.
⁶*Midrash Rabba: Bereshith*, 26:5.
⁷*Ibid.*, 28:8.
⁸*Jasher* 4:17-18.
⁹*Midrash Rabba: Bereshith*, 26:5; Josephus, *Antiquities of the Jews*, I, 2.3.
¹⁰Ben Gurion, I, 119, 154; *Zohar: Bereshith* 56a.
¹¹*Ibid.*, 152, 155; *Jasher* 4:5-6, 12.
¹²Animals were also destroyed because they had perverted their lifestyle. They were also no longer necessary on the earth without man since they had been created for his sake (Ginzberg, V, 180, note 32; Ben Gurion, I, 197-198).
¹³It is said that Noah participated in the vices of the times until he was 48 years old when he repented (*Midrash Rabba: Noah*, 30:8). He apparently withdrew from the wicked and lived in the mountains where he studied the books of the righteous, particularly Enoch (*Zohar: Bereshith*, 58b).
¹⁴Ginzberg, V, 132.

- ¹⁵*Ibid.*, I, 147. (Cf. *Genesis* 5:29.)
¹⁶Origin, *Contra Celsum*, III, 41; Tertullian, *Genesis* 3:30; *Midrash Rabba: Noah* 30:7; Since he was also building the ark, it was only one hundred years according to the *Apocalypse of Paul*, 50.
¹⁷*Talmud: Sanhedrin* 108a; *Midrash Rabba: Eccles.* 9:15.; Ben Gurion, I, 179.
¹⁸*Sibylline Oracles*, I, 177-233.
¹⁹*Midrash Rabba: Bereshith*, 26:6; Ben Gurion, I, 188.
²⁰*Ibid.*; Philo, *Quaestiones et Solutiones in Genesis*, 1:19; Josephus, *Antiquit.*, I, 37; Lantantius, *Institutiones*, 2:14-15.
²¹*Midrash Rabba: Bereshith*, 30:7.
²²Five: *Jasher* 3:34; Ben Gurion, I, 183. Fifty-two: *Pirke de R.E.*, 23. One hundred: Origin: *Contra Cels.*, 4:41; Augustine: *Civitas Dei*, 15:27; Tertullian, *Adversus Marcionem*, 3:3.
²³*Pirke de R.E.*, 23.
²⁴*Hypostasis of the Archons*, p. 31, line 16; Epiphanius, *Pan. Haer.*, 26:1 According to the Koran she was assigned to hell for this action (*Sura* 66:10).
²⁵*Midrash Rabba: Bereshith*, 32:11; *Talmud: Sanhedrin* 108b; *Pirke de R.E.* 23; *Targum Yerushalmi*, *Genesis* 6:14-15; Josephus, *Ant.*, I, 3.2.
²⁶Ben Gurion, I, 201.
²⁷*Sefer Noah*, 150-160; 2. *Enoch* 33:12; 1. *Enoch* 10:1-3.
²⁸360 and 900: Ben Gurion, I, 203-204. 366: *Pirke de R.E.*, 23. 606; Ben Gurion, I, 201. 330 and 900; *Midrash Rabba: Noah* 31:11. Philo mentions four floors in *De Vita Mosis*, 2:60.
²⁹*Pirke de R.E.*, 23.
³⁰*Midrash Rabba: Noah* 32:4.
³¹*Pirke de R.E.*, 23.
³²Ben Gurion, I, 201; Hippolytus, *Arabic Fragment to the Pentateuch*, *Genesis* 6:18.
³³*Midrash Rabba: Bereshith*, 31:11; *Pirke de R.E.*, 23. In *Genesis* 6:16 it mentioned a window in the ark. The Hebrew *TSOHAR*, however, refers to a light rather than a window in our sense.
³⁴For example, *Pirke de R.E.*, 23; Augustine, *Civ. Dei*, 15:27.
³⁵*Jasher* 6:2.
³⁶*Midrash Rabba: Bereshith*, 32:13, 32:8.
³⁷*Ibid.*, 32:8; *Pirke de R.E.*, 23; *Targum Yeru.*, Gen. 5:20; Philo, *Moses*, 2:12.
³⁸*Pirke de R.E.*, 23; *Midrash Rabba: Noah* 31:12. Anciently men and women were also kept separate in the churches, where they sat on different sides of the aisle.
³⁹*Book of Adam and Eve*, II, 8:11.
⁴⁰*Jasher* 4:20, 5:6, 21.
⁴¹Ginzberg, I, 142, 154; *Midrash Rabba: Noah* 32:7. Some believe that Methuselah's name means "when he is dead it (i.e., the flood) will come."
⁴²According to the Masoretic Text. It is 2642 by the Septuagint and 2262 in Josephus, *Ant.*, I, 3.3. Philo set the date exactly on Noah's birthday in *Quaestiones*, 2:33, 47. It was also the day of the Vernal Equinox.
⁴³Ginzberg, I, 162.
⁴⁴*Jasher* 6:11. See also Ben Gurion, I, 184.
⁴⁵Ginzberg, I, 158.
⁴⁶*Zohar: Noah* 62a, 66a.
⁴⁷Ben Gurion, I, 195-196; *Midrash Rabba: Bereshith*, 28:2.
⁴⁸Because of the extreme longevity the antediluvians lived to be contemporaries to their own posterity to the fifth and sixth generation (Ben Gurion, I, 188). Barring diseases and large scale wars, the population could have reached several billion by the time of the deluge (See Cleon W. Skousen, *The First 2000 years*, pp. 139-145).
⁴⁹Ben Gurion, I, 186; Ginzberg, I, 162.
⁵⁰Ginzberg, V, 181-182.
⁵¹*Ibid.*, 182.
⁵²Ben Gurion, I, 210. Some writings assert that only figs were available on the ark. See *Midrash Rabba: Noah*, 31:14; Augustine, *Civ. Dei*, 15:27.
⁵³Ben Gurion, I, 210; *Talmud: Sanhedrin*, 108b.
⁵⁴*Midrash Rabba: Noah* 30:6.
⁵⁵*Ibid.*, 32:11.
⁵⁶Philo, *Quaestiones*, 2:49. Eight people entered the ark and eight left, showing that no children were born during that year.
⁵⁷*Midrash Rabba: Noah* 32:11; *Talmud: Sanhedrin* 108b; Ben Gurion, I, 209.
⁵⁸*Pirke de R.E.*, 23 note 12; Ben Gurion, I, 219. However, see *The New Bible Commentary*, F. Davidson ed., second edition, 1954. Eerdmans, Grand Rapids. Pp. 84 & 85.

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MEGALITHS AND NEOLITHIC MAN

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European Neolithic societies have traditionally been viewed as homogenous, barbaric, farming communities organized as regionalized chiefdoms. Their visible remains are principally their graves, which were often built using large blocks of stone. In France and Britain, some more unusual stone structures are to be found. This article focuses attention on the peoples of Neolithic Britain, looking particularly at their cultural achievements and social structure. Evidences of an advanced culture are found, in sharp contrast to conventional views. Evolutionary theories of man's cultural development are shown to be totally inadequate and an alternative explanation of the characteristics of European Neolithic societies, based on the Biblical framework of history, is discussed.

1. Introduction

A journey of only about twenty-five miles allows the writer to visit Arbor Low, a man-made structure in the uplands of Derbyshire. The monument is situated near the brow of a hill and is surrounded by a bank which is over 2 m. high and about 80 m. in diameter. Within the bank is a 10 m. wide ditch, a central circular area, and a ring of over forty large and heavily weathered, recumbent stones. In the centre of the 40 m. diameter ring is a cove or U-shaped setting of stones. From the top of the bank, there are very fine views of the surrounding countryside, and the distant horizon is almost unbroken. Much of the land is farmed and there are few evidences of human habitation.

It is hardly possible to visit the site without wondering how and why it was built. What purpose did it serve? What was the significance of the bank, the ditch, the stone circle and the cove? Why was it built in what is now such an isolated part of the country? How was the large labour force necessary for such a structure assembled and organised? How could the uplands of Derbyshire support a population of sufficient size to undertake such a venture? It is easy to ask questions, but very difficult to supply answers!

Whilst Arbor Low is undoubtedly an extraordinary structure, it is by no means unique. Other mounds and rings exist not only in Derbyshire but throughout the British Isles. Together they represent the visible remains of an enterprising community that flourished in prehistoric times. The word megalith is derived from the Greek *megas* (great) and *lithos* (stone), and has been coined to describe the nature of the constructions. Archaeologists have devoted considerable time and attention to studying the monuments and graves, and can claim a measure of success. Neolithic peoples were responsible for building these distinctive structures, primarily in the second and third millennia BC. They were organised into regionalised farming communities and, rather than build villages and towns, they generally followed a nomadic way of life. They buried their dead with great care, and most of the information that we have of their abilities and customs is derived from the construction of the graves and the goods placed inside the tombs.

The absence of written records means that our knowledge of these people is very limited. It is the purpose of this article to review some of the developments

in archaeological thinking about Neolithic man in the British Isles, to identify some social and cultural characteristics of particular interest, and to relate these findings to the Biblical framework of history.

2. The Megalithic Structures

Megalithic burial mounds are widespread in Europe: Italy, Sicily, Malta, Spain, Portugal, France, Holland, Denmark, Sweden, Germany, England, Wales, Scotland and Ireland all contain distinctive remains of Neolithic man. Although there are regional differences, nevertheless the constructions have many common features.

The magnificent Maltese temples were built with great skill and are considered to be the earliest known, free-standing roofed stone buildings anywhere in the world.

The Iberian peninsula furnishes numerous examples of a Neolithic society which buried its dead in elaborate tombs. Some burial chambers were cut into solid rock; others were passage graves roofed with massive capstones and the whole enclosed with a mound of smaller stones and soil.

In France, the Neolithic communities built passage graves and practised collective burials. They also erected long mound or gallery graves. In addition, other megalithic stone structures were built, ranging from single standing stones, like Le Grand Menhir Brisé, to complex alignments like those at Carnac in Brittany.

Both passage graves and gallery graves are found in Britain, although the passage graves are concentrated in the far west and north of Scotland. A particular feature of the British Neolithic constructions is the large number of stone circles that are scattered in profusion throughout most of England, Wales, Scotland and Ireland.

An excellent review of the relevant information is provided by MacKie¹, and reference to his work should be made as a helpful introduction to the subject.

It is highly significant that much of this megalithic construction work either preceded, or was contemporary with, the building of ziggurats in Sumeria and pyramids in Egypt. The results of many radiocarbon dating tests indicate that the European megaliths must be regarded as of independent origin, and cannot be considered as derived by diffusion from the Sumerian or Egyptian civilisations.

It is hardly possible to survey these archaeological monuments without being impressed by the enterprise,

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skill and determination of their builders. Undoubtedly their origins are shrouded in mystery. Who built them? Why was there such a widespread interest in grandiose megaliths? Myths and legends about the circles and alignments abound, for ignorance fosters speculation and superstition. This article draws on recent research into these structures with the intention of taking a fresh look at these Neolithic peoples, their culture and their achievements.

3. Megaliths and Archaeological Theories

Archaeologists are accustomed to thinking of the comparatively slow evolution of human culture: from the Palaeolithic hunter and cave-man to the Neolithic farmer, followed by the Bronze Age and Iron Age societies. In the absence of historical records on which to build theories, presuppositions have exercised a dominating influence in the study of prehistory. Furthermore, scholars are very dependent on the discoveries made by slow and tedious archaeological excavations and, in North-western Europe, a picture of the Neolithic peoples has emerged primarily from a study of graves and their contents.

The recognition of certain distinctive traits in the grave goods has led, for example, to the identification of successive waves of immigration in Britain. For many years, the Neolithic and Early Bronze Age people have been regarded as little more than barbarians, although the magnificence of some of the daggers and ornaments found in the more recent graves testify to the fact that they were far from being savages. It is generally believed that the megalithic structures provided each family group or local community with a religious base which stabilised their nomadic way of life.

During the last twenty-five years, however, a major new factor has been introduced, primarily by Thom^{2,3}, but also by Newham^{4,5}, Hawkins⁶, and Hoyle⁷. Thom has devoted many years to surveying the megalithic structures of Britain and northern France, and has come to some remarkable conclusions. He believes that the level of technological expertise and conceptual thinking which the megalith builders possessed is far beyond that of the primitive neolithic farming culture envisaged by most archaeologists.

Thus, Renfrew writes: "These findings have created a great furore among British archaeologists, some of whom are reluctant to believe that the barbarian inhabitants of prehistoric Britain were capable of such ingenuity."⁸ MacKie has a similar comment: "Thom has not gone unchallenged by the archaeological world. His conclusion that there was a highly skilled class of professional astronomer-priests and wise men in existence when the standing stones were built simply does not fit with the picture of late Neolithic Britain which has been built up over many decades by many hands and from a great variety of archaeological evidence. This was a picture of a relatively simple society, barbarian and rural, probably with chiefs and a ruling hierarchy of some kind but with no sign of the sophisticated, semi-civilised priesthood that Thom's work should imply."⁹

The radical nature of Thom's conclusions is well expressed by Barber: "Thomism is severely, even paradox-

ically, at odds with our archaeological view of the Neolithic period. They cannot be reconciled by any adaption of the latter but rather demand a completely new Neolithic overview. Apart from Thomism, nothing else in archaeology or outside it, in related subjects like the history of cosmology, demands change of the Neolithic paradigm. Therefore we archaeologists are not unreasonable in demanding the highest possible levels of credibility of tests of these theories . . ."¹⁰

However, despite the challenges, Thom's work is slowly gaining acceptance among professional archaeologists. So strong is the evidence and so compelling are the conclusions, that outright opposition is now a totally unacceptable position to adopt. The following discussion of neolithic culture draws extensively on Thom's findings.

4. Features of Megalithic Culture

A study of surviving remains of the megalith builders allows some estimate of their social order and culture to be made. Of necessity, the following discussion covers the different points briefly, but references are given to books or articles where the subject is treated in greater depth.

4.1 Widespread cultural links.

4.1.1. Extensive use of the Megalithic Yard.

After accurately surveying many of the stone structures of Britain and Brittany, Thom made use of a statistical technique to analyse their dimensions. Were the stone circles and alignments laid out with the assistance of measuring rods? The test results were positive, and Thom has concluded that the dimensions are quantised. Is there a connection between the length units that have been identified between the different sites? Thom has found that measuring rods of 0.892 m. were employed in Brittany, England and Scotland to lay out the stone rows and stone circles.¹¹ This unit of length has been named the "Megalithic Yard." Evidence has also been found for the use of the "Megalithic Rod," which equals 2½ megalithic yards, and the "Megalithic Inch," which equals 1/100 megalithic rod.

A helpful discussion of this work is provided by MacKie,¹² who has this comment on the implications of Thom's findings. "The metrology and geometry that the circle builders used in their projects was highly organised to the extent that the lengths of the measuring rods were standardised at a single centre: if the rods had been copied from one region to the next errors should have accumulated and the actual variation between the rods of different areas should have been much greater. If it is correct, this deduction must have very important implications for the social organisation of Late Neolithic and Early Bronze Age Britain since it is scarcely conceivable that such a situation could have come about unless there was one major training centre for the wise men of that period where the appropriate knowledge and skills were taught by the wisest of the order and from which 'graduate' astronomer-priests and magicians were sent out all over the country."¹³

This is exactly the conclusion of Thom.¹⁴

4.1.2. Pottery design.

Archaeological investigations have always given an important place to pottery analysis. This is because the design and structure of pottery serves as an easily recognisable identification label for each distinct social group. Numerous samples of pottery have been recovered from the burial mounds and other neolithic sites in Britain and, despite local variations, there is a general uniformity of this type of material culture.

MacKie summarises the position as follows: "The finds which have been made over the years in the chambered mounds of the far north include the kind of early Neolithic pottery that such sites have yielded everywhere in Britain. In spite of regional variations in the round-based pottery bowls, the material culture of the whole of Britain at that time is remarkably uniform and does not by itself provide many clues as to whether the society of the time was divided into distinct classes or not."¹⁵

Such findings imply a countrywide cultural stability in these prehistoric times. In whatever way the people may have organised themselves regionally, they did not lose a sense of national identity.

4.1.3. Axe industries.

A notable feature of neolithic Britain was the intensive mining of flint and stone from many different parts of the country. These excavations provided raw materials for the construction of axes, weapons and tools for domestic uses, and several dozen sites have now been identified as prehistory mines.

In south-east England, flint tools were popular and were obtained by mining in chalk. One frequently mentioned site is Grimes Graves in Norfolk, and archaeologists have been looking more closely at this area in recent years. Excavations have revealed that the miners went about their work in a systematic way.¹⁶ They sank shafts through the chalk, through inferior flint deposits, until the best quality flint seam was reached at depths approaching 15 m. This preliminary earthworking required the removal of over 600 tons of chalk. Horizontal galleries were then cut into the chalk to remove the flint. Their simple but effective picks were made from deer antlers. Blocks of flint were transported to the surface and roughly shaped into axes before being despatched. When the useful lifetime of a mine was over, the shaft was made safe by filling it with chalk rubble, and another shaft was sunk some distance away so that flint extraction could continue. Good quality flint was prized because it was hard enough to stand up to rough treatment and it was also capable of being flaked and ground to the desired shape.

In the west and north of Britain, suitable igneous or metamorphic rocks were in common use. Important mining centres were: Great Langdale in Westmorland (a greenish volcanic tuff), Graig Lwyd in Caernarvon (augite-granophyre rock), Tievebulliagh Hill in County Antrim (porcellanite) and the Penwith area in Cornwall (greenstone). In many cases, petrological examination of stone axes has enabled their source to be identified and it is clear that axes were transported considerable distances throughout Britain.^{17,18}

It is concluded that the neolithic mining industry points to the existence of a society with an effective communications network and extensive trade routes. The mining industry came into existence to satisfy the market for flint and stone axes, and the economic links within the country were such that mining became a successful way of life for many people. A comment about specialised craftsmen and distributors is made in section 4.4.

4.1.5. Conclusion.

This discussion of cultural links has focussed attention on three quite different aspects of British Neolithic culture. Evidences of social interaction and influence, communication and trade have been identified. The indications are that the communities were not insular and they did not aim to be self-sufficient. There were extensive cultural contacts, and more than simple farming interests were needed to maintain them.

4.2. Advanced conceptual thinking.

4.2.1. Megalithic geometry.

Hand in hand with Thom's discovery of the Megalithic Yard has come the recognition of complex geometrical patterns in the lay-out of the stone circles. Truly circular rings are to be found throughout Britain, and there are also a significant number of flattened circles and ellipses. In his analysis of these complicated shapes, Thom has concluded that they are based on Pythagorean triangles with dimensions in megalithic yards. Notable examples, which illustrate well the geometrical principles employed by those laying out the rings are Avebury, Woodhenge, Long Meg and her daughters and Castle Rigg.

Thom's summary of his own conclusions is sufficient to indicate that the megalith designers were accomplished mathematicians. "He (megalithic man) had an extensive knowledge of practical geometry, and used the 3,4,5 right-angle triangle extensively. He also knew the 5,12,13 right-angle triangle, the 8,15,17 and the 12,35,37. There is a suspicion that he also knew the 9,40,41. He had in addition discovered many other triangles with integral sides that satisfied very closely the Pythagorean relation. These triangles were used in a peculiar geometry, in which he constructed rings, set out in stone, of various shapes: circular, egg-shaped, elliptical, etc. These constructions were made according to two rules: all linear dimensions had to be integral multiples of the unit, and the perimeters had to be multiples of $2\frac{1}{2}$ units."¹⁹

Thom's arguments on megalithic geometry have been cautiously accepted by some professional archaeologists, as is illustrated by these comments of Forde-Johnston. "In recent years views on stone circles have been greatly influenced by the work of Alexander Thom. His careful survey of a large number of sites has revealed, among much other information, the fact that many of them are not truly circular but are, nevertheless, carefully laid out, displaying a hitherto unsuspected knowledge of geometry among the builders. He has been able to demonstrate that there were several

different types of oval arrangement, each clearly based on sound geometrical principles.”²⁰

4.2.2. Megalithic astronomy.

The megalith builders were very conscious of the movements of the sun and moon in the sky, and their interests may have extended as far as predicting lunar eclipses. This is the conclusion of Thom after studying many of the stone circles and alignments in Britain. Stones were erected to study the sun and moon and to make predictions about their future motions. The following summary is taken from the preface of Thom's book *Megalithic Lunar Observatories*.

“As the investigation advanced it became evident that I was not dealing with monuments oriented for some ritualistic purpose but rather with the remnants of a scientific study of the Moon's motion. When this is recognised it will be found that a great mass of material falls into place. We must no longer assert that these people could not possibly have known this or done that. It has proved much more fruitful to ask ourselves how a trained scientific mind would have approached their problems, always bearing in mind the kind of facilities which were available.”²¹

Thom's reference to a “trained scientific mind” is the key to understanding the significance of his conclusions, and why they are so controversial among archaeologists. The movements of the sun and moon are highly complex, and it must be understood that unless measurements are made intelligently, they might just as well not be made at all. Thom's research into the astronomical use of the megalithic circles and alignments leads to the inference that their designers were remarkable for their intellectual prowess.

“Anyone who makes a detailed study of the more advanced sites like Temple Wood and Ballymeanach will realise that the people who built them possessed a highly developed knowledge of the complicated movements of the Moon in the sky, and that they must have employed some form of extrapolation. The implications are far-reaching. The design of the necessary sectors, whether obtained by pure reason or by some complex empirical operation, demanded a highly trained intellect. The discipline necessary could not have arisen out of nothing. There must have been behind it a school or a system of mathematical reasoning . . .”²²

The fact that there was not just one structure, but many observatories up and down the country is an indication that the investigation is not concerned with only a pocket of human brilliance and initiative, but rather with people of high intellectual capabilities who were fairly common in the British Isles.

4.2.3. Conclusion.

Neolithic societies are considered illiterate, primarily because they are supposed to be primitive, but also because no written records have ever been found. However, despite this lack of evidence on literacy, there were among the British Neolithic population a number of inventive, resourceful, numerate, enquiring, practising scientists. The evidences for this are found nationwide, and indicate that a high level of conceptual

thought was present in their society.

“When we think of the conditions under which these people worked and the limited material aids which they could employ we begin to appreciate what they did achieve. There are hundreds of sites throughout Britain which can surely teach us a great deal more if they are examined in an unbiased manner. Whatever we do we must avoid approaching the study with the idea the Megalithic man was our inferior in ability to think.”²³

4.3. Sophisticated technological ability.

The intention to build astronomical observatories had to be translated into practice. It takes wise men to conceive of such projects, but it requires skilled draughtsmen, managers and artisans to accomplish the plan. Designs had to be prepared, manpower needed to be organised, the right materials had to be used, and the construction work needed to be closely controlled. An illiterate, innumerate farming community would not even know where to begin such a task!

There is no doubt that Stonehenge in Wiltshire is the outstanding construction of megalithic man, and even today, when in a state of obvious ruin, it still evokes a sense of amazement at the resourcefulness of the builders. The history of Stonehenge has been much discussed and it is generally agreed that there were several stages of development. It is still a matter of debate as to whether the building of the massive stone circle took place in the Late Neolithic or the Early Bronze. However, since there is a clear continuity of cultural interests and abilities linking all the phases of Stonehenge's construction, the outcome of the debate does not affect the argument of this article.

Fig. 1 illustrates the main features of the monument. The outer perimeter is marked by a ditch with, when it was originally dug, two gaps for access. The chalk from the ditch was thrown up to form the bank, which is a circular structure having a diameter of about 98 m. Inside the bank are 56 roughly circular pits, known as the Aubrey holes, which form a ring of about 88 m. diameter. Two other rings of pits have also been discovered, but they are not visible in the photograph. The great stone circle, often called the sarsen circle, is the most striking feature of Stonehenge, and when it was built there were 30 upright and 30 lintel stones. Five huge trilithons formed a horseshoe inside the sarsen circle, but only three are standing today. Another peculiarity of Stonehenge is the presence of the smaller stones, known as the bluestones, which once formed a circle of uprights within the sarsen circle and a horseshoe of uprights within the trilithons. Whilst other stones, holes and structures could be mentioned, this brief description of the monument is sufficient to introduce a discussion of the technological expertise of the builders.

4.3.1. The transport of the stones.

The sarsen stone used for the outer circle of uprights and lintels and for the trilithons is a very hard form of sandstone. It is found on the Marlborough Downs, about 18 miles north of Stonehenge, and so, it is deduced, the massive stones must have been transported by

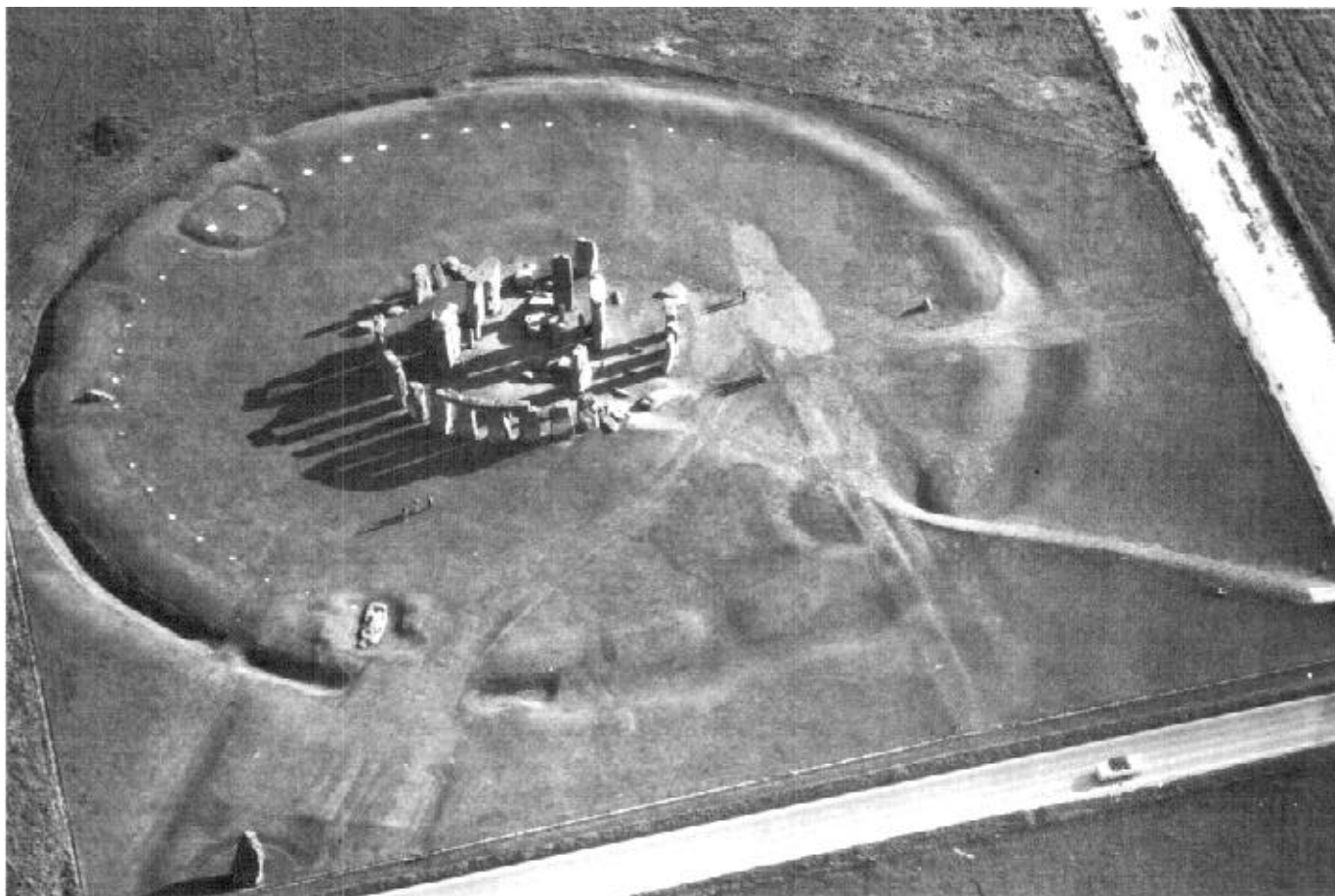


Figure 1. Stonehenge: an aerial view from NNE.

men. "The problem of engineering and man-power involved in this astonishing feat may be the better appreciated by realising that some of the heaviest stones of the monument weigh in the region of fifty tons, and had to be moved with only the simplest forms of rope, lever, roller and sledge."²⁴ Atkinson has discussed the techniques employed, the route and the problems that had to be overcome. "On this basis it can be calculated that the smallest requirements for the transport of the eighty-one sarsens to Stonehenge would be 1,500 men working for five and a half years, and working, moreover, without more than a few days rest between trips."²⁵

The bluestones have provided a completely different perspective on the builders of Stonehenge. Petrological examination of the dolerite rocks has allowed their origin to be traced to the Prescelly Mountains of North Pembrokeshire in Wales. "There can be no question of the stones having been carried even part of the way towards southern England by ice during the Pleistocene period, and their appearance at Stonehenge can only be explained as the result of deliberate transport by man. The question to be answered is therefore quite clear: by what route, and by what means, were these eighty-odd stones, weighing up to four tons apiece, brought from Prescelly to Stonehenge, a distance as the crow flies of some 135 miles?"²⁶ A number of clues suggest that the

stones were brought from the Prescelly Mountains to the coast at Milford Haven, then shipped around the south coast of Wales to the River Avon. Transport would have continued by river, with comparatively short overland hauls.

The very existence of these megaliths at Stonehenge, therefore, testifies that the builders possessed sufficient engineering and sailing skills to transport large blocks of stone over considerable distances. Manpower was necessary, but without the intelligent use of means, and a working knowledge of the geography of southern England and Wales, the stones would have been left where they were.

4.3.2. The tooling of the stones.

Sarsen stone occurs naturally as polygonal slabs, and it is very rare for pillar-like shapes to be found. Therefore, it is probable that the giant stones were roughly shaped before transportation. A widely used method in antiquity was to drive wooden wedges into preformed cracks in the rock, soaking the wedges in water and leaving the rock to split apart as a result of the expansion of the wood.

The stones were tooled to the correct shape and surface finish by pounding them repeatedly with stone mauls. "In view of the relatively advanced level of

technology exhibited by many other aspects of the design and construction of Stonehenge, it may seem surprising that so apparently primitive a method should have been used for dressing the stones. In fact, however, no other method is possible in the absence of modern mason's tools of steel, and the pounding process is dictated entirely by the intractable nature of sarsen. It is not generally realised that sarsen is the most difficult of all British rocks to work, and requires from two and a half to three times the effort to produce a comparable result on granite, itself considered to be one of the least tractable of all building stones.²⁷ Various degrees of tooling and polishing the stones have been detected by the archaeologists. Those surfaces seen from within the sarsen ring have been carefully smoothed, the sides of the uprights are coarsely dressed, whilst the outer faces are frequently very rough.

"Few visitors to Stonehenge have any true idea of the immense labor and patience involved in the tooling of the stones. Experiments made . . . by a professional mason in 1923 showed that the process of pounding a sarsen with a stone maul removed about six cubic inches an hour, entirely in the form of sand and dust. If we assume that on the average a thickness of two inches has been dressed away from all the surfaces of the uprights and lintels, the total volume of stone removed would be of the order of three million cubic inches. It would take a force of fifty masons, working ten hours a day and seven days a week, a period of some two years and nine months to finish the dressing of the stones alone . . ."²⁸

4.3.3. The geometry of Stonehenge.

The sarsen circle and the trilithon horseshoe have easily recognisable shapes. Thorn *et al*²⁹ have considered the geometry of the different rings around the sarsen circle, the circle itself and the horseshoe of trilithons, and have concluded that the dimensions of the construction were carefully planned.

Probably the simplest example to consider is the geometry of the sarsen circle. The inside faces of the uprights are of interest, since they were given the most attention in dressing. The inside perimeter of the circle is 45 megalithic rods in length, to within three centimetres. "This divides into thirty segments, each of one rod in length and separated by gaps of half a rod, and it is remarkable how well the surviving stones fit this scheme."³⁰

For a detailed discussion of the geometry of Stonehenge, Thorn's paper should be consulted. MacKie has judicious comments on this and on astronomical alignments.

4.3.4. The erection of the stones.

The probable methods employed by the builders are helpfully discussed by Atkinson.³¹ It is known that holes were carefully prepared to receive the uprights, and it is almost certain that the megaliths were hauled into position with the assistance of sheerlegs. It is also thought that timber cribs were used to raise the lintels to the required height. As has been noted in section 4.3.3., the sarsen circle was laid out according to a geometrically

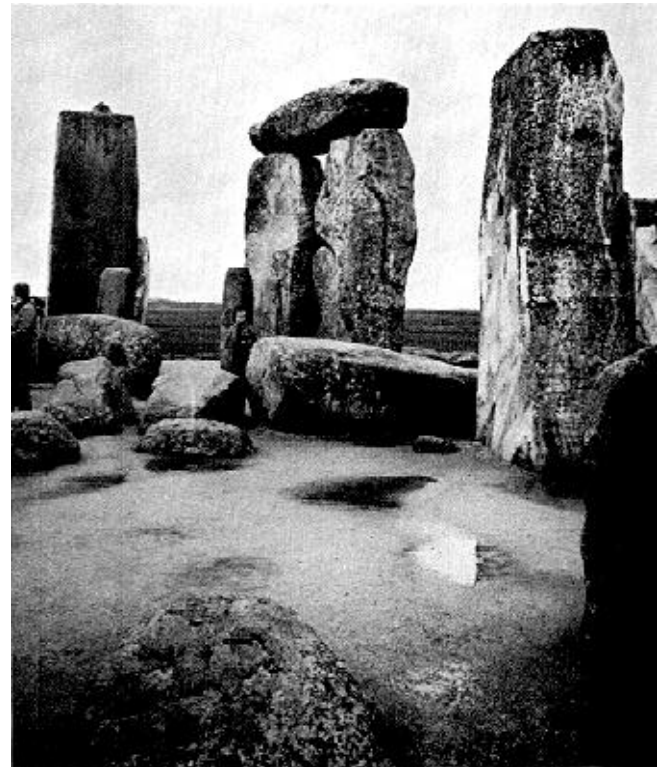


Figure 2. Trilithon stones at Stonehenge.

precise plan. To raise thirty uprights, averaging 26 tons each, successfully into their appointed positions was a considerable achievement.

Of particular interest is the way the uprights and lintels were interlocked to achieve stability in the construction. Each upright was tooled to provide tenons into which the lintels could fit. An example of this feature is seen in Fig. 2, where the tenon on stone 56, one of the trilithon uprights, is prominent. At the foot of this stone is its fallen lintel, complete with two mortices. It is probable that the tenon and mortice pairs were tooled immediately prior to final positioning.

Furthermore, the lintels on the sarsen circle were given additional stability by providing them with interlocking tongue and groove joints. One of the lintels near the entrance has a good example of a tongue projecting from it, and is illustrated in Fig. 3. "The lateral movement of the lintel for trial fittings and for its final setting in place would be effected with levers as before, swinging each end of the stone sideways a few inches at a time."³²

In spite of the gentle gradient of the ground at the Stonehenge site, and in spite of the difficulties of setting enormous blocks of stone accurately in the ground, the builders achieved a remarkably high standard in the positioning of the lintels. "Evidently great care was taken to get the upper surfaces of the lintels horizontal, and level with each other. There can be no doubt that this object was achieved with considerable accuracy, in spite of the size and weight of the stones and the primitive equipment of the builders. The maximum error from a mean horizontal plane of the tops of the surviving uprights . . . is less than 7 inches, and it is quite

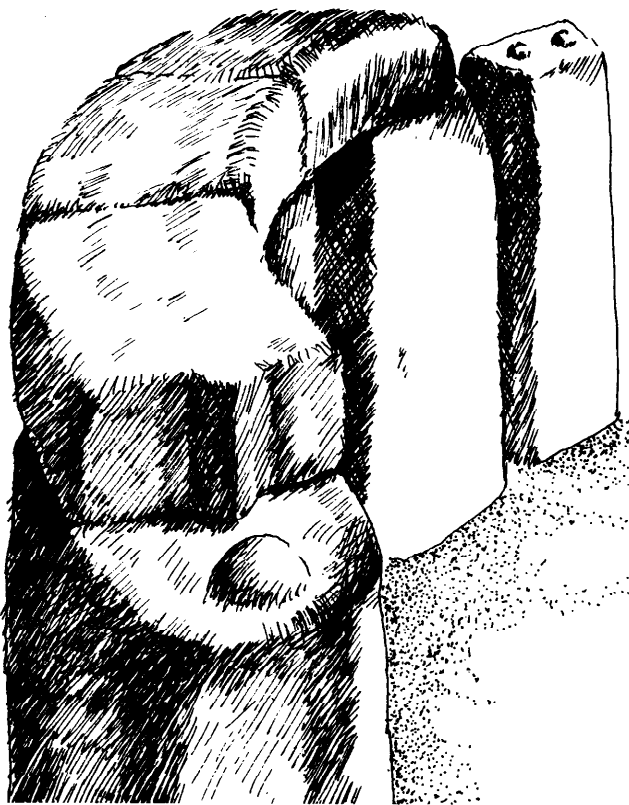


Figure 3. The entrance stones of Stonehenge. (Based on Plate VA of Reference 24.)

possible that the major part, at least, of such errors were compensated in the final shaping and fitting of the lintels themselves. Certainly this has been done in the case of the entrance lintel (stone 101), on the under side of which the visitor can see quite clearly a rebate worked about an inch deep on the end of the stone, to lower it by that amount upon its supporter (stone 1).³³

4.3.4. Final dressing of the stones.

The more Stonehenge is studied, the more apparent becomes the inventiveness and expertise of the architects. Three other aspects of their work are noted in this section.

The circle of lintels was tooled to shape and not left as a thirty-sided polygon. The curvature of each horizontal block is best seen by looking along the line of the lintels over the entrance, as in Fig. 3. It follows that the builders were concerned about the finer details of their monument, and were not merely enthusiasts for erecting great stones.

Atkinson has these additional comments about the dressing of the circle uprights. "Seen in elevation the stones taper towards the top, the amount of taper, for any one surface, averaging 5 ins. In many cases this taper is not straight, but convexly curved, a device known under the name of *entasis* from the columns of Greek temples and later buildings in the classical style. Its purpose there is to create an optical illusion of straightness (since a taper which really was straight

would appear, paradoxically, as concave), and it is not impossible that the *entasis* of the Stonehenge uprights, though ruder and exaggerated in form, may be a deliberate attempt to create this illusion by the same means."³⁴

The lintels of the trilithons "show a very subtle refinement, in that they are some 6 ins. wider at the top than the bottom. This means that the sides are inclined slightly towards the ground, probably with the intention of creating the illusion that they are vertical. If they were in fact vertical, their height would make them appear to recede."³⁵ Such corrections for perspective certainly have interesting implications for the architectural consciousness of the builders.

4.3.5. Conclusion.

There is no doubt that Stonehenge exhibits an extraordinary variety of mechanical, mental and aesthetic skills. It is often said that Stonehenge is unique, which is true; but it is important to realise that it is not out of context. It has been chosen as the subject of discussion in this article because it exhibits so many facets of Megalithic man's expertise, but many of the achievements of the builders of Stonehenge are also to be found at other sites. A study of Avebury, Silbury Hill, Woodhenge, the New Grange Mound, Maes Howe, and other major constructions gives independent confirmation that their builders were talented engineers and architects.

Thom, who has devoted much time to a systematic study of the megaliths, has made this general comment. "It is obvious that behind all this must have lain a solid background of technological knowledge. Here I am not thinking only of his knowledge of ceramics, textiles, tanning, carpentry, husbandry, metallurgy, and the like, but of his knowledge of levers, fulcrums, foundations, sheerlegs, slings, and ropes. Involved in his linear metrology was his knowledge of how to make accurate measuring rods, shape the ends, and use them accurately. There is evidence that he did not use the slope length on the ground, but the horizontal distance, as does a modern surveyor, and that he could 'range in' a straight line between mutually invisible points. There was also his ability to build and use boats: he travelled freely as far as Shetland, crossing the wide stretch of open water north of Orkney, as well as the exceedingly dangerous Pentland Firth and the North Channel between Kintyre and Ireland. This involved a knowledge of the tides and tidal currents that rule these waters."³⁶

4.4. Complex stratified societies.

The skills required to build sophisticated megalithic structures come as a result of specialisation. The projects needed theoreticians, designers, architects, surveyors, master-builders, administrators, stonemasons, engineers, etc. A simple semi-nomadic farming community does not generate these skills for, in order to survive, agricultural expertise must be encouraged above all else. Professions and trades are only possible when the society is more complex and differentiated, whereby men can afford to devote themselves to specialised occupations. It is clear that mining was a

major industry in many parts of the country (section 4.1). Miners, stone-masons and travelling salesmen could make a living in Neolithic Britain. This is an independent witness to the existence of professions and to a degree of interdependence in the social structure of those times.

Furthermore, a simple farming community does not have a lot of spare man-power. Any farmer knows that there is always something to do to tend his animals and his land. Yet megalithic constructions required vast resources of man-power: enormous quantities of earth were moved; stones were transported from one place to another and placed in position; etc. Millions of man-hours have been estimated for the building of Stonehenge alone! Figures of this magnitude are staggering, for there is no way that the neolithic society, as it has been generally understood, could have satisfied these massive labour requirements. In those cases where there are historical records of societies which undertook large scale building projects, it is found that there was a strong sense of national cohesion, a stratified society, and a powerful and affluent leadership.

Any investigation of megalith building in Britain will conclude that interest in this type of construction lasted for over a thousand years. Few of the sites were occupied for all of this length of time, and the building activity was certainly not continuous in any particular place. Nevertheless, some essential ingredients of megalithic society can be found throughout the period, and this implies a continuity of culture and a stability of the social order. The megalith builders did not come and go in a generation, but they had a profound influence on the national life of Britain for a long time. Here again, such continuity and stability is incompatible with traditional views of neolithic man. Insular,

regionalised communities may retain local practices and customs, but, with the passing of time, they will tend to diversify and any initial uniformity of culture will be lost.

The picture, therefore, is one of an advanced, near-civilised culture in Neolithic Britain, and is inconsistent with evolutionary views of the development of human society.

4.5. General comments.

Evolutionary presuppositions about the development of human culture are deeply entrenched in the thinking of most archaeologists, and many of their conclusions are, in reality, no more than expressions of preconceived ideas. With the British Neolithic, such a heavy emphasis has been placed on farming as a significant evolutionary innovation, that many other aspects of its cultural life have not been given the attention they deserve. The concept of a stratified society is one which does not fit easily into this evolutionary picture, and the megaliths are almost considered to be activities that were done in the people's spare time.

The general public is supplied with artist's impressions of what the megalith builders looked like. Fig. 4 is redrawn from the official guide-book to Stonehenge and Avebury,³⁷ and illustrates the men who were responsible for the construction of the sarsen circle and the trilithons. They are represented as tribesmen with comparatively simple lifestyles and technological abilities. In another popular work,³⁸ the builders of Stonehenge and the miners at Grimes Graves are pictured as men of a wild, unkempt appearance, clothed only in skin loincloths and indistinguishable from most representations of Palaeolithic troglodytes. So striking is the in-

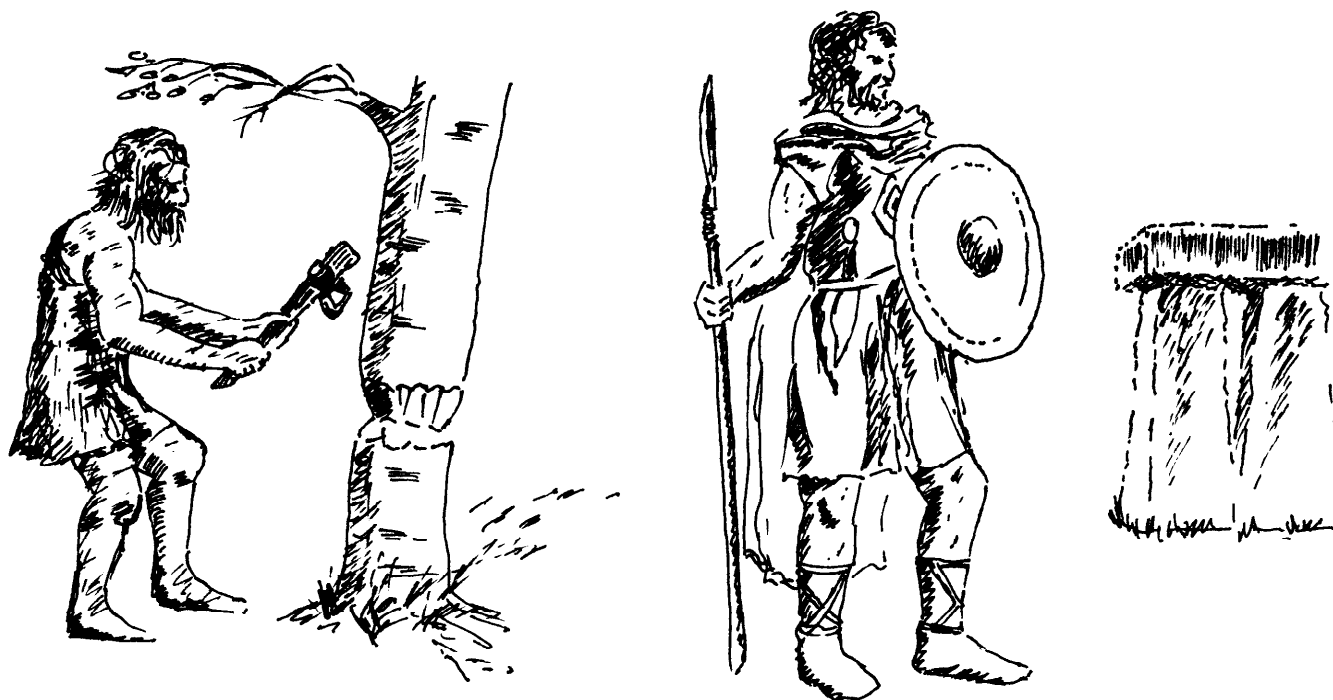


Figure 4. An artist's impression of the builders of Stonehenge. (Based on illustrations in reference 37.)

congruity between the facts and these illustrations that the latter are reduced to the level of cartoons.

However, in the light of Thom's work and the visible achievements of the megalith builders, there are some fundamental questions to be answered. If these people were so clever and resourceful, why did they not build cities and start a civilisation akin to Sumeria and Egypt? How did they get their knowledge and why was it so widespread in Britain? Why did they want to build megalithic structures and use up so much valuable man-power? What benefits did the megaliths bring to their society? How do we interpret this aspect of prehistory within the whole framework of our understanding of the human race? These are some of the questions that are discussed in the following sections.

5. The Quest for Explanations

Probably the greatest danger facing students of the past is the snare of speculation. It is so easy to confuse the fruits of a vivid imagination with the conclusions of a mature judgment. Even where there are written records to guide the historian, he must still be very careful to proceed with his work with a sober mind.

Comments have already been made about the evolutionary presuppositions of prehistorical studies, and how preconceived ideas have coloured scholarly thinking about the past. Whilst it is not possible to remove presuppositions from our thinking, it is important to realise that they are there and that they do guide our studies in certain directions.

As has been noted earlier, a new model is needed for the British Neolithic society, because the conventional views have been unable to assimilate the findings of Thom. To my knowledge, only two serious attempts have been made to provide such a model.

5.1. The Egyptian priests theory of Ivimy.

Ivimy³⁹ has proposed that megaliths betray the presence of an outpost of Egyptian priests in England, and that this group used their astronomical skills to maintain a position of leadership over the 'natives' of the land. He accepts the conventional views about the indigenous inhabitants of Britain, and attributes all the evidences of sophistication to the influence of the few highly skilled immigrants.

Whilst Ivimy's work contains much of interest, it does illustrate the point made above about a vivid imagination. The evidences that we have do not suggest a localised occurrence of genius, but bear witness to a relatively high level of culture throughout the whole nation. A pocket of Egyptian priests might have been able to hold the allegiance of people in their immediate vicinity, but it does not seem realistic for them to have initiated vast building projects in other parts of England, Scotland and Ireland.

Furthermore, whilst it is possible for intellectuals and theoreticians to inject new ideas into society and to draw up plans which might be described as 'visionary' or 'in advance of their time', those plans will remain on the drawing-board unless there are the resources, skills and interest in the population at large for bringing them to pass. Without a society that was capable of undertak-

ing the task, Ivimy's Egyptian priests would have been powerless to effect anything of significance in Britain.

5.2. The professional religious élite theory of MacKie.

MacKie is the first professional archaeologist to have taken the findings of Thom seriously and has sought to build a model of the neolithic society which is consistent with this evidence. His ideas have been published in *Science and Society in Prehistoric Britain*. "The question that this book attempts to answer is this. Is all the varied archaeological evidence which is now available about the Britain of some 4,000 years ago explained best by assuming that the population of that time was essentially rural, homogenous and organised into something like chiefdoms? Or can we on the other hand construct a more plausible picture by supposing that it was a much more organised, stratified and technically competent society evolving towards the proto-urban stage?"⁴⁰

MacKie argues strongly for a stratified community, with a ruling intelligentsia who were responsible for the organisation of the people and the building of the megaliths. He summarises the argument of his book as follows. "In the previous chapters I have tried to show that the archaeological evidence surviving from the Britain of 3,000–1,500 BC will support two major explanatory social hypotheses of kinds not hitherto considered seriously, if at all, by prehistorians. The first hypothesis depends almost entirely on the work of Alexander Thom together with a little similar work by other hands and one excavation designed to test his specific interpretation of one site. It supposes that considerable achievements were made at that time in 'intellectual' matters, namely elements of what was later called Euclidean geometry, of field surveying and exact measurement to a high degree of skill, and of observational astronomy of a systematic and advanced kind. A corollary of this is here taken to be that such achievements are only credible in a stratified Neolithic society, one which was organised to allow specialised groups to pursue these activities for the whole of their time, supported by mass labour when necessary and always by surplus food. The second major hypothesis follows from this and is that Middle and Late Neolithic society, in southern Britain certainly and probably elsewhere, was indeed organised in this way and that groups of wise men—perhaps a theocratic élite—lived a life apart in special ceremonial centres or monasteries which can be identified both by their unusual nature and also by specific evidence from artifacts and food refuse."⁴¹

MacKie's arguments are powerful and the book is well worth reading in full. Although he can be criticised on some points for unwarranted speculation, it is my opinion that MacKie has provided the best analysis of Neolithic Britain that has yet appeared in print.

5.3. Fundamental questions.

The existence of a society so radically different from what has generally been supposed has still to be explained. How did the people gain an interest in astronomy? Where did their advanced knowledge come from? What

are the implications for the evolution of culture? Why did they choose to build megaliths rather than towns? From our present knowledge of archaeology, it is impossible to answer these questions. Any discussion lies in the realm of hypothesis and speculation.

The problem faced by archaeologists with an evolutionary approach to origins is only partly how to explain the existence of a comparatively small group of intelligent leaders. It is also necessary to explain how the whole society was relatively advanced in technology, skill and resourcefulness. An illustration may help to clarify this point, based on the building of the English railway system in the Nineteenth century.

The innumerable cuttings, embankments, tunnels and viaducts were all constructed by a large and hard-working labour force. Millions of tons of earth and stone were moved. However, there is no doubt that manpower alone would never have succeeded in completing the task. The railway network was a product of an enterprising, industrial society and the construction work bears witness to the technical expertise of the builders. Without a large number of skilled personnel, drawn from many different trades and professions, no progress could have been made. It is one of the arguments of this paper that the construction of megaliths in prehistoric Britain required the existence of a society of many talents, and that cultural stratification was not merely at the level of a few leaders, distinguishing them from the homogeneous masses, but it was to be found throughout that society. Any hypothesis which is concerned to explain the origins of the British Neolithic must be prepared to accept a society which was capable of actually building the megaliths.

As it happens, it is very difficult to find any evidence at all which has a direct bearing on these fundamental questions. MacKie's hypothesis is that professional priests emigrated from the Mesopotamian region in the fifth millennium BC and gained an influential dominion over most of Neolithic Europe. The specialised knowledge of these priests was passed from generation to generation, and used to advance their position in society.⁴² No doubt, this hypothesis will be discussed in the literature, but it must be realised that it lacks any positive archaeological support and that it is defended only by circumstantial evidence.

On the basis of field evidence alone, it would not be appropriate to make any comments about the origins of the British Neolithic, but merely to note its advanced cultural characteristics. However, despite the lack of historical documents produced by that society, our knowledge of prehistory is not exclusively determined by the results of archaeological excavation. A reliable general history of early man is given in Genesis 1-11. The quest for explanations should not be placed in abeyance before considering the Biblical information relevant to the cultural achievements of early man and the way men came to inhabit different parts of the earth.

6. A Biblical Perspective

The Biblical framework for the social history of the

human race divides the time into three unequal periods: antediluvian, postdiluvian preBabel and postdiluvian postBabel.

Antediluvian culture (Genesis 4-6) included the family as the social unit and the husband as the head of his house; the ability to speak rationally and coherently; the practice of livestock and arable farming; the owning of personal property; the ability to make fire, to sew and to make clothes; the building of cities; the existence of a stratified society which included sedentary and nomadic people, farmers, professional musicians, and craftsmen in metal and in wood. Other skills can also be deduced: the practice of building boats and fishing; the cultivation of vines and the fermenting of wine; an understanding of accurate mensuration and the prizing of precious metals and stones.

All these features appear within ten generations from the first man, and there can be no doubt that traditional evolutionary theories about human cultural development are totally misconceived. Antediluvian man was essentially 'modern' in his resourcefulness and conceptual abilities. It did not take him long to make brass and iron objects by smelting ores, and he was capable of embarking on large-scale building projects.

After the Flood had devastated and restructured the whole of the earth's surface, the human population began again to multiply. Since they were descended from the family of Noah, all the people spoke with the same language. The consensus was to remain as one nation in the earth and not to allow division and fragmentation to take place. As numbers increased, they migrated to the Mesopotamian region and made their base there. A city was to be built in brick and also an enormous monumental tower. Their aim was to make a name for themselves, and in so doing they sought to preserve a sense of national unity.

In this brief description of events immediately following the Flood, there is no suggestion of any degeneration from the culture of the antediluvian period. They did not hesitate to commence extensive building projects and there was no lack of expertise to achieve their aim. However, although men were culturally advanced, they were spiritually dead. Before God, they were in the darkness of unbelief and their motives were utterly corrupt. Their desire to build a city and a tower was, in reality, an expression of defiance to Almighty God. Despite the recent judgment of the Flood, they persisted in the ways of their fathers and sought for independence and self-sufficiency. They would not have the Lord to rule over them and they grasped the reins of power for themselves. Their project of building a large tower was an important means of achieving this aim. The leaders aspired to an absolute rule, with no fragmentation of society into dissenting groups. Their goal was totalitarian world government.

In the mercy of God, this society was broken up. At this time the different languages were brought into being, the one nation became many, and the people were forced to migrate over the face of the earth. In some places, principally Sumeria and Egypt, civilisations sprang up quickly and Custance⁴³ has noted that the abilities and achievements of these societies exhibit a continuity with the culture of antediluvian and

postdiluvian men as recorded in the Bible.

These things being premised, it is now necessary to assign a place for Neolithic man and, in particular, the British Neolithic, within this general scheme. It is certain that the people were postdiluvian, for there has been no worldwide flood since the building of the megaliths. It is also certain that they were contemporaries or near-contemporaries of the early Sumerians and Egyptians. Therefore, they are postdiluvian postBabel people.

In the opinion of the writer, the spread of Neolithic peoples over the earth was a direct consequence of the judgment at Babel. The extended timespan that is normally assigned to the migration of Neolithic man across Europe is a direct result of the radiocarbon dating method. However, as has been shown elsewhere,⁴⁴ the C-14 dates need to be calibrated and, in real time, the Neolithic period before the rise of civilisations was probably comparatively short, of the order of generations.

Neolithic man carried with him the knowledge of civilisation, of technology, of a structured society and of the Tower of Babel. If there was any significant continuity of culture, at least some of the community must have retained and transmitted their knowledge to others. These people went out into an hostile and untamed earth, and this forced them to be hunters and nomadic farmers until they had mastered their environments. The existence of relatively advanced technology and a complex social structure among them, therefore, should not be regarded as nonsense and out of the question. The Biblical history provides a context in which advanced cultural features do make sense. It is not the argument of this section that the Bible *requires* such characteristics in neolithic societies, for it has no direct reference to the subject. Nevertheless, *consistency* is essential to a coherent Biblical understanding or origins, and this consistency is observed.

Is it possible to link particular cultural characteristics of the British Neolithic with social practices which are found in the Book of Genesis? For example, can anything be learned from burial customs? Abraham and Sarah were buried in a cave; Rebekah was buried under a pillar or standing stone; and Deborah, Rebekah's nurse, was buried under an oak tree: the evidence is meagre, to say the least. It might be deduced that burial practices were different according to the social status of the deceased, but it is impossible to make a convincing case from so few instances, and to justify connections between the practices of an independent nomadic family and those of peoples living in other parts of the world.

However, despite the lack of any explicit connections, it appears to the writer that one cultural affinity is worthy of consideration at the level of hypothesis. This concerns the widespread practice of megalith building in the early history of many societies, whether civilised or not. Megalith building took many different forms, but there was undoubtedly a common interest in this type of construction. To recognise that these people were descendants of those who scattered from Babel provides substance to the idea that the desire for megalith building was deeply rooted in many national groups

and that its origin should be traced back to Babel itself.

The Tower of Babel was an expression of opposition to God: a declaration of human independence and self-sufficiency. Such a rebellious spirit did not depart from men as they scattered from the Plain of Shinar. When they found a land in which to settle, their thinking continued along the same lines. They did not humble themselves to seek the Lord, but persisted in building structures that were echoes of Babel. Any connections with the burial of the dead, idol worship or astronomical observations should not efface the motto of the builders: "Let us make a name, lest we be scattered abroad upon the face of the whole earth." (Genesis 11.4) The continuity of the Neolithic cultures indicated above may be regarded as a success for the idea of the megaliths being a means of achieving social cohesion.

Finally, why was there an absence of towns in Neolithic Britain? Towns are built when people can guarantee their supplies of food, for this enables them to stay indefinitely in the same place. If the food supply is uncertain, a nomadic existence is to be preferred. It has been shown that the inhabitants of Neolithic Britain were certainly capable of building towns. Since this was not their practice, it may be inferred that the countryside could not support a settled community—other than the few cases cited by MacKie. What is the explanation for this?—for the British countryside today can easily support settled communities. The writer does not have a clear answer to this question. He suggests that the climate in N. W. Europe was significantly different in Neolithic times from today, and that this impeded the formation of sedentary societies. A similar suggestion was made in a previous article⁴⁵ and is consistent with the situation described above.

7. Summary and Conclusions

Recent studies of the British Neolithic peoples have unveiled aspects of their cultural attainments which have fundamental implications for our understanding of those times. This article has sought to gather together several different strands of evidence, concentrating on those which are indicative of sophistication in technological skill and social structure.

Since these evidences are incompatible with the traditional models of social life in the British Neolithic, it is necessary to reconsider all the data and to formulate alternative models. The work of MacKie has been briefly discussed and commended as a significant step forward. MacKie argues for a stratified society ruled by a religious intelligentsia.

Even if these new views of the British social structure are only partly correct, the traditional evolutionary approach to the development of human culture must be discarded. A Biblical perspective on the origins of this society has been discussed, based on information supplied in the book of Genesis. In particular, this concerns the people who were dispersed to different parts of the earth after commencing to build the Tower of Babel. Consistency between the Biblical information and the archaeological evidences has been noted, to the extent that the Christian student finds no tension in his mind as

he pursues his investigation of the peoples of prehistoric Britain.

One important lesson that should be drawn from this revised interpretation of the past concerns the danger of placing too much importance on a limited range of archaeological artifacts. The traditional picture of British Neolithic society is very dependent on the study of graves and gravegoods, and inadequate attention has been given to other sources of information. The consequence has been that an artificial picture has predominated. This danger of selectivity leading to erroneous conclusions must be very carefully watched when studying nomadic peoples, because they leave behind so little for archaeologists to recover and study. For example, consider the life of Abraham, who led a nomadic way of life. He was a civilised man and he enjoyed the benefits of civilised life. He was wealthy and powerful, so that he had personal dealings with the Pharaoh of Egypt and the king of the Philistines, and he also defeated other kings on the battle field. He was one of the important people of his day—and yet his burial chamber was all that he left for posterity. An archaeologist could have little idea of the significance of this man from a study of his grave. Other nomads may have been just as civilised as Abraham, and yet have left just as little tangible evidence of their advanced culture.

Attention has been drawn several times in this article to the importance of presuppositions in the study of the past. In the study of early man, evolutionary views have predominated and archaeologists generally appear to be unconscious of the fact. A proper discussion of Thom's work has been seriously impaired by a commitment to evolutionary principles, and the resistance to the new ideas has been largely a result of prejudice rather than rational thought. The evidences for the British Neolithic being advanced in social structure and cultural attainments are now very strong, and it is time for the facts relating to neolithic peoples in other parts of the world to be re-examined.

Acknowledgements

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DICTIONARY OF DECEIT

Being a compendium of terms often used in misleading ways in writings about evolution

JOHN N. MOORE*

Adapted: cover word for observed conditions, but no real explanation.

Column: used in geology when no physical referent exists; conveys connotations of reality.

Cosmology: non-rigorous use as if interchangeable with cosmogony; conveys connotations of seeming validity and reliability of *science* of cosmos.

Creation: used to convey coming into existence of something new as if by some natural means; conveys connotation most accurately reserved for supernatural acts of Supreme God.

Dating: used to convey connotation of seeming accuracy resulting from specific *measurements* by man-made chronometer.

Discontinuous variation: when juxtaposed, terms seem contradictory; variations are not usually connoted as discontinuous or interrupted, but continuous.

Evolution: ambiguous without immediate designation of degree of change involved (i.e., prefix mega- or micro- should be used.)

Historical, History: proper use involves activities of human beings; so misleading use conveys connotation of real objects and events.

Hypothesis: not always restricted to concepts testable by careful research.

Measurement: used commonly when "estimate" would be more accurate.

Mechanism: cover word for observable conditions; conveys connotative support to mechanistic world-view.

Nature: (often capitalized); capitalization involves reification or deification of all or part of natural environment (anthropomorphism).

Natural: often employed ambiguously when supra-natural concepts are involved.

Natural laws (Laws of nature): really only descriptive; but often used as if they were prescriptive, like civil laws.

Natural selection: cover word for what is really differential elimination (or differential survival); conveys connotation of volitional choice where none exists in the natural environment.

Punctuated equilibrium: when juxtaposed, terms seem contradictory; equilibrium usually connotes tranquil persistence.

Record: term usually has to do with the activities of human beings; so its use here conveys a connotation of real occurrences. See "historical".

Related: With regard to kinds, goes beyond mere similarities; conveys connotation of observable familial relationship.

Religion: used propagandistically; full connotation of word involves practices of worship, procedures, and conduct.

Science: used propagandistically; commonly to refer to anything done by scientists.

Self-reproducing (Replicative): no cell component reproduces in isolation; use of "self" conveys connotation of human volition (anthropomorphism).

Sequence: goes beyond exactness of observable conditions (e.g. in rocks); conveys connotation of known cause-effect relations.

Spontaneous: often used where "instantaneous" would be more accurate, since no scientist can avoid external intervention in research.

Theory: used commonly for almost any idea regardless of scope or inclusiveness; conveys status to ideas accepted for proper *scientific* theory formulated according to rigorous criteria and in accordance with the limitations of scientists.

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Noah and the Flood

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⁵⁹Plato asserted that the flood had been only local (*Laws* 677a), as did Aristotle in his *Meteorology*; but it must have been world-wide or the ark would not have been necessary. If it had been only local, all Noah had to do was leave the area temporarily or move to higher elevation to escape the waters. God could have saved Noah without the ark by another miracle, but the flood was needed as a testimony for future generations, according to Hebrew teachings (Ginzberg, V 174, note 19).

The *Book of Adam and Eve* 53:7 reads "And I will bring them to a distant land and the land in which you dwell now shall remain desolate and without one inhabitant in it." Modern research seems to concur: "The Flood survivors are 'lost' and have to be told by divine revelation where they are." (E.G. Kraeling, "the Earliest Hebrew Flood Story," *Journal of Biblical Literature*, LVI, 288ff).

The Mormon Church teaches from their religious writings that Adam and his descendants lived originally on the American continent, in the area of Missouri, and the flood carried Noah halfway

around the world to the traditional landing site in the Middle East. (The Church of Jesus Christ of Latter-day Saints: *The Doctrine and Covenants*, Sections 116, 117).

⁶⁰Zohar: Noah 29a.

⁶¹Midrash Rabba: Noah 35:2; Ginzberg I, 116. It is not seen when mankind is righteous.

⁶²Clement, *Recognitions*, I, 79; IV, 12. Origen, *Homilies in Ezekiel*, 4:8; Philo, *Quaestiones*, 1:96. Noah is the last of the old generation before the flood and the first of the new after the flood.

⁶³Zohar: Noah 61a.

⁶⁴Jubilees 8:10ff.

⁶⁵Ginzberg, I, 175.

⁶⁶See Jasher 7-9.

⁶⁷Jubilees 10:14; Eusebius, *Chronicon*, I, 19ff; Jellinek, *Bet-ha-Midrash III*, 31-32.

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⁶⁹See the *Gilgamesh Epic*; 1. *Enoch* 60:7; Homer, *Iliad* 13:45ff., 14:32ff.; Pausanias, *Description of Greece*, I, xviii.7;

A UNIT ON BIOLOGICAL ORIGINS FOR THE SECULAR CLASSROOM

DAVID PAUL LICATA*

Christian teachers of science often face a dilemma when confronted with the necessity of teaching evolution. This article relates the solution found by one teacher in a secular high school. The goal of the course is to present an objective discussion of both evolution and Creation. The core of the unit is a data table which clearly compares the world-views of Creation and evolution.

Introduction

The teaching of evolution is a foregone conclusion in most public high schools. Since most people view Creation as a religious rather than scientific interpretation of origins it is rarely discussed in secular science classes.

But it doesn't have to be that way. The alert and enterprising believer who teaches science can make good use of materials from the *Creation Research Society Quarterly*, and other creationist books and pamphlets, as well as secular resources, to construct a fair and balanced unit that objectively presents both evolution and Creation as alternate modes of origin and allows the students to draw their own conclusions.

Following is a description of such a course which was presented by the author when he taught biology at Pacifica High School, Garden Grove, California. The author firmly believes in Creation. The textbook for the course was *Modern Biology*¹ by Otto.

Lesson Plans

Lessons were set up so that there would be equal time given to the discussions of evolution and Creation. Each worldview was presented as being entirely factual. It was shown that each view could fit the available data. Then comments were made about each view. Three days were allotted for lecture and audio-visuals on each—a total of six days. As a discussion of Creation may lead to topics of a religious and often personal nature quite apart from discussing scientific evidence, most lessons were presented as lectures. Questions were fielded by the teacher as they came up in an effort to avoid class debate. If more time could be allotted to the issues of origins a carefully researched formal student debate might be highly instructive for all students.

The general outline for the unit was:

Day 1. Lecture and Film Strip.

I. Introduction to Evolution

- A. Geology of Evolution—supplemented by the *National Geographic* filmstrip "The Earth."²
- B. The primitive Earth
 1. The atmosphere
 2. Land masses
 3. Experiments of Fox, Miller, and Oparin.
- C. Organic Evolution—an introduction.

Day 2. Lecture with Chart

II. The Theory of Organic Evolution

- A. Paths of Evolution—commonly accepted evidences (with the beginning of the comparison chart—see Table I)
 1. Homology
 2. Vestigial Organs
 3. Embryology
 - B. Lamarck's Theory of Evolution (not accepted)
 - C. Darwin's Theory of Evolution
 1. Natural selection
 2. Survival of the fittest
 - D. The Mutation Theory of DeVries (as described in text book)
 1. Mutations occur—some "good" most bad
 2. Enough "good" mutations result in a better creature
- ### III. Factors affecting Evolution
- A. Gene Mutations
 - B. Environment
 - C. Migration and Variation
 - D. Change in Environment
 - E. Isolation
 - F. Speciation
 - G. Adaptive Radiation
 - H. Convergent Evolution

Day 3. Lecture

- ### IV. Summary and comments
- A. Evolution of the Universe
 - B. Evolution of the Earth
 - C. Biological Evolution
 - D. The evidence, a review—including comments on chart

Day 4. Lecture

- ### V. The "Other" Interpretation
- A. Why another interpretation
 - B. Three systems of acquiring knowledge
 1. Empiricism
 2. Rationalism
 3. Revelation
 - C. Why the Genesis account of Creation
 1. Universe was created/was not created
 2. If was: by personal Being/by nonpersonal Being
 3. If personal: revealed presence/not revealed
 4. If revealed: still interested/not interested
 5. We reject as useless all the "nots"—only Genesis speaks to the positive issues.

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Table 1. This table is an example of the kind of chart which can be constructed to exhibit the evolutionary and creationist interpretations of the major data concerning origins. In order to exhibit as much data as possible at once it was necessary greatly to abbreviate each argument and occasionally to omit less important sections. An overhead projector is a very useful tool in displaying the chart.

DATA	EVOLUTION		CREATION	
	EXPLANATION	COMMENTS	EXPLANATION	COMMENTS
Ice Age	Origin uncertain.	Dinosaurs extinct.	Related to the Flood	Dinosaurs extinct, fossils deposited.
Similar morphology	Common form and skeleton by common ancestor.	Most ancestors extinct and not yet found.	Same Creator.	Cf. artist: identical work by same brush strokes.
Homologous organs.	Similar structure means related by origin.	Differences related to adaption and use.	Same Creator.	If form is efficient, why change? Each creature has differences for adaption.
Vestigial organs.	Left over from unknown ancestor.	De-evolution? Really vestigial?	No vestigial organs. If some not used that is de-evolution.	De-evolution agrees with the law of entropy. Cf. Romans 8:20.
Similar embryos.	Development follows the stages of evolution.	Most biologists now reject this	Embryos of all creatures have the same environment.	Stages are not all that similar.
Mutation theory. (De Vries)	Many minute changes lead to better and different organisms: that is evolution.	Requires very long time. Transitions not found.	Mutations may cause changes within a species. Most are lethal or recessive	No change between species ever seen. If different species mate, the offspring, if any, are sterile
Environment and fittest as survival. (Darwin)	Survival of from determined by determined by environment.	Better traits from mutations. Most recessive and non-useful unless fully developed.	Species may vary but not evolve. If a variation helps it may stay.	All variation is small. Much possibility for variation is part of the genetic code.
Pepper moth. (England)	Environment changed; black moths were favoured; so more black.	Called proof of evolution.	Definite proof of adaption and variation only.	Most have changed back to white. None changed to other species.
Not one genus observed to change in history.		Not enough time.		Never happens.
Radio active dating. (K-Ar, U-Pb, Sr-Rb)	Earth is 5 billion years old.	Allows long time for evolution. Uniformitarianism. (C14 similarly over shorter times.)	Billions of years in the gap. Or, appearance of age.	Radio halos prove appearance of age? New research.
Grand Canyon.	Fossil column formed over millions of years.	Prime example of geologic column and age dating.	Mostly formed in Flood. No erosion seen	Four layers missing; two reverse.
Entropy.	Reverse entropy.	How is inexplicable.	De-evolution occurs: less order, not more.	Creation was subjected to lack of order. Romans 8:20.

VI. The Genesis Account

Verses 1-4 of Genesis 1 were carefully exegeted in detail. Days 2-7 were summarized. The First and Second Laws of Thermodynamics were discussed along with comments on pre-deluge life. The Flood itself was described and discussed.

Day 5. Film Strip and Lecture

The previous day's discussion of the Flood was supplemented with the *National Geographic* filmstrip "Floods."³

VII. How creationists interpret the evidence

See "Comparing the Evidence" below. This section gives the Creationist interpretation of the topics discussed under II.A. "Paths of Evolution," and III. "Factors affecting Evolution" above.

Day 6. Film Strip and Lecture

VIII. Concluding thoughts on Creation and Evolution

See "Concluding Thoughts" below. Includes filmstrip "Cultural Evolution."⁴

Comparing the Evidence

While discussing Evolution a chart was prepared with three columns titled: DATA, EXPLANATION, and COMMENTS. The DATA column consisted of a listing of 12 significant observations often considered as relating to evolution, many taken from the textbook. Under the EXPLANATION heading were listed the evolutionary interpretations of each observation: how each fits the evolution model, why the particular piece of data is found, or some justification. Finally any additional remarks were added in the COMMENTS column when evolution was reviewed.

When Creation was discussed two additional columns were added to the chart, again labeled EXPLANATION and COMMENTS. In these columns were entered the Creationist interpretation of the data and comments as necessary. Here the *Creation Research Society Quarterly* and other Creationist writings proved most useful in providing a scientific basis for the Creation model of the data. Many back issues of the *Quarterly* were made available for students to read independently.

The format used in the chart allows for direct comparison of the evolution and Creation models (see Table I). Even though it is necessary vastly to abbreviate long arguments in order to display them adequately, students can readily see the differences between the two views and the fact that the evidence is subject to more than one "valid" interpretation. Part of the value of this is that it encourages critical thinking and cautions students carefully to weigh observations and conclusions before accepting them as fact.

The 12 items used were selected as the most important points discussed in the textbook or significant arguments of Creationists. Every possible argument could not be used as time simply did not permit a thorough discussion of more than the 12 items selected. Other teachers may wish to modify the chart presented and adapt the course to their textbook and personal opi-

nions regarding such things as the "gap" in Genesis 1:1, etc.

Concluding Thoughts

At the end of the comparisons the classes viewed the filmstrip "Cultural Evolution."⁴ This secular filmstrip is a discussion of the sociological effects of the general acceptance of the Theory of Evolution. The debasement of man is noted in the filmstrip as well as the appeal to the theory as an excuse for claiming one race is superior to another. Unlike the other filmstrips in this series the author found this one to be highly objective and show evolution to be the tool of godless men that Creationists believe it is.

The evolutionary view of man presented in the filmstrip is contrasted with the separation of man from the animals through Special Creation. The separate and responsible position of Man with respect to nature (originally given dominion over the Earth) is noted. The conclusion reached is finally summed up by saying, "Evolution makes man a little higher than the animals; Creation makes him a little lower than the angels."

These concluding remarks are not of a totally scientific nature. The main purpose is to show that one may choose to accept either Creation or evolution as a fact. Either view can be reconciled to agree with much of the evidence (at least in principle). Neither view can ever be proven scientifically since the origin of the Universe is not a matter of science (which deals with observable and repeatable experiments), nor of history (which depends on records—and no human recorded the event—in person), but of faith.

The final choice is then seen to be not so much a result of accepting incontrovertible scientific proof, as of personal faith. The careful teacher will be able to delineate the choice clearly enough that students can see that the real issue goes beyond merely HOW man appeared on Earth, but actually addresses the question of WHY man is on Earth. Clearly only the Creationist interpretation answers this latter, more important question.

Class Response

Those students who felt they did not want to hear the scientific evidence for Creation were allowed to go to the Media Center (library) during the three days when Creation was discussed. They were assigned to prepare reports on various aspects of Darwin's Theory.

The 44 students who remained in class (all but three) were asked anonymously to fill out a questionnaire and evaluate the six-day unit on origins. Responses were required for the first eight questions. The last two regarding church attendance were optional.

Following is the survey and results tabulated by per cent (except where indicated otherwise):

1. Do you believe that the evidences and information presented in this unit were presented in an objective and fair manner?
YES 96 NO 4
2. Do you approve of this treatment of the subject of origins?
YES 93 NO 7
3. How would you improve it? (suggestions listed by decreasing frequency of response)
No improvement needed
More detail on topics/more time

- More student involvement/less lecture
Vocabulary sheets (which the author agrees is very important)
More arguments for Evolution
More arguments for Creation
4. Did you object to any part of the presentation? What?
YES 7 NO 93
One student wanted more arguments for Creation, and one wanted more for Evolution, one objector made no comment.
5. If you did object should that part of the unit be omitted?
YES 0 NO 100
6. Did you believe mostly in Evolution or Creation BEFORE this unit?
EVOLUTION 27 CREATION 62 N/R 11
7. Do you NOW believe mostly in Evolution or Creation?
EVOLUTION 25 CREATION 64 N/R 11
8. This unit:
- | | All Students | Originally Evolutionists | Originally Creationists |
|--|--------------|--------------------------|-------------------------|
| Caused me to be more convinced of Evolution | 7 | 25 | — |
| Caused me to be more convinced of Creation | 25 | — | 41 |
| Caused me to be more convinced of neither | 39 | 25 | 44 |
| Changed my belief from Evolution to Creation | 4 | 17 | — |
| Changed my belief from Creation to Evolution | 0 | — | 0 |
| No response | 25 | 33 | 15 |
| TOTAL | 100 | 100 | 100 |
9. Do you attend church or synagogue?
YES 45 NO 27 N/R 29
10. If so, how often? (As a percentage of those who attend)
(Note: the responses here are likely to be somewhat skewed toward higher attendance as responses were optional and regular church attenders were more likely to answer)
- | | |
|----------------------------|----|
| Once or Twice a year | 4 |
| Four to eight times a year | 16 |
| Once a month | 8 |
| Once a week | 60 |
| Over once a week | 8 |
| No response | 4 |

Note that while only 45% of the students indicated church attendance almost two-thirds said they believed in creation.

Conclusion

Construction of a fair and objective unit on both Creation and Evolution is possible and desirable.

Students respond positively to a well thought out and clear presentation of the issues. With such a balanced presentation Christian teachers of science in secular intermediate and high schools can expose their students to both world views, encourage critical thinking, and demonstrate how a good scientist (an example for all reasonable people) must look at all sides of an issue and weigh all possible interpretations before drawing his conclusions.

It is hoped that this paper will generate some response and sharing of ideas relative to the objective presentation of the subject of origins in secular schools. The author found it necessary to present evolution as this is a part of the school district's competency standards. But it was not at all difficult to present more than one philosophy and let students make their own decision as to which world view better fits the evidence. From the class response it is apparent that most students, having been presented with evidence for both sides, made a choice which Creationists know to be most consistent with the evidence.

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OUR FRIENDS HOLD BACK

WILLIAM J. TINKLE*

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This article is not one of our scholarly dissertations which reveal the true order of the world, but just a friendly talk with an important type of person. There are many church members who appreciate right conduct but consider right beliefs unimportant. We have a message for that person; and we are very desirous that he be our friend. Let us speak to him from here on.

We are supposing that you are not a member of the Creation Research Society, but have maybe borrowed

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this issue of the *Quarterly*. We like to lend, for we are not esoteric. Let us sit down and have a friendly talk.

Our statement in each issue of the *Quarterly* that "We are an organization of Christian men of science" is not an attempt to give the public a good impression of us; it is a simple statement of where we stand. When we were organizing the Society it was suggested that we could have many more members by inviting sympathetic non-Christians to come in. But we decided against that, believing that we could do more good by being true to the cause of Christ. We believe, moreover, that

anyone who confesses that Christ is Lord should, to be consistent, give very serious consideration to the doctrine of Creation. Conversely, anyone who believes in Creation should, to be consistent, consider very seriously Christ's claim upon him, if he has not already done so.

Agreement Desirable

I talk with you, my friend, because you have not yet appraised the world as we see it. You call yourself a theistic evolutionist, saying that the animals and plants have started from simple matter and were gradually improved just as the evolutionists say, but God was the author and superintendent of the struggle and selection that developed them. Now I cannot force you by argument to change your belief; but we think that if you understood the matter more thoroughly you would agree of yourself. With due respect to good people we say that you cannot credit God with creating living things and at the same time say that they became large and complex by being pounded by nature.

Since both of us are Christians our testimony should be the same instead of contradictory. You should face the unpleasant fact, if one is known as an evolutionist his influence goes with the atheists, who prize evolution highly and made it a vital talking point.¹ Your influence belongs with us, not with atheists and free-thinkers. Let the world know how illogical it is to credit chance and time with the creation.

Many statements have been made in such a way as to result in misunderstanding and confusion. Instead of speaking of the controversy between science and religion we should recognize that it is between two groups of scientists: one explaining the world and its contents as the result of chance, the other group saying that it was planned and formed by an intelligent and powerful God. Science and evolution have been presented as the same word with a different spelling and thus it makes confusion. The Creation Research Society is led by scientists but we have a better explanation of the world than evolution. That Christianity is friendly to science is proved by the good growth of science in Christian lands.

Real Advancement

A so-called proof that man himself is the product of evolution is to credit that process with all the material progress in the history of the world. A careful scientist will not do this, for he sees that material progress has made no change in the basic nature of mankind. Progress comes about in this way: a man invents a tool, uses it and leaves it to his son, who uses it and also invents a machine. Another man writes a book and leaves it to his son, who writes another and keeps both. Thus tools and books accrue, helping mankind but not improving intelligence quotients; this process of accretion does not change the essential nature of mankind.

An Example of Belief

A good example of theistic evolutionist is Charles Raven of the University of Cambridge.² He believes in

teleology, recognizing God's planning of events, but desires to believe also in Darwin's faith in chance change and struggle to make a world.

Raven discourses at length in his book on the problems which arise in the mind of one who, like him, tries to look at life from the standpoint of Christianity and also from the standpoint of chance change and natural selection. While he desires to hold on to Christianity he does not admit on any page that life may not be due to evolution. Raven's conclusion seems to be that all life developed thus because a majority of people accept it. Poor logic; at one time a majority believed in ghosts, changing lead to gold, and a flat earth.

Near the end of his book, Raven makes a statement which may reveal his faulty logic. Concerning a choice between ecstasy and logic he comments, "The suggestion apparently made by Whitehead that we should decide between them on a basis not of the quality but of the quantity of the evidence (p. 120) seems strangely unscientific". It seems to me that this is just what most people do in following the evolution philosophy; they simply follow the crowd, quantity instead of quality.

By the way, if you believe in evolution, what are the definite scientific facts which have influenced your decision?

Problems of Youth

Present research and thought are given in an excellent book by a veterinarian, R. L. Wysong.³ He gives a sample of the chatter of students who are being influenced by Darwinian ideas.

Animals are our relatives, everybody knows that. They're here as a result of blind, purposeless forces and so are we. Who is to dictate what is right or wrong for us? chance? natural laws? Phooey on religious morality, says the group leader.

Such is the drift of thought among those who have given up the world-view of an intelligent and purposeful God and substituted for it chance and natural selection. Do you want your influence to augment such chatter? Of course not. Then come and join with us in the Creation Research Society.

Careful Science

G. A. Kerkut, a biologist of the University of Southampton lists several assumptions which are taken for granted but seldom mentioned in discussions of evolution.⁴ For the sake of brevity I shall quote only the last.

The seventh assumption is that within the vertebrates the fish gave rise to the amphibians, the amphibians to the reptiles, and the reptiles to the birds and mammals.

This claim is repeated as ordinary truth by many a person. Ask him whether the grasshopper came from the earthworm or the earthworm from the grasshopper and he will say that the earthworm is mentioned first in "the book"; but he "knows" that man and the ape came from common ancestors. Certain statements are handed from one to another until they are accepted as proved and needing to be questioned no longer; but they are only a memory drill.

But you say, "My son will not give up his faith; I have

taught him to believe in both evolution and the Bible;" ah, yes, but if his mind is developed so that he understands logic as a college student should, he will see that he can't believe both because they are contradictory; and he will give up one of them.

Listen to a wise modern scientist, A. E. Wilder Smith:⁵

A great difficulty in dealing with this and allied subjects is the fact that the average layman is not presented with a coherent account of new discoveries. These new discoveries are beginning to resurrect some of the most ancient beliefs of mankind with respect to First Causes. For years now, perhaps for almost one hundred, the ancient beliefs have lain buried for fear of the scientific materialist. Now, as we shall see in later chapters, the mummies are being brought to life. It is as if wheat stored at the time of the ancient Pharaohs is suddenly beginning to germinate in the light and warmth of scientific progress. But students still continue to come to college and universities where they lose faith in anything divine because the newest developments are often not interpreted and made relevant to them.

Understanding the Bible

This article is written to Christians; remember that we believe the Bible. A liberal minister said in my presence that the first three chapters of Genesis are written in poetry. Pfeiffer, however, in his commentary on Gen-

esis,⁶ says otherwise. He mentions what he calls "The Song of the Sword" (Gen. 4:23) with his statement, "This is the first bit of poetry quoted in the Bible." This theologian does not agree with the minister, who seemingly did not want to believe the Genesis account, which sounds to us like plain prose, just as this theologian indicates. And wherever the New Testament mentions the subject it states clearly that creation was the personal work of God.

If you theistic evolutionists will come with your friends where you belong you can have the assurance that you are helping a great and succeeding cause. You can find out from the *Quarterly* how to join, and your part of the expense will be small compared with the good we are doing in many countries, including New Zealand, the farthest country in the world.

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A PROPOSAL FOR THE COMPARISON OF EVAPORITE FORMATION MODELS WITHIN A CREATIONIST FRAMEWORK

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The existence of evaporite deposits is one of the many unsatisfactorily explained phenomena in earth science. This discussion reviews various models of evaporite formation and their anomalies. Also, the authors propose a means of testing the uniformitarian assumption often associated with evaporite formation models. This is of interest to creationists in that uniformitarian models require more time for evaporite formation than is allowed by Biblical chronology.

Evaporite deposits are beds of salts often thought to be formed by evaporation of brines. Geologists observe this in regions known as sabkhas. These formations occur in arid regions adjacent to the sea, where sea water can seep under a sandy margin near sea level which is underlain by non-porous bedrock. Salt beds several inches thick form by the sabkha process. Sabkhas differ from evaporites in that according to most evaporite formation models the salts are deposited from the sea water as a precipitate. These evaporite beds often contain very pure salts, in contrast to sabkha deposits. They may be hundreds of feet thick, cover hundreds of square

miles, and are often found thousands of feet underground.

Scientists understand sabkha formations fairly well, but the origins of the great salt beds remain puzzling. The uniformitarian belief is generally that by some means a brine evaporated over a period of millions of years depositing a precipitate. This implies that the salt at the top of an evaporite may be millions of years younger than the salt at the bottom of a bed.

Origin of Evaporites

Evaporite deposits have been known since antiquity, especially in arid regions where salt was used as a form of exchange. Only within the last 100 years have salt mines been explored with particular regard to their

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origin. Friedrich von Alberti¹ in 1852 formulated what may be called the first scientific theory of evaporite production. He basically implied that evaporites were formed from deposition of volcanic "vapors" (magmatic fluids) arising from the depths of the earth. Although this is crude as stated, he had only a rudimentary chemical foundation on which to base his theory; and in this light his model appears quite interesting (expanded discussion *infra*).

In 1854 Bischof used the idea of a marine origin from evaporation of sea water in isolated basins behind a bar in which the sea remained after periods of high tides. Ochsenius, in his 1877 studies of the present-day lagoon at Kara-Bogaz-Gol on the eastern side of the Caspian Sea, was led to modify Bischof's original bar model. His model differed from Bischof's in that it allowed for an open outlet to the sea, brine filling the basin to the level of the bar. This would allow for continuous deposition of salt precipitates until the basin filled.

These models seem faulty in the light of the fossil record. This speculation (evaporating sea water) inherently implies that the salts would contain an abundance of marine fossils. Also, the salts would occur in layers whose chemical composition would follow the order determined by Usiglio² in 1849. These predictions do not match the data from the salt beds. The natural salt sequence only rarely matches the Usiglio sequence, and the salts rarely contain fossils; furthermore those fossils that do exist are exclusively non-marine.

Walther in 1900 proposed a "desert theory" in an attempt to explain these anomalies. He used a model in which the salts were deposited in a land-locked basin from evaporating brines formed by meteoric water containing dissolved minerals. However geologists have difficulty explaining the origin of the vast quantities of brines necessary to accomplish this process on the scale required by many large evaporite deposits. Furthermore, the lack of auxiliary sedimentary "sludge" in the evaporites argues against this model. Hsu³ has recently resurrected this idea. He attempts to explain the recent DSDP (Deep Sea Drilling Project) discoveries of evaporites under the Western Mediterranean Sea. These authors maintain otherwise, since the acolian clay, the stromatolite formations, and the marine deposits which are found there more closely correspond with the conditions associated with sabkha formation⁴ rather than evaporite formation.

Branson in 1920 realized that the bar hypothesis (any model involving an isolated lagoon) would not explain the frequently observed almost mono-mineralic evaporite sequences. The model he proposed consists of a series of evaporating bodies of sea water such that a single salt precipitates within each body. The least soluble salts precipitate in the first basins, and the brine flowing from one basin to another becomes pre-concentrated with the next constituent. However, the small geologic probability of this occurring, and the fact that no examples of the formations suggested are known to exist either presently or in the geologic record, present difficulties for the model.

An excellent modification of the bar theory was made by R. King in 1947, in attempting to explain the thick,

nearly pure anhydrite Castile Formation of Texas-New Mexico. He attempts to explain how the brine in an isolated basin could be kept continually enriched in calcium without precipitating the sodium. The only problem in the scenario is that there is no physico-chemical reason for the brine to remain saturated with respect to calcium and undersaturated with respect to sodium. (It relies on chance.) The model involved the notion of a basin that is refluxed with sea water, so that the denser sodium-enriched brine flows back to the sea. However, the authors point out that tidal action most certainly would interrupt this process, and this was never taken into consideration in the model.

Omer Raup⁵ in 1970 published another possible mechanism for evaporite production. This model rests upon the fact that a precipitate may spontaneously be produced by mixing different solutions of different concentration of salts. That is, the combination of two (or more) solutions may result in a precipitation of one of the constituents even though each individual solution may be undersaturated with respect to a certain ionic pair. This mechanism interests creationists in particular since it does not require millions of years for the evaporation of vast quantities of water. Furthermore it could be Biblically feasible, having taken place according to the account in Genesis 7:11 (NASB) "... on the same day all the fountains of the great deep burst open ...".

Raup's model is particularly attractive in regard to the origin of sylvite (KCl) since it can be deposited directly through brine mixing. Previous to this the origin of sylvite deposits was considered to be not from primary deposition but from a secondary alteration product of the original mineral carnallite ($\text{KMgCl}_3 \cdot 6\text{H}_2\text{O}$). It was thought that the carnallite was then weathered by ground water to produce the sylvite. The reason for this is because sylvite would not have been produced through mere evaporation of sea water with increasing potassium concentration⁶.

It seems that many authors have tried to formulate a universal mode of evaporite production. However, after observing the range of evaporite deposits presently known, one might assume that a suite of models may be required to explain them. The authors point out that with slight modification von Alberti's model could be quite feasible. In this model the brine has a magmatic origin and may be modified chemically and/or physically (by changes in temperature and pressure which affect the solubility and ionic activity of its solutes) as it travels through the host rock. The brine at some different pressure and temperature cannot hold its solute any longer; consequently some constituents precipitate. Note well that this may happen at the earth's surface, but by no means is it limited to this, as it may precipitate somewhere below the surface. This model places few limitations on the brine. It may still enter into further host rock reactions or may enter another brine pool to participate in a reaction suggested by Raup. This mechanism, too, may be reconciled with the Biblical account of Noah's flood, as far as the fountains of the deep and the time required for deposition are concerned.

Dating Evaporites

On the basis of time, all the evaporite models mentioned may be categorized into one of two types, those which demand a long amount of time (hundreds of millions of years) and those which require a geologically short period of time (thousands of years or less). There does not seem to be any gray area involved. Therefore a tremendous insight may be gained by finding how long it took to form a deposit. This can be done by comparing the age of the salt on top with the age of the salt on bottom (see Figure 1.).

Dating evaporites presents a serious problem. The situation calls for the use of a radioactive dating method. However, the only radioactive element available in evaporites in sufficient quantities for dating is potassium, as found in sylvite (KCl) deposits. Before Raup developed his model there was no possibility of using potassium to date an evaporite, since they were not thought to be original deposits. The dates obtained would reflect only the last time of alteration rather than the actual time of original deposition. Since Raup has shown that sylvite can be a primary deposit, the age of a sample dated radiometrically would then correspond to the time of formation rather than to the age of last chemical alteration⁷.

Potassium decays through beta decay to produce a Ca-40 daughter and through electron capture to produce the Ar-40 daughter. At the present time the only widely used dating method using potassium is the K-Ar method. It fails here due to (1) the porous nature of the salt allowing atmospheric contamination of Ar-40, (2) the mobility of radiogenic argon and subsequent leakage. However, as noted by Strate⁸, Ca-40 is a non-volatile daughter product and should not be lost during a deformation process. Therefore a K-40—Ca-40 dating method appears to be the only alternative available at the present time. Strate further suggests that the present status of K-40—Ca-40 dating may be improved by (1) the use of a Wetherill-like Concordia diagram^{9,10}, and (2) measuring the K-41/K-39 ratio in the sample when evidence of possible K-isotope fractionation is present, in order to calculate the actual K-40 content of the sample.

Note that it may be difficult to obtain a true date for the age of the deposit, but also note that it is not necessary to date the salt in absolute terms. One does not need to know the true age of the salt to test whether or not deposition occurred over a long period of time. The essential issue is how the age of the "older" salt compares with the "younger" salt.

Conclusions

The various models rely on either the slow evaporation of water (over millions of years) or the rapid change in chemical potential of an ionic species via brine mixing or changes in temperature and pressure. The authors propose a method of dating the time of deposition of evaporites using K-40—Ca-40 method to date layers of the lowest deposits and successively higher layers (the distance between layers depending on the time interval and precision of the age determination) in order to determine if the brine-mixing

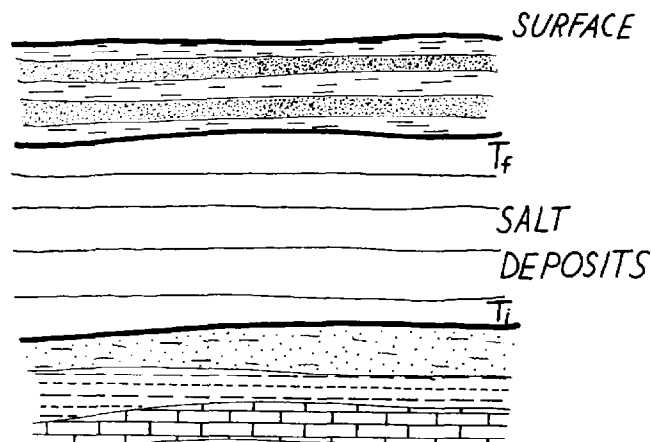


Figure 1. This diagram illustrates a typical evaporite deposit. If it took millions of years to form the deposit then the difference in the initial and final time of deposition (T_i-T_f) should be large. If the deposit was laid down quickly, then (T_i-T_f) would be small.

hypothesis of evaporite formation of Raup is correct. The implications are obvious. If a creationist's hypothesis is correct, then one should find a shorter time for the deposition of the evaporite bed as compared to the slow evaporation model.

The major North American deposits occur in three locations—Moab, Utah, the "age" of which is Mesozoic; the Carlsbad formation of Permian "age"; and the Saskatchewan formation of Devonian "age". There is also a sylvite deposit in the Soviet Union known as the Tonensk deposit along the Dnieper-Donets basins¹¹. Thus, there are a number of samples which could be used to evaluate the rate of formation of sylvite evaporite deposits.

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THE MATURE CREATION: MORE THAN A POSSIBILITY

G. RUSSELL AKRIDGE*

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The electromagnetic fields surrounding a point charge conserve energy, preserve an orderly universe, and satisfy the mass-energy equivalence of relativity if the universe is created mature. As a part of this mature electromagnetic field, light from the distant stars was created enroute from the star to the earth. A new interpretation is presented herein for discontinuities in the electric field relating to charge creation.

Introduction

The subject of a mature creation, sometimes called creation with apparent age, has been discussed by men in the fields of philosophy, theology, and science.¹ Until now, writers have approached the subject of the mature creation as a sufficient condition for the original state, but never as a necessary condition for the original state. In this article, the mature creation is shown to be a necessary condition, not merely a sufficient condition, for the original state of matter.

The time development of the electromagnetic fields surrounding a recently created charge in a primordial state are compared with those surrounding a recently created charge in a nature state. The primordial charge creation will lead to two unreasonable situations: (1) a universe in which energy is never conserved, and (2) a universe in which there is likely to be a continual state of disorder. The mature charge creation will have none of the difficulties found in the primordial charge creation. A generalization of the argument shows that the creation of any object described by fields must be done as a mature creation. Although only classical fields are considered in this article, the concept is strong enough to call for the mature creation as a necessary condition of an orderly universe.

A participant in the audience of the creation seminar held at the Dallas Bible College in May, 1978, asked Mr. Slusher the following question about the visible portion of the electromagnetic spectrum:² If the universe was created no more than ten thousands years ago, how can we see the light from stars millions of light-years from the earth? One of the explanations Mr. Slusher gave was that the light from the distant stars was created enroute at the same time the star was created. This article lends support to Mr. Slusher's answer. The creation of starlight enroute is actually a necessary condition for an orderly universe.

Evolutionary Fields

The time evolution† of the electromagnetic fields due to a point charge $+q$ created without its surrounding Coulomb field is examined in Appendix A. Maxwell's equations yield the following expected time development of the electromagnetic fields surrounding q . The magnetic induction $\mathbf{B}$ is zero. The electric field intensity $\mathbf{E}$ is a discontinuous function, because the effects of the charge creation travel outward from q at the speed of

light c . The electric field intensity is the Coulomb field $E = q/4\pi\epsilon_0 r^2$ inside the spherical region $r < ct$. This is the region accessible to the field propagating away from q at the speed of light. The electric field intensity is zero outside this region. The field propagating at the speed of light could not reach this region $r > ct$ in time t . This expanding spherical region of Coulomb field is illustrated in Figure 1. The expanding spherical region of influence is an evolutionary field in the sense that it can be used to determine the age of the charge. This evolutionary dating method is shown in Figures 2 and 3. If the Coulomb field of a charge q is sensed by an observer a distance R from q , then that charge's expanding Coulomb region must have had time to propagate to him. Hence, the observer concludes that the charge was created at least as long ago as R/c , because it would take that long for the expanding Coulomb region to reach him. Alternatively, if the observer does not observe a charge at a distance of R/c , he must select from two possibilities. (1) There could be no charge at R . (2) There could be a charge at R but it could be so far away that its expanding Coulomb field has not been able to reach the observer yet. In this case, q must have been created no longer ago than R/c , because at that time the expanding Coulomb region reaches the observer. If the

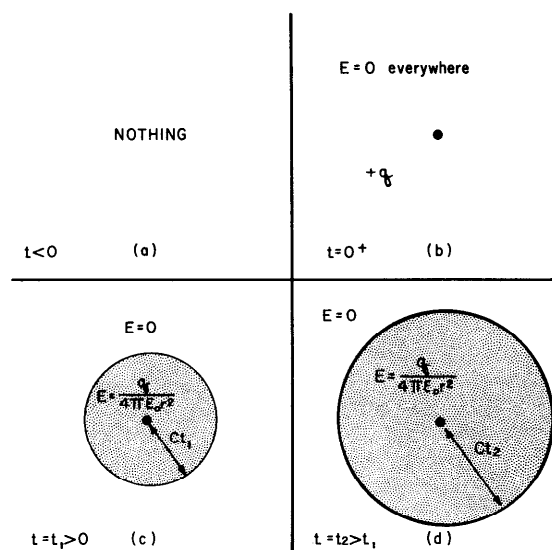


Figure 1. The time development of the fields surrounding a stationary charge q created with no fields at time $t = 0$. 1(a) and 1(b) show that the charge q is created at $t = 0$, but q 's electric field is not created along with it. 1(c) and 1(d) show the time development of the Coulomb field surrounding q . This Coulomb field region is a spherical region expanding from q at the velocity of light. Inside that region, at a distance r , the magnitude of the field is $q/4\pi\epsilon_0 r^2$, as shown. Outside, there is as yet no field.

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†By the evolution of a field is meant just development, the true meaning of the word. Nothing Darwinian is implied.

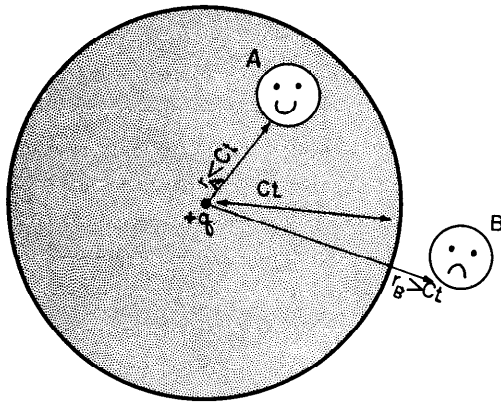


Figure 2. Determination of the age of q . Both observers, A and B, know their distances, r_A and r_B , from q . Observer A knows that q is older than r_A/c , because the Coulomb region expanding at the speed of light has reached him. Observer B is unaware of the presence of q . Observer B must conclude that if there is a charge q a distance r_B from him, it is younger than r_B/c , because the Coulomb region expanding at the speed of light has not reached him.

observer knows there is a charge a distance R from him, he is certain that its age is less than R/c .

In a recent article, David M. Harris proposed a solution to the same problem of light from distant stars. The problem is

... the difficulty of reconciling the fact that we can see the stars that are apparently billions of light-years away, with the fact that the universe is probably only thousands of years old.³

Mr. Harris offered an alternative to the view that the light was created from star to earth. His proposal illustrates the current continuing interest in the original state of the electromagnetic spectrum as compared with what we observe it to be now.

Before the consequences of the expanding Coulomb field are examined, let us follow the logical extension of evolutionary field to date the age of the universe. No one observes the effect of a single stationary electron or of a single stationary proton light-years away from the earth. The fields of a single charge are far too weak to be noticed at that distance. However, huge complexes of electrons and protons which stars can be considered to be, can be observed with the naked eye even though they are believed to be many light-years away from the earth. The fact that the electrons and protons in the stars are in rapid motion will make no difference in the discussion to follow. The motion of the charges will not alter the speed c with which that field propagates, and the following discussion depends only on the speed of propagation.

The age of the universe could have a limit set on it by measuring the distances to the most distant visible stars as shown in Figure 3. If the most distant star visible were, say, 10,000 light-years from the earth, then the age of the universe would be only 10,000 years. Light from more distant stars would not have had time to reach the earth. As time progressed, new stars would continually pop into view in the night sky as their expanding spheres of electromagnetic fields finally reached the earth. Of course, the actual situation is quite dif-

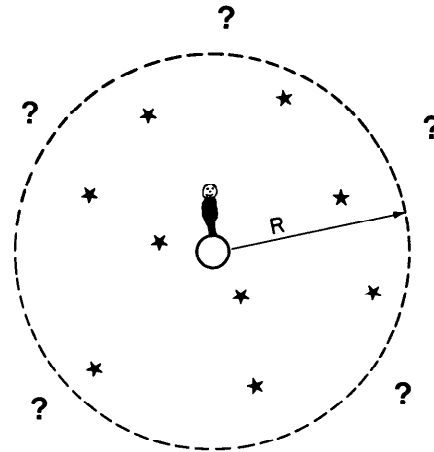


Figure 3. Determination of the date of Creation. The earth observer notices stars out to a distance R , but no further. He can conclude: (a) the universe is limited in size, or (b) the age of the universe is R/c , because the light from stars more distant than R has not had time to travel to the earth since Creation.

ferent. One can observe the light from vast numbers of stars many billions of light-years from the earth,⁴ and new stars are not observed to pop into existence. (Except the occasional novae, which have nothing to do with the present argument.) Thus, it would seem that the universe must be many billions of years old, because the light that left the stars billions of years ago can be seen on earth today.

The presupposition in either the age of the star or the age of the charge argument is that created charges are initially surrounded by zero fields. An alternative to this particular choice of initial condition will be presented in the next section. In the remainder of this section, the mathematical and physical consequence of this zero field initial condition is examined. The simple case of the point charge is used instead of the star. The same principles apply to both the star and the point charge, but the single charge is mathematically simpler.

At a time t after the creation of this charge, the spherical Coulomb region has expanded to a radius $r = ct$. The spherical region contains a non-zero electric field everywhere within it. At time $t + \Delta t$ the spherical Coulomb region will expand to a larger radius, $r + \Delta r = c(t + \Delta t)$, and it will support a larger volume of electric field. This increased volume occupied by the electric field means that the total energy contained by the field has increased during time Δt . The energy density in an electromagnetic field is⁵

$$\frac{dU}{dV} = \frac{1}{2}(\epsilon_0 E^2 + \mu_0 H^2) \quad (2.1)$$

Thus, the increase in field energy ΔU during time Δt is

$$\Delta U = \frac{\epsilon_0 E^2 \Delta V}{2} \quad (2.2)$$

As shown by Figure 4, $\Delta V = 4\pi r^2 \Delta r$ is the increase in the volume occupied by the field during Δt . Since the field propagates at the velocity of light,

$$\Delta r = c \Delta t \quad (2.3)$$

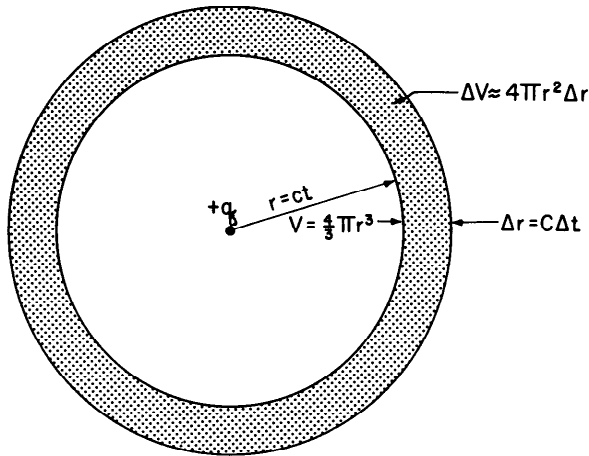


Figure 4. Non-conservation of energy. As the spherical Coulomb region expands from radius $r = ct$ to radius $r + \Delta r = c(t + \Delta t)$ at time $t + \Delta t$, the electrostatic field occupies an increased volume $\Delta V = 4\pi r^2 \Delta r$.

When equation (2.3), and the Coulomb field $E = q/4\pi\epsilon_0 r^2$ are substituted into equation (2.2), the result is

$$\frac{dU}{dt} = \frac{q^2}{8\pi\epsilon_0 c} \frac{1}{t^2}. \quad (2.4)$$

The rate of creation of the energy to expand the volume occupied by the field as expressed by equation (2.4) is *never* zero. Thus, energy must forever be created from nothing to allow for the expansion of the Coulomb region at the speed of light. The creation of energy from nothing violates all known laws of physics. This non-conservation of energy is sufficient grounds for rejecting the assumed evolutionary initial condition of zero fields at the instant of q 's creation.

A word of caution is in order about the magnitude of the non-conservation of energy. The term $q^2/8\pi\epsilon_0 c$ in equation (2.4) in the MKS system has a numerical value of only 7.19×10^{-18} eV-sec. Further, the factor of $1/t^2$ in equation (2.4) decreases the value of dU/dt as time proceeds. Thus, non-conservation of energy at the rate of one eV per second per electron occurs only during the first nanosecond of the electron's lifetime. After 6,000 years, the rate of non-conservation of energy is decreased to only 2×10^{-40} eV per sec. per electron.

There is a physical reason for the constantly increasing amount of energy that must be created and stored in the electric field. Appendix A shows that the expanding Coulomb field is equivalent to a layer of surface charge whose total charge $-q$ is uniformly distributed over the surface of the expanding outer boundary of the Coulomb field. The force necessary to expand this spherical surface charge outward against the inward pull of the charge $+q$ requires the input of energy expressed by equation (2.4). From this point of view, energy must be continually created to force opposite charges further and further apart.

The problem of order in the universe is posed by the evolving fields. A given charge will experience shock after shock as the expanding Coulomb regions of charges at different distances burst upon it from random directions. These sudden accelerations would cause the charge to emit sudden bursts of radiation

causing the disturbance to continue. Thus, the creation of an orderly universe is threatened by the evolving fields. Whether or not the initial disorder ever subsided, at least the initial state of the universe would be a condition of gross disorder.

Mature Creation

There is an alternative to the initial condition of zero fields surrounding a charge at the instant of the creation of that charge. The alternative does conserve energy, does preserve order in the universe, and does resolve the paradox of the light from the distant stars.

The alternative: At the instant of creation (a) each electrically charged particle was created and (b) the fully developed electromagnetic field surrounding each charge was also created. These fully developed electromagnetic fields created with the charge at the instant of creation are called mature fields. If one insists on retaining the evolutionary presuppositions, these mature fields have the appearance of age at the instant of creation. Of course, the appearance of age when there is no age is not God's way of fooling anyone. Rather, it is a result of an erroneous preconceived notion of evolution.

If the single charge were created at $t = 0$, and if the surrounding Coulomb field $E = q/4\pi\epsilon_0 r^2$ were also created at time $t = 0$, then the fields would not change with time at all. The field would forever be a solution of Maxwell's equations. No energy need be created to sustain the field. The energy for the entire field would be created at the same time the charge was created. A charge in a more complicated state of motion at the instant of creation would have a more complicated but fully developed electromagnetic field appropriate to its state of motion.*

Order in the universe would not be threatened if the mature electromagnetic fields were created at the same time their charge sources were created. With the complete field present at the instant of creation, there are no expanding Coulomb regions causing discontinuities in the motion of other charges. Rather, the field from each charge extends outward to all other charges at creation and therefore acts on them in a continuous manner after the creation event.

The paradox of light from the distant stars is no longer a paradox. Light is an electromagnetic disturbance. Creation of the charges in the star would be accompanied by the creation of the mature electromagnetic field of the charges in the star. Unlike the evolutionary field, this mature electromagnetic field would extend throughout the entire universe at the instant of creation. Thus, the light from the distant stars would be created enroute from those stars at the instant of creation. Therefore, when one observes the light from a star one billion light-years away, he does not observe the light that actually left the stars one billion years ago. Rather, he observed the light that was created enroute only a few thousand years ago. As strange as

*It is true that if a charge already existing, along with its static field, be moved, set vibrating, etc., a different field will spread out from it. That is what happens when light is emitted. However, there is no creation of energy in such a case. It is just a transfer of energy which is provided by the force which caused the motion, vibration, etc.

this concept may seem, it is required for an orderly universe in which energy is conserved.

One final support for mature creation comes from the equivalence between mass and energy, $E = mc^2$. According to the theory of relativity, energy and mass are interchangeable. In fact the classical electron radius is derived⁶ from the assumption that the energy contained in the electrostatic field $E = q/4\pi\epsilon_0 r^2$ of the electron is equal to the mass of the electron times c^2 . If the mass of the electron and the energy in the field of the electron are equivalent and interchangeable, creation of one alone would be impossible.

Appendix A

Maxwell's equations for the electromagnetic field "in vacuo" are⁷

$$\nabla \cdot \mathbf{E} = \rho/\epsilon_0 \quad (\text{A.1})$$

$$\nabla \cdot \mathbf{B} = 0 \quad (\text{A.2})$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \quad (\text{A.3})$$

$$\frac{1}{\mu_0} \nabla \times \mathbf{B} = \mathbf{j} + \epsilon_0 \frac{\partial \mathbf{E}}{\partial t} \quad (\text{A.4})$$

In the above equations, $\mathbf{E}$ is the electric field intensity, $\mathbf{B}$ is the magnetic induction, ρ is the electric charge density, and $\mathbf{j}$ is the electric current density. We seek to show that the expanding Coulomb field

$$\mathbf{E} = \hat{\mathbf{r}} \frac{q}{4\pi\epsilon_0 r^3} U(ct - r), \quad \mathbf{B} = 0 \quad (\text{A.5})$$

is a solution to Maxwell's equations. The unit step function U is described in Appendix B. Equations (A.2) and (A.3) are 0 = 0 for the assumed solution in equation (A.5). Substituting equation (A.5) into the first of Maxwell's equations (A.1) gives

$$q\delta^3(\mathbf{r}) U(ct - r) - \frac{q}{4\pi r^2} \delta(r - ct) = \rho \quad (\text{A.6})$$

The Dirac delta function, δ , is explained in Appendix B. The $q\delta^3(\mathbf{r})U(ct-r)$ term describes the point charge $+q$ created at the origin at time $t = 0$. The other term, $-q\delta(r - ct)/4\pi r^2$, is unexpected. It describes a charge $-q$ uniformly distributed over the surface of an expanding sphere of radius $r = ct$.

When the assumed solution (A.5) is substituted into the final equation (A.4) of Maxwell's equations, the solution for the electric current density is

$$\mathbf{j} = -c \frac{q\delta(r - ct)}{4\pi r^3} \hat{\mathbf{r}} \quad (\text{A.7})$$

This $\mathbf{j}$ is the electric current density produced by the expanding spherical shell of uniformly distributed charge $-q$.

This expanding shell of charge is now shown to be a consequence of Gauss' law as pictured in Figure 5. In Figure 5, the Coulomb field has expanded to a radius $r = ct$. The inner Gaussian surface S_i is a sphere of radius slightly less than r , and the outer Gaussian surface S_o is a sphere of radius slightly greater than r . Gauss' law is

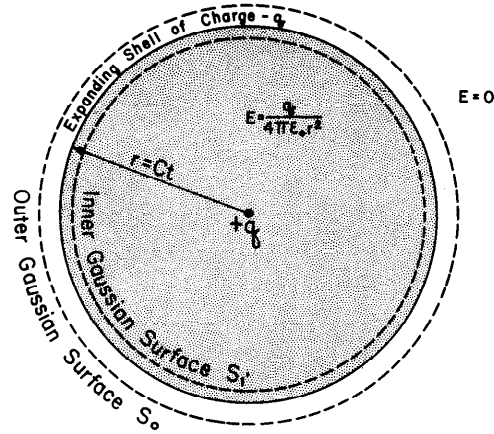


Figure 5. The two Gaussian surfaces: The Coulomb field $E = q/4\pi\epsilon_0 r^2$ extends out to a spherical shell $r = ct$. Gaussian surface S_o is slightly exterior to the spherical shell. Gaussian surface S_i is slightly interior to the spherical shell.

$$\oint \mathbf{E} \cdot d\mathbf{S} = \frac{Q}{\epsilon_0} \quad (\text{inside volume bounded by surface } S) \quad (\text{A.8})$$

When Gauss' law is applied to the inner Gaussian surface S_i where $E = q/4\pi\epsilon_0 r^2$ the result is

$$\frac{Q}{\epsilon_0} (\text{inside } S_i) = \frac{1}{4\pi} \frac{q}{r^2} \cdot 4\pi r^2, \text{ or}$$

$$Q (\text{inside } S_i) = q$$

When Gauss' law (A.8) is applied to the outer Gaussian surface S_o where $\mathbf{E} = 0$, the result is

$$Q (\text{inside } S_o) = 0$$

However, the only difference between the volumes enclosed by the two surfaces, S_o and S_i , is the spherical shell between them.

$$\begin{aligned} Q (\text{on expanding shell}) &= Q(\text{inside } S_o) - Q(\text{inside } S_i), \\ &= 0 - q, \\ &= -q \end{aligned}$$

The fundamental principles of physics are violated by the expanding shell of charge. First, the shell of charge is expanding at a speed equal to the speed of light in a vacuum c . The theory of relativity demands that every object travel at a speed less than the speed of light, unless that object has zero rest mass.⁸ For example, the photon, a quantum of light, can travel at the speed of light only because the photon has zero rest mass. On the other hand, the electron can never travel as fast as the speed of light, because the electron has a non-zero rest mass of 9.11×10^{-31} kg. All known electrically charged objects have non-zero rest mass, and they cannot travel at the speed of light. Thus, the expanding shell is not a known electrically charged object. The second principle of physics violated by the expanding shell of charge is the quantization of charge. In 1909, R.A. Millikan demonstrated that electric charge comes in quanta equal to integer multiples of 1.6×10^{-19} Coulomb, the charge on the electron. Until recent years, physicists believed that the smallest unit of electric charge was 1.6×10^{-19} Coulomb. Now, physicists speculate that a

smaller unit of charge, the quark, equal to $\frac{1}{3} \times 1.6 \times 10^{-19}$ Coulomb may actually be the smallest unit of electric charge.⁹ In any case, physicists are sure there is some smallest unit of electric charge. However, the expanding shell had a charge $-q$ uniformly distributed on it. If this expanding shell was due to the creation of a single electron, the expanding shell would contain the charge $-q$ of a single electron uniformly distributed on it. The single electric charge on the expanding spherical shell becomes more and more spread out, instead of being quantized as the laws of physics require.

The expanding charged shell cannot be a physical reality for the two reasons previously stated. However, the charged shell has been shown to be a valid mathematical consequence of Maxwell's equations with zero field initial conditions. There are only two logical explanations. First, although the model is mathematically possible, it is not physically possible. Therefore charge creation with an expanding Coulomb field is an impossibility in the real world. If Maxwell's equations have remained unchanged over the years, the conclusion is that no charges ever have been or ever will be created with expanding Coulomb fields around them. Creation of both the charge and its complete (mature) Coulomb field is the alternative. The second logical explanation is that the mathematical solution is correct, but that the physical interpretation is incorrect. The discontinuity at $r = ct$ in electric field which has always been interpreted as a physical surface charge,¹⁰ is not a charge in this case. Rather, the discontinuity is a consequence of charge creation. The general conclusion is that discontinuities in electric field are a result of either a surface charge at the location of the discontinuity or of a charge created earlier somewhere else. We have never noticed the discontinuities in electric field caused by charge creation because charges are not now created by themselves (unless one accepts Hoyle's discredited theory).

The propagation velocity of the field discontinuity distinguishes between a genuine surface charge and a remnant of charge creation. If the propagation velocity of the field discontinuity is less than the speed of light, the field discontinuity is a result of surface charge located at the surface of discontinuity. If the propagation velocity of the field discontinuity is equal to velocity of light, the field discontinuity is a remnant of charge creation at another location in the past.

Appendix B

The unit step function¹¹ $U(t)$ is zero whenever t is negative, and $U(t)$ is $+1$ when t is positive.

$$U(t) = \begin{cases} +1, & t > 0 \\ 0, & t < 0 \end{cases} \quad (\text{B.1})$$

A graph of $U(t)$ appears in Figure 6. Roughly speaking, $U(t)$ "turns off" whatever it is multiplied by if $t < 0$, and $U(t)$ "turns on" whatever it is multiplied by whenever $t > 0$.

The Dirac delta function $\delta(t)$ is the derivative of the unit step function.

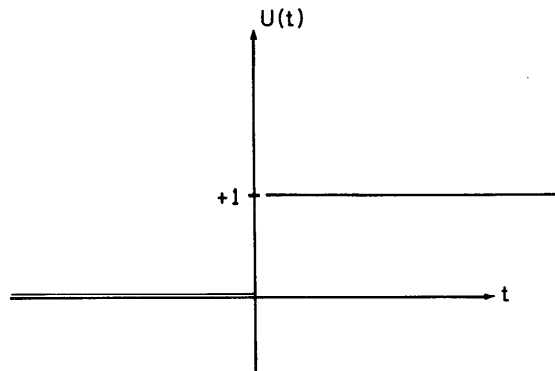


Figure 6. The unit step function $U(t)$. This might fairly be named after Heaviside, as the delta function is after Dirac.

$$\delta(t) = \frac{dU(t)}{dt} \quad (\text{B.2})$$

From the graph in Figure 6, the slope of $U(t)$, and therefore the value of $\delta(t)$, is zero for $t \neq 0$. Thus, $\delta(t)$ can differ from zero only at (or near) the origin $t = 0$. The behavior of $\delta(t)$ at the origin $t = 0$ can be obtained by integrating equation (B.2).

$$\int_{-\infty}^{+\infty} \delta(t) dt = U(+\infty) - U(-\infty) = 1 - 0 = 1$$

Thus, the area under $\delta(t)$ must be 1. Since $\delta(t)$ differs from zero only at one point, $t = 0$, $\delta(0) = \infty$. A convenient approximation to $\delta(t)$ consists of using $\delta(t) = 0$ except in a small region near the origin. Then $\delta(t)$ surges upward to a very large value in this small region around $t = 0$. The total area under the curve is 1. This graph of $\delta(t)$ is shown in Figure 7. Loosely speaking, $\delta(x)$ would describe an object all of which is located at $x = 0$, i.e., a point object. In Appendix A, the electron is represented by $\delta(x) \cdot \delta(y) \cdot \delta(z)$ because it is thought to be a three-dimensional point charge.

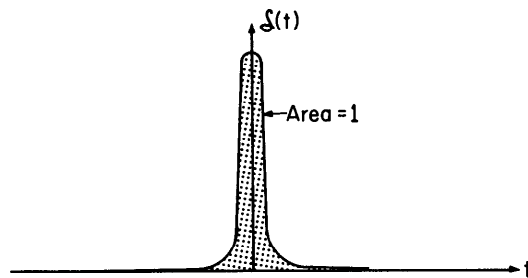


Figure 7. The Dirac delta function, $\delta(t)$.

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(Continued on page 83)

MUSIC: EVOLUTION OR CREATION?

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We all know that the theory of evolution has influenced not only every part of science but also every aspect of life, and all branches of art!

In musicology as a study, and music as an art, a threefold influence can be seen. The first has to do with theories about the origin of music and musical instruments, the second with the criticism of music, and the third with contemporary composition and playing of music.

The History of Music

The opinion about the history of music, found in most books, is that vocal music had its origin in the imitation of animals,² while musical instruments were developed from tools or weapons commonly used. *The Larousse Encyclopedia of Music*, for instance, says: "It is probable that the gong originated from a simple cooking pot, while the earliest harp may have been a modified hunting bow."³

The music of primitive tribes, then, is interpreted as a young state in the evolution of music. From those primitive forms of music, it is said, evolved a higher music, just as the abilities and knowledge of man are said to have evolved. According to this view, the music of today would have to be on a higher level than, for instance, that of the middle ages.

Since we do not believe in the evolution of man, we need to test all theories of evolution very carefully.

First of all, music is a human activity and ability. The gap between anything like music, practised by apes, and music as practised by man, is even greater than the gap in regard to language. Of course, birds sing; the animal with the highest musical ability is said to be the nightingale, which can imitate more than twenty melodies. But it can only imitate; and this imitation has the same function as the cry of another animal. Man, on the other hand, can compose his own music, can sing or play together with others, for instance in a choir, can use musical instruments and design them, can compose music without any immediate function, and can think about his music!

The second thing to be noticed is that all the theories about the origin of music are speculations;² for there are no records older than about the third millennium B.C.. Indeed, a few reindeer bones with holes, which some believe to have been flutes, have been found; and bows, like hunting bows, shown in some paintings, have been said to be music bows.¹ So the theory of the early evolution of music has as little basis in fact as has that of language.⁴

From about the third millennium B.C., however, onward until the present, are found instruments, pictures, descriptions of pieces of music, writings on the theory of music, and even some written music. *The Atlas to Music*, while maintaining the evolution of music, states: "Moreover the time of antique high civilizations begins only after the natural catastrophes with floods (Bible and Gilgamesh epos) assumed around 3000 B.C.."⁵

Many historians deny that there was music on a

higher level before the Flood. But I am sure that there was; because I believe that God created man with all his faculties and abilities, including that of making music. It did not take thousands of years to get man singing. So it is no problem when we read in Genesis Chapter 4 about Jubal, who was a descendant of Cain in the seventh generation:⁶ "... Jubal, the ancestor of all musicians who play the harp and the flute."⁷ Jubal was displaying the same pioneering attitude as his brothers did, in being the first to live in tents, and to use bronze and iron.⁸

Many scientists believe that music, like language, has one source; and in this they agree with what the Bible seems to teach. But the fact that cultures living thousands of miles from one another use almost identical instruments is remarkable and curious, as the *Atlas to Music* says.⁹

The music of the third millennium B.C. was not primitive, as if it were just evolving. In India there were found more than twenty different instruments, a complicated staff system, and no sign of a long evolution at all. It seems that a high standard was there all at once, a standard, incidentally, which in India has not since been reached again.

In Mesopotamia has been found probably the oldest musical culture, which influenced painting and the religion. By Babylonian times music there had long since declined.

In China there are written works, supposed to be as old as from 2300 B.C.. At that time every learned person was to be educated in music. Emperor Tschun wanted them to know the staff system, based on mathematically calculated basis notes, and the rich history of the Chinese music.¹⁰ Later, Confucius said: "Morals and music decide about the life of a community."¹¹

Music was likewise very important in Egypt, where there seem to have been large orchestras maintained by the state. And that instrumental music and song played a large part in Hebrew life is clear from the Bible. This is true also of times long before David and Solomon, who, incidentally, were not the only singing rulers of those days.

One thing is to be seen in all these cultures. Without any long delay or preparation, there is music on a very high level, widespread among the people, and playing a very important role in religion and social life. But the rise of music is always followed by a long decline. Just compare the music of Israel in the time of Christ with that of the psalms. Or what happened to Greek music, about which quite a lot is known from paintings on

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vases¹² and other sources of information, during Roman times? In both cases a decline is apparent. Cultures still decline today, as Dr. Francis Schaeffer has shown in his commendable book *How Should We Then Live? The Rise and the Death of the Modern Culture*.¹³

The Criticism of Music

The influence of a belief in evolution is to be seen, not only in modern music, but also in what is said about that music. If everything is evolving, there is no point in evaluation or criticism, because music, like everything else, is in precisely that stage of development which is now needed. To one who believes thus, that stage has, of course, no further justification than its existence; therefore it cannot be classified as good or bad. All that matters is how the composition came into being and the reasons why it has to be as it is; in other words, its mechanistic aspect. If this be so, there could be no standards for the evaluation of music.¹⁴

Of course, one could find in any composition elements, taken from what has gone before. Even in the modern music, everything which had been part of music for centuries could not be forgotten. But if one consider only how it arose and why it arose in that way, it is possible to forget that it was composed, and personally, by some composer. The mechanistic viewpoint leads to losing the personal part. H. R. Rookmaker calls one of his books *Art Needs no Justification*.¹⁵ He maintains that because God created life, and man's faculties and abilities, art is justified. Art is not something which was just there in another form before. Rather, it is a sign of the Creation through a personal God. To one who does not believe that God created man, art has no justification, unless it help somehow in preserving the species man. But to a believer in creation, art and music might be called living documents of a living relationship with a personal God. Then music has its meaning, or should have; and one can judge whether or not it fulfills its meaning.¹⁶

Music, then, is not a product of a mechanistic process—a by-product of evolution. It is the product of a personal activity which is as close to a true act of creation as finite man can come. And it depends on abilities and faculties created by God. Only from this viewpoint can one really say: "*Soli Deo gloria*";¹⁷ and only from it can he look for a set of values for music.

The Bible, incidentally, has something to say about this matter. The Biblical standards are to be found in some hundred(!) verses concerning music.

Because man is a fallen being, affected by sin, sin surely also influences music. So a decline is what would be expected; it can be avoided only by a living relationship with our Lord Jesus Christ.

Contemporary Music

One who followed evolutionary notions to their logical conclusion would have to call contemporary music always better than the older works. Or, if he could not deny a decline, he would have to inquire how the older music inspired another culture where the evolution went on. But is the whole level of music improving? Usually one will see a decline in one part of

music (or of another art) while another part is improving. Consider an example. H. R. Rookmaker shows that in earlier times everyone made music and was, in some sense, an artist. But when art became more complicated it became an occupation for specialists, music as well as other arts.¹⁸ On a lower level (of performance) everyone is a musician; on a higher level, only a few. Now, who will decide which is better: that everyone make music, or that music be complicated? Well, I do not want to say that music is worse for being the occupation of a few. My point is that it depends on what is considered to be most important, whether a change is considered good or bad.

This shows why some people are annoyed by references to some music as primitive. Is it primitive because it is on a level which has to be the lowest level of evolution? Because it is not according to contemporary Western standards? On questions like this, many people have been influenced by evolutionary views without even noticing it. If music is to be called primitive at all, the only right reason would be if it was a result of the decline which is found at any place or time where God is forgotten. On that point the Bible can tell us something. But then we had better ask ourselves whether the music of our own places and times reveals any knowledge of or relation with God.

Music as Practised

The evolutionary viewpoint has influenced not only musicology, the theoretical and philosophical consideration of music; but also the composition and performance is affected by the philosophy of the composer or performer. As Guinness, Francis Schaeffer, H. R. Rookmaker and many others have shown, in a world without meaning, as it would be according to the evolutionary view, music also becomes meaningless. Indeed, that has happened in the nineteenth and twentieth centuries; and I do not need to cite examples. But a believer in creation should recognize and point out the difference between meaningless music and music which has something to say. The one destroys, as is the will of the devil; the other edifies, as is the will of Jesus Christ. If a rock group sings about love or God, it may mean nothing; but if we, as Christians, sing about it, it means everything. Music which is just the result of a mechanistic process has lost its worth. But when it is the result of an activity akin to true creation, it is a part of being in the likeness of God.¹⁸ It is a fulfilling of God's will to bring the Earth under man's control, and to defeat the chaos. Such music proclaims the glory of God's creation. Read Psalms 148 and 150!

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(Continued on back cover)

PHYLOGENETIC DEVELOPMENT OF SWEAT AND MAMMARY GLANDS

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Sweat glands, and mammary glands, which are modified sweat glands, are unique structures peculiar to mammals. The evolution model of origins predicts that there will be an upward, irreversible development of both sweat glands and mammary glands as one goes up the ladder of mammalian development. Observations reveal, however, that there is an up-and-down variation of complexity of sweat glands among the orders of mammalia. Gaps are evident, as sweat glands are absent in two orders, Proboscidea and Rodentia. With regard to mammary glands, there is not a smooth downward loss of teat number among orders of mammals as sheep, horse and elephant all have a single pair of teats just as man. These data correlate nicely with the prediction of the creation model: that the Creator did not follow the mode of evolutionary development but rather made different provisions of sweat glands and mammary glands in different animals of the class, mammalia, in order to serve His specific purposes.

The ability to sweat is unique to the animal class of mammalia. A further distinctive trait of mammals is the nourishing of their offspring from milk secreted from mammary glands. It is obvious that the name mammal, meaning milk secreting animal, is derived from the word mamma (milk). The relationship between sweat glands and mammary glands may be considered under histology, i.e., the study of tissue structure. There are numerous anatomical and physiological similarities between sweat glands and mammary glands. Some authorities^{1,2} claim that mammary glands are modified sweat glands. But if so, it seems odd that mammary glands are well developed in all mammals, sweat glands in only some.

If evolution is the true explanation of the origin and diversity of life, the development of sweat glands and mammary glands would be a smooth, upward, irreversible process. There would be some degree of uniform increase in complexity directly related to each mammalian order culminating in the most advanced stage in man. Any great gaps of development or regression away from this upward development would be counter to the predictions of the evolutionary model of origins.

However, if the doctrine of special creation is the true explanation of the origin and diversity of life, the provision of sweat and mammary glands in various species of the order of mammalia would be variable, and reversible. They would be absent in some species, and most highly developed in man.

Let us take a look at the data that describe the occurrence of sweat glands and mammary glands in the various species of animals going up the supposed ladder of development.

Sweat Glands

One function of skin involves osmoregulation, i.e., the control of the passage of pure solvents from the lesser to the greater concentration when two solutions are separated by a membrane which selectively prevents the passage of solute molecules but is permeable to the solvent. Through osmoregulation i.e. perspiration, the loss of heat through evaporation is controlled. In mammals the control of heat release in this way is usually regulated by structures called sweat glands. As the body temperature increases the rate of secretion of sweat in-

creases. The sweat contains water and various electrolytes. The heat loss occurs via kinetic energy or latent heat of evaporation released when the sweat evaporates into the air. If a mammal does not sweat, it must have some other mechanism by which it can relieve excess body heat. The relative loss of water via respiration (i.e., cool air breathed in, warm out) or sweating varies from species to species.³

Authorities are not in complete agreement as to the presence of sweat glands or similar structures in some animals. According to Young⁴, amphioxus has no skin glands, fish have a water-proof layer of skin, amphibia have fish-like skin, reptiles have dry skin with no skin glands and birds have no sweat glands and therefore very little heat loss from the skin. Bentley⁵ claims that amphibia can absorb sodium and water. Hafez⁶ claims that birds, rodents and lagomorphs (rabbit family) do not have sweat glands. Swenson⁷ claims "many small-mouthed mammals (mouse) which have no sweat glands and do not pant, use evaporation of saliva which they spread over their skin surfaces." Vander *et al*⁸ claim that most other mammals differ from man in lacking sweat glands. This last statement is essentially untrue as we shall see. Indeed, conflicting opinions can be found on a number of these points; these are cited to show what is commonly said.

Sweating may act to maintain homeostasis of fluids and electrolytes; and to regulate body temperature. Sweat glands have been classified physiologically into two types: 1) apocrine (holocrine)—structures that lose part of their cellular protoplasm when they secrete and 2) merocrine (eccrine)—structures that secrete only their glandular solvent when they secrete. These sweat glands vary in size with changes in ambient temperature, becoming larger in winter and smaller in summer.

In cats there are coiled eccrine sweat glands on the skin and apocrine sweat glands in the hair follicles.⁹ Yet, Taylor¹⁰ claims that sweat glands in cats and dogs are confined to the plantar surface of their feet. Miller¹¹ partially agrees with Taylor's opinion concerning sweat glands in dogs, claiming that merocrine glands are found only on the foot pads while apocrine glands are found in the hair follicles. Bensley¹² claims that in rabbit sweat glands are absent from the general skin surface but are present in the hair follicles of the lips, internal surface of the ear and external genital organs. This disagrees with the opinion of Hafez¹³ cited above. Sheep

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have sweat glands only in their primary hair follicles.¹⁴ Therefore, they rely primarily on respiration for cooling, except for whatever cooling is obtained directly by conduction. Sheep, camels and donkeys can drink approximately one-fourth their body weight in water at one drinking without any apparent harmful effect.¹⁵ Hafez¹⁶ claims that morphologically the sweat glands of camels appear to be an intermediate state of development between cattle and man. The pig has very ineffective sweat glands, its cutaneous water loss being very low even in hot weather. Because of this the pig wallows in water or mud in order to lose heat. A smear of wet mud on the pig's skin promotes an evaporative rate comparable to man, who possesses the highest sweat rate of all mammals.¹⁷ In spite of their ineffectiveness, the pig's sweat glands are large, yellow-brownish and visible to the naked eye.¹⁸

Bos indicus cattle have larger sweat glands and greater numbers than *Bos taurus*. There are more sweat glands on the hump of Brahman cattle than on their flank. Also, Brahman cattle have their sweat glands activated at a higher ambient or skin temperature than those of *Bos taurus*. Brahman cattle depend largely on sweating and barely use respiratory exchange for cooling purposes.¹⁹ The goat can dissipate heat via its great superficial vascularization in its horn.²⁰ Hippopotamus secretes a red, apocrine sweat which is referred to as "bloody sweat."²¹

Elephants have enormous bodies and very small mouths. They have no sweat glands and perform no panting or intense salivation. They cool themselves by sucking cool water into their trunk and spraying themselves.²²

Sweat glands are highly complex in horse and man. The eccrine type glands are better developed, more numerous and more functional in man than other mammals.²³ It is estimated that commonly man loses 20% of his heat lost through evaporation and can lose up to 80% of his heat thus during vigorous exercise.²⁴ Indeed, limitations on such loss of heat may limit one's performance. Accumulated sweat that drops off the skin yields no heat loss. Humans with leprosy who cannot sweat relieve heat by panting and slobbering.²⁵

As to the phylogenetic development of sweat glands in man, Rothman states "the apocrine glands, paralleling the gradual decline of the hair system, have become rudimentary in most places, while the eccrine glands have developed to a most perfect system."²⁶

With regard to development of sweat glands within the class of mammalia, Montagna states that "both types of sweat glands have existed for a long time and may have appeared independently in the different orders of mammals."²⁷ This quotation alludes to evolutionary presuppositions.

Do sweat gland numbers differ among different races of man? According to Table 1,²⁸ the answer is yes. They vary from a low of 558 per square cm of skin in Caucasians to 950 per square cm of skin in Negrito youth. This is a 70% increase in sweat gland number for the Negrito youth over Caucasians. Incidentally, the development of sweat glands is almost the inverse of what a Darwinian of the last century would have called

the evolutionary development of the races.

On the basis of this review, all mammals do not possess sweat glands. Sweat glands are absent in elephants and most rodents. Also, there is not an upward development in complexity of sweat glands as we go up the alleged ladder of mammalian development. The cat has highly-developed eccrine sweat glands, sheep poorly-developed sweat glands only in their primary hair follicles, camels have medium-developed sweat glands, pig poorly-functioning sweat glands, cattle poorly functioning sweat glands, and horse and man the most highly developed system of sweat glands. The absence of sweat glands in two orders of mammals with their arbitrary development in other orders correlates nicely with the presuppositions of the creation model.

Table 1. Variation of the number of sweat glands in different races.

Race	Mean no. of sweat glands per square cm. of skin
American (white)	558.2
American (negro)	597.2
Filipine	653.4
Moro	684.4
Negrito (adult)	709.2
Hindu	738.2
Negrito (youth)	950.0

Mammary Glands

Mammary glands are accessory reproductive structures that resemble histologically apocrine sweat glands. Their secretion of milk serves to nourish their offspring after birth. During puberty they develop in both sexes but attain functional utility only in females. The hormonal mechanism for the manufacturing of milk differs among species. In some species both estrogen and progesterone produce both ducts and alveoli, in others estrogen produces ducts while progesterone produces alveoli. At the end of the reproductive period of the female mammal, the mammary glands incur involution and shrink.²⁹ (This is obviously a simplified outline of the matter; there are many complications which can not be included here.)

Of interest in the phylogenetic development of mammary glands is the number of teats in various species. Some mammals have up to 25 teats. The numbers of teats have a relationship to the number of offspring that can be born at a time. The teats in all placental mammals are arranged in two long rows.

If there were phylogenetic development of the number of teats according to evolutionary presuppositions, we would find a uniform loss of teats going up the alleged ladder of mammalian development culminating in a single pair of nipples in the highest developed mammal, man. However, if there is nonuniform loss of teat number going up the so-called ladder of development with regression toward single pairs in various mammals, this would correlate with the creationistic presupposition of variations in structures and functions among different levels of mammals due to the Supreme Being's specific purpose for certain species.

Let us look at the data on teat number among mammals.

The egg-laying monotremes have no nipples at all. For example, duck-billed platypus expresses its milk from 100 milk ducts on its chest.³⁰

The cat, a typical carnivore, has two series of five teats each making ten in number. The pig of the order *Artiodactyla*, suborder *Suina*, has usually 12 in number, the same as the dog, a carnivore. Ruminants of the order *Artiodactyla* but the suborder *Pecora*, have four teats called udders. Yet, small ruminants like sheep have two in number, just like man. The horse of the order *Perissodactyla* and suborder *Equoidea* has two single teats like man. Also, the elephant of order *Proboscidea* has a single pair of teats very much like man.³¹

The similarity of teat number in dog and pig and the single pair of teats in sheep, horse, elephant and man are not an indication of a uniform loss of teat number going up the ladder of so-called mammalian development. Instead they are observations indicating a specific highly-developed function for certain mammals in different orders which correlates rather neatly with the creation presupposition.

Summary

Sweat glands are absent in two orders of mammals, *Proboscidea* and *Rodentia*. There is an up-and-down variation of complexity of sweat glands among the other orders of mammals. With regard to mammary glands, there is not a smooth downward loss of teat number among orders of mammals. For instance, sheep, horse and elephant have a single pair of teats the same as man. These observations tend to agree with the predictions of the creation model of origin of matter and life, and to run counter to the predictions of the evolution model of origins.

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PANORAMA OF SCIENCE

Alone in the Universe

Iosef S. Shklovsky, a Moscow State University astronomer says: "We are alone in the universe."¹ Now that's a switch for a secular scientist and one who along with Carl Sagan in the 1960's authored a classic paper arguing that there should be millions of inhabited planets similar to Earth in the Milky Way galaxy. He indicates that there is nothing (no intelligent information) coming from the trillions of stars (with hypothetical planets) that cannot be explained on the basis of natural phenomenon.

Shklovsky says that the prevalent belief that we are not alone in the universe goes back to "cloudy ideas of the multiplicity of inhabited worlds that penetrated ancient religions." The very idea is that since the earth is inhabited, and, by current dominant evolutionary world-view, became that way by chance events and processes, there "must be other worlds out there somewhere

similar to earth." However, any mathematician will tell you that a statistic of ONE cannot be extrapolated into millions and billions. The fact that the earth is inhabited proves nothing regarding possible inhabited worlds elsewhere.

He concludes that: "The fact that we have come to grips with most of them (the few fundamental laws of physics) and yet still cannot detect a manifestation of extraterrestrial life means that such life is exceedingly rare." I would say that carbon-based life elsewhere in the Universe is not only exceedingly rare, but ZERO. This statement is supported by Scripture: e.g., Psalm 115:16: "The heaven, even the heavens, are the Lord's but the earth hath he given to the children of men."

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BOOK REVIEWS

A Key to Dooyeweerd, by Samuel T. Wolfe, 1978. Presbyterian and Reformed Publishing Co., Nutley, New Jersey. 125 pp. pb. \$2.95.

Reviewed by George F. Howe.*

In one thorough but readable book Samuel Wolfe presents an introduction and commentary on the vast writings of the late and great philosopher from the Netherlands, Herman Dooyeweerd. Wolfe is appalled by the fact that Dooyeweerd's momentous strides in a Christian philosophy of science have been largely unnoticed in the United States, and attempts to rectify that situation in this volume.

At the onset, Wolfe sketches the last 75 years of political philosophy in the Netherlands—a fascinating subject. He likens Abraham Kuyper's leadership around 1900 to a "Billy Graham" becoming president of the United States and founding a university on a par with Harvard! And, if Carl Henry were then to write an encyclopedic philosophy of the movement, this would be like the role Dooyeweerd played in reference to Abraham Kuyper and the Free University of Amsterdam.

In chapters that follow, Wolfe traces the 14 spheres of Dooyeweerd's philosophy from the first sphere (time) to the 14th sphere (faith). Such development of nesting spheres should not be entirely foreign to the modern mind, Wolfe asserts, for biologists frequently assign a hierarchy to life systems extending upward somewhat as follows: atoms] molecules] organelles] cells] tissues] organs] organ systems] organisms] species] communities] the biosphere!

By contrast, Dooyeweerd's 14 spheres of philosophy, in ascending order are: time, space, motion and energy, biotic, human sensorium, understanding and logic, the will and the cultural mandate, semantics, social intercourse, economics, esthetics, laws, ethics, and faith. In this view, all spheres are relative and subservient to Christ's death and resurrection. Such panoramic ideology is known as the "cosmonomic" or "law" philosophy of Herman Dooyeweerd and is based to some extent on the teachings of Abraham Kuyper, as indicated above.

Chapter one involves a discussion of Dooyeweerd's two basic spheres—time and space. Wolfe shows here, as in other chapters, that each sphere leads to the next higher. He exposes a myopic mindset of materialists in which the lower spheres (matter, etc.) are somehow considered to be "real" while the higher spheres (thought, faith, etc.) are treated as merely hypothetical.

In the third chapter Wolfe traces a brief but scintillating history of genetics. With good reason, he stresses the inadequacies of the mechanistic approach to the cell and calls attention to the cytoplasm as a complementary information source (so that DNA cannot be considered the ultimate or only controlling factor in the cell).

To the contrary, Dooyeweerd saw the living cell itself controlling or binding the molecular substructure in a process he named "enkapsis." In keeping with this concept of enkapsis, the organism controls the molecules rather than the molecules governing the organism. Dooyeweerd's departure from mechanistic biology at this point is unique in that it does not partake of the impractical mysticism of the old-line vitalism. Presently, certain noted biologists like Dr. Barry Commoner are likewise coming to see that DNA is only one of many possible controlling features inside the life cell.

Wolfe has made one minor error on page 19 where he speaks of the DNA as a helix of *amino acids* while DNA actually is a helical polymer composed of *nucleotides*.

C.R.S. readers will be interested to find that Samuel Wolfe has dealt with the valuable contributions of Dr. J. J. Duyvené de Wit—a gentleman of science who applied the cosmonomic concepts of Dooyeweerd to experimental and theoretical biology. Dr. de Wit stoutly resisted evolutionary speculation and authored several valuable antievolutionary papers in the area of physical anthropology and cell biology. He was respected as an authority in the field of fish genetics. In his later years, Dr. de Wit was under severe attack by evolutionists in his own university, but took a very faithful stance and was in progress of making contact with Creation Research Society at the time of his death. It was De Wit's dream to build a bridge from Dooyeweerd to the C.R.S. This section of the book by Wolfe will undoubtedly be the most salient feature for C.R.S. readers and Dr. De Wit's writings themselves might be profitably reanalyzed in an attempt to find rapprochement between cosmonomic philosophy and the current creationist movements. Both Wolfe and De Wit would agree that the former would supply a strong philosophical foundation for the latter.

In his analysis of the origin of logical thought (chapter 6), Wolfe contrasts numerous schemes of philosophy from Plato to Sartre with the cosmonomic philosophy and the contrast is summarized in this quotation from p. 45: "Dooyeweerd has thus freed the World of Thought from the tyranny of the would-be philosopher-kings from Plato to Husserl and Sartre. He has brought the principles of Christian liberty into the elusive world of the mind."

In treating the seventh sphere of the will, Wolfe develops Dooyeweerd's idea of the cultural mandate in which it is proposed that believers must live out the truths of the Gospel into all spheres of human activity.

Wolfe believes that the cosmonomic idea of sphere sovereignty centered in Jesus Christ may have its ultimate fulfillment in America—"I am presenting, not mere academic speculation, but a platform from which a new source of life can hopefully spring up in the United States—that of the medieval aspiration fulfilled in the consummation of the American Dream." (P. 61.) He further believes that cosmonomic thought may be profitably wedded to creationist ideology resulting in a totally coherent philosophy of origins. (P. 62.) It is at this point that author Wolfe may have to go back to

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work and forge another volume on that very subject—pointing out the specific ties that should be made and the benefits that might accrue.

This book contains choice statements and quotable quotes such as the following:

"In amenities, in courtesies, in speech the saving grace always lies in thrift." p. 64.

"Thus as a mental discipline the true learning process is something of a dying to self." p. 65.

"I believe free enterprise truly under the golden rule is the best of social forms but without the golden rule could well be the worst." p. 83.

"Dooyeweerd like Chopin seems to have a propensity for burying his cannon-balls in flowers or other forms of camouflage." p. 118.

There are many more of these and it is thus my opinion that the book has a literary merit all its own—above and beyond its stated purpose.

Wolfe is not oblivious to weaknesses in Dooyeweerd's synthesis—pointing out that the last two spheres (the ethical sphere and that of faith) ought to have been a point of culmination but that instead, "... in the last two spheres he [Dooyeweerd] frankly just seems to lose his grip." (P. 112.)

Wolfe believes that perhaps it was this ultimate flaw in Dooyeweerd that has prevented the cosmonomic philosophy from being widely accepted on this conti-

nent. But where the master (Dooyeweerd) loses strength, the disciple and expositor (Wolfe) holds high the master's hand and brings the law philosophy to a stirring culmination in the sphere of faith. Wolfe shows how Abraham Kuyper correctly judged that faith is the root of the entire learning process. "Dooyeweerd himself has said that the sphere of faith is the open window through which the light of eternity shines on temporal coherence." (P. 115.) Wolfe carries this idea of Dooyeweerd's further by stating that "... while faith is the consummation of the theoretical synthesis, it is also the root thereof."

Wolfe demonstrates that all the spheres are fulfilled in the sphere of faith—"All the straining and striving focus on the rose-window of the final sphere of faith beyond which lies the boundless ocean of divine love." (P. 116.)

The book ends with three useful indices—Scripture, names, and titles.

This volume is exactly what its title suggests—a "key" to the work and writings of one whom some judge to be the most important Christian philosopher of science in recent years. In the coming years, Wolfe's exposition will be a valuable tool for students of scientific philosophy and history. Wolfe hopes that Dooyeweerd's philosophy will have its ultimate fruition in America. If it does, this book will be the catalyst.

LETTERS TO THE EDITOR

Silicon in Living Things

Our discussion, about the notion encountered in science fiction, that there may be, somewhere, a form of life based on silicon, rather than carbon, set me thinking and investigating about the part played by silicon in the living things which we know here on Earth. It turns out that, while the fiction remains fiction, the truth is, as the saying goes, stranger than fiction.

For instance, I was surprised to find that silicon is an essential component of a wide variety of living forms. The about 16,600 different species of diatoms, which are members of the *Chrysophyta* Division of the Algae, have an outer shell of silica that is beautiful in design when observed under the microscope: every species has its own pattern of striations, beading, ribs, pores, and curved lines that are so regular and precise that microscopists use them to standardize their microscopes! In California, there are beds of diatomaceous earth (the skeletons of diatoms) that are 1400 feet thick, that supposedly collected on the bottom of an ancient ocean before the mountains were formed, pushing the ocean bed to mountain-top level.

The *Equisetum* or Horsetail genus of green plants have so much silica in their tissues that they have been used as "scouring rushes." Corn leaves are sharp-edged

because a thin film of silica forms in the cuticle, and all the other grasses deposit silica in various parts of the plant. All plants grown in soil contain silica in their tissues, sometimes in the form of the gemstone, opal.

Bacteria also incorporate silica, in extreme cases to 14% of their ash-content. Ruminant animals, such as the cow, do not develop the rumen and would die of breakdown of their intestinal tracts when raised on a diet low in silica: a shovel of sand added to their refined ration corrects all the deficiencies and speedy recovery results. All animals that have been examined, and also the human, have soluble silica in their blood at about 1 mg/100 ml of blood, which is higher concentration than that of the individual amino acids, or of many of the "trace elements" that are known to be essential for life. The requirement for silicon is almost impossible to determine, since we live in a world that is 2/3 silica (at least on the surface) including the glassware, concrete structures, and sand.

Since silica is almost insoluble, it is still a mystery how the living cell dissolves it and keeps it in solution under the mild conditions essential for life. It could be absolutely essential for life of all species, but our biochemistry is still too primitive to explore this area.

As to the original question about the possibilities of silicon-organisms surviving at the extremes of temperature, theoretically they could, but I see no way

they could respire, reproduce, or react—all essentials of living organisms.

Yours truly,
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Received 1 March, 1978.

More on the Jumping Cow

The *Creation Research Society Quarterly* of September, 1978, shows a picture of the remarkable cow with a map of the world on her side.¹ Theory has it that it was impressed from the memory of her ancestor, the cow that jumped over the moon. Evidence that the famous jump occurred a very long time ago is the fact that the map shows the now non-existent lands of Atlantis and Mu, the latter reported by the cow as Moooooo.

The author of the article failed to mention that it was through this famous jump through space that the moon itself got its name—as the cow passed over it she said, “Moo-o-o-n.”

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Sincerely,
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Viruses—not Evolutionary Links

In an article in the *Quarterly* of June, 1978,¹ the writer characterises the evolutionists' view of origins as amino acids to simple life forms to viruses to bacteria and so on. Many evolutionists do indeed regard a virus as an evolutionary link between non-living chemicals and singlecelled organisms. Whether or not one regards a virus as “living” or not, one thing is clear—it can in no way be ancestral to singlecelled creatures. A virus has no metabolism of its own, no energy source, no means with which to duplicate itself. It merely carries the genetic information encoded on a nucleic acid which is necessary for its own replication—*provided* that it first has access to the complex chemical “factory” of a fully-formed, operational living cell. The information it carries is therefore meaningless (in both a creationist or evolutionary scheme) without the pre-existence of a living cell.

This simple point is often missed when evolutionists try to use instances of change in viruses as evidence for evolution. For example, in the wellknown Tennessee debate in 1975 between creationists Morris and Gish and evolutionists Schweitzer and Jones, a listener demonstrated at question time that he had been impressed with Dr. Arthur Jones' assertion that a virus had “evolved”. In reply, Dr. Henry Morris reiterated that creationists have no dispute about “horizontal” changes “within the kind.” It could have been added that no matter how drastic a change occurs in a virus,

this can, as pointed out above, in no way have any relevance to a discussion about observational evidence for an evolutionary history of life.

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Yours Sincerely,
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C. Wieland is a medical practitioner, and President of the Creation Science Association in South Australia. (Editor)

On the Origin of the Watermelon and Other Fruits

About our discussion of the origin of such cultivated plants as the watermelon, some of the facts are as follows:

According to *Bailey's Encyclopedia of Horticulture* the melon grows wild in Africa. It also occasionally goes wild in the United States; that is, it can grow without the aid of man's cultivation. Elephants and various other African animals enjoy the fruit very much, although of course the wild ones are quite small.

The early French explorers found that the Indians were growing watermelons in the Mississippi valley. Watermelons were depicted by early Egyptian artists, 4,000 or more years ago. And melons of some kind are mentioned in Numbers 11:5.

There are two questions, are there not? First: why some species of fruit have the capacity of being improved rather rapidly by selection and breeding, and others do not. Thus, for instance, the coffee berry, *Rhamnus californica*, has an abundance of small black fruits which have a very bitter taste. I doubt if any amount of selection would ever make the fruit of this tree pleasant to eat, or significantly increase the size. On the other hand the peach, though it has many very small wild forms, can rather easily be increased in size by cross-pollination and selection. Incidentally, it is thought to be a native of China. From the Creationist point of view, it would seem that some plants are endowed with the ability to produce large, pleasant-tasting fruit, and others are not.

The second point may lead to a dilemma for evolutionists, and goes as follows. The evolutionist must believe that originally the watermelon, or whatever its ancestor was, grew only wild. Now those proto-watermelons either did or did not have a somewhat juicy sweet fruit, large in comparison with the seeds (although perhaps not nearly so much so as today's cultivated varieties.) If they did, how did they get to be that way? The standard evolutionary answer is “natural selection”. But what possible natural selection would cause a plant to have fruit even a little like a watermelon? What advantage to the plant could it be to have the seeds enclosed in such a structure as a melon?

If, on the other hand, the proto-watermelon was scarcely like modern melons at all, how did some early plant breeder know that it would be worth his while to cultivate and breed it for a number of generations?

A Creationist may suggest that maybe some of these plants were originally never wild at all; they were given to Adam and his descendants, either in the Garden or outside. Some may have gone wild later, to lead to the wild forms found now. And, of course, God could have created the original melon in one form as well as in another. Is it possible, in fact, that, within the Garden at least, there was originally no distinction between wild and cultivated plants?

On the other hand, is it possible that God gave some early men some direct instruction in plant-breeding? When, in the time of Enos, men began to call upon the name of the Lord, surely He answered them; and who can say what may have been revealed to Enoch, in three centuries of walking with God?

This whole subject of the origin of domestic plants—and animals—is worth more study by Creationists, who may be able to give better answers than the evolutionists have done. Maybe an issue of the *Quarterly* might be devoted to that subject some time.

Yours sincerely,
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A Boundary Mentioned in Ancient Literature

I was very interested in the article "A Solution to Seeing Stars" by David M. Harris in the *Quarterly*,¹ in which he presented the theory that we might be enclosed by some kind of spherical boundary. Indeed, there are some references in ancient religious literature to a barrier which surrounds our solar system or the earth alone.

The word used for this barrier is *katapetasma* (from *kata*, down from, up to, toward; and *petannumi*, to stretch out, to unfold, to expand), usually translated as curtain or veil. It is used in the Septuagint of the Old Testament, and in the New Testament, in Exodus 26:37, 38:18, Numbers 3:26, Leviticus 21:23, 24:3, Matthew 27:51, Mark 15:38, Luke 23:45, Hebrews 6:19, 9:3, 10:20. Following are a few references from apocryphal texts which mention this veil-like boundary surrounding our system:

"They appointed him over the seventh heaven, below the veil (*katapetasma*) between the thing above and the thing below." (*Hypostasis of the archons*, Nag Hammadi Codex II, p. 95, lines 19-22).

"The veil first concealed how God controlled the creation, but when the veil is rent and the things within are exposed this house will be left deserted." (*The Gospel of Philip*, Nag Hammadi Codex II, p. 84, lines 23-28).

"He made a veil for their worlds, surrounding them like a wall." (*Second Gnostic Work*, 47a, in Carl Schmidt, *Texte und Untersuchungen*, VIII (1892)).

"He created the veil between the immortals and those who came about after them . . ." (*Sophia Christi*, p.

118, lines 7-11).

Especially the following text mentions the light of the sun, or any star, in particular:

"For the light of the sun in its true form cannot be found in this place, because its light penetrates through many veils (*katapetasma*) and places, but the light of the sun in its true form, which is found at the place of the virgin light, shines ten thousand times more than the twenty-four invisibles . . ." (*Pistis Sophia*, 184).

Reference

¹Harris, David M., 1978. A solution to seeing stars. *Creation Research Society Quarterly* 15 (2):112-115.

Sincerely yours,
Marcus von Wellnitz
441 South State Street
Orem, Utah 84057
Received 21 November 1978

Limited Variability an Old Idea

"In his recent article 'Variation and fixity among living things: a new biological principle,' Frank L. Marsh described the principle of the limitation of variation—'processes of biological variation can go no farther than to produce new variants within basic types already in existence' (p. 118).¹ Dr. Marsh is right to say this is an important concept, but I don't think he can justifiably claim that it is new. Some readers may call to mind the 1858 paper of Alfred Russell Wallace, entitled 'On the tendency of varieties to depart indefinitely from the original type.' The eye-catching word in the title is 'indefinitely', since it was widely assumed at the time that species could become modified, but only 'Definitely' or within limits. It is this idea, presumably, which Dr. Marsh is claiming to be new. An earlier reference can be found in a book Dr. Marsh mentions in his article—Charles Lyell's *Principles of geology*. In the chapters in which he criticised Lamarck's theory, Lyell enunciates various principles to be used in accounting for intraspecific variation, such as the modification of individuals to some degree by the force of external causes, the transmission to a certain extent of these modifications to offspring, and the fixed limits beyond which the descendants from common parents can never deviate from the type (see, for instance, pp. 581-583 of the 1853 9th edition).

The principle Dr. Marsh draws attention to is probably accepted by all modern biologists who deny both evolutionism and saltationism. Readers may be interested in a forthcoming article, 'Alternatives to evolutionism', which is expected to appear in 1979 in *School Science Review*, the journal of the Association for Science Education in the U.K.. The article discusses five different theories of the history of life, but most attention is devoted to the steady state theory of species. This theory incorporates the principle of limitation of variation, and although it denies special creation, creationists may nevertheless find it of some interest since it also denies evolution and saltation. Special creationists and steady state theorists share much common ground—in the interpretation of the fossil record, for in-

stance—and both parties may benefit in their fight for recognition if they know of each other's work."

Reference

¹Marsh, Frank L., 1978. Variation and fixity among living things: a new biological principle. *Creation Research Society Quarterly* 15 (2):115-118.

Yours sincerely,
G. H. Harper
Centre for Science
Education
Chelsea College, London
Received 4 December, 1978

Reply to Harper's Comments

I have read the interesting comments of Geoffrey H. Harper on my article which appeared in the September 1978 *Quarterly*. Lest Harper be of the opinion that I was not aware that there were scientists in the 19th century who held to the opinion that there was a limit in nature with regard to how far variation could go, I would like to assure him that I am really fairly well acquainted with at least some of their theories in that interesting period. The schoolmen were generally of the opinion that Genesis taught a close fixity built into nature which made biological variation impossible. At the other extreme was Wallace (quoted by Harper) who thought variation occurred quite without limit.

I would refer Harper to a still earlier time when the limitation of variation had its origin. In Genesis 1:12 (New English Version) we read: "So it was; the earth yielded fresh growth, plants bearing seed according to their kind and trees bearing fruit, each with seed according to its kind." Here is the origin of the natural law or principle of the limitation of variation as it applies to plants.

As one studies the superstition and confusion of assumptions and theories in the period to which Harper refers, he may be impressed with the fact that at that time there was clearly no scientific principle or law of limitation of variation. Ideas about it yes, but no demonstrable law. In order to be a true scientific principle all pertinent natural evidence must support the statement of the principle. However, it was not until well into the 20th century that scientific study of variation had proceeded to the point where a true principle could be perceived here. Difficult to understand is the fact that mechanistic evolutionists cannot yet perceive this principle although it holds the remarkable distinction of being demonstrable in every pertinent item of laboratory proof. No case has been demonstrated where processes of variation have done more than to produce another variant within a basic type (morphological and usually physiological) which is or was already in existence.

It was in the light of the absence in science of this principle in the past several centuries and at the present time that I decided to use the word "new" in the article under discussion. But if this use causes the reader to worry about the adjective while the main point escapes, then I have made a sorry mistake. This existence of the law of limitation of variation in nature is of tremendous

significance in the problem of origins. The special creationist needs to perceive the utter invalidity of the doctrine of organic evolution in its presence, and at the same time its complete harmony with the doctrine of special creation. A good knowledge of this natural limitation law is all that is needed to combat the doctrine of mechanistic evolution. Organic evolution and a law of limitation of variation (as defined in this discussion) cannot exist on the same planet at the same time.

As I read Harper's letter, incidentally, I am reminded of a matter which has seriously confused many discussions of origins. This is the use of the word "species" where "basic type" (or created kind) is meant. Genesis says nothing about creation of species. "Kinds" are stated to have been produced. With the man in the street today the species might be thought of as the kind—the man kind. But with cattle, a bison species is apparently actually a subspecies of the cattle kind or type. Darwin observed variation occurring within kinds and thought that instead of merely observing the formation of subspecies within a single polytypic species (microevolution), he was witnessing the origin of new basic types (macroevolution). The chance is very good that Darwin was led into the idea of unlimited development by confusing the basic type with the species.

Harper speaks of a forthcoming article in which one of the theories given of the history of life is that of "the steady state theory of species." I will guess that here the expression "basic type" should replace the word "species". Because the word "species" means utterly nothing in science today, I hope the author can see his way clear to use "basic type" or some distinctive term—if that is what he has in mind. One would wonder how a species, in the narrow sense, for example with 214 subspecies (Southern Pocket Gopher) could be regarded as having a "steady state." We will look forward with interest to the appearance of this article in *School Science Review* in 1979.

Frank L. Marsh
Berrien Springs
Michigan 49103
Received 28 December, 1978

Geocentrism, Heliocentrism, and Joshua's Long Day

Surely Dr. Hanson¹ is not seriously suggesting that we abandon the heliocentric model of the solar system in favor of a geocentric model of the entire universe!

I believe we should think of Joshua's long day in a heliocentric framework, although it is described in geocentric terms like the ones we use when we say "sunrise" and "sunset." True, this forces us to accept a cessation of the earth's rotation, and we must then ask, "How?"

We may start by imagining a gradual deceleration, as long as the processes of deceleration and re-acceleration require only a small fraction of the day. To stop the earth's rotation in 90 minutes, a uniform deceleration of about 0.01g would be required at the equator. (Elsewhere on the surface, the rate would diminish with the cosine of the latitude.) Such decelerations and re-accelerations would negligibly affect living things and objects on the surface.

However, if the necessary torques had been applied to the earth's crust, and only to the crust, the inertia of the mantle and the core might have caused disastrous results. Therefore we must imagine a pattern of torques applied to the entire earth and decreasing continuously with decreasing distance from the earth's axis. Once we visualize such a pattern, we can imagine it to be applied to every object on the surface and even to the atmosphere. If we go this far, we can drop the need for a slow deceleration and re-acceleration, and can think of both as being very rapid.

The long day of Joshua 10:12-14 was a miracle like the raising of the dead. Our present-day knowledge of biochemistry should not cause us to question the latter type of miracle, but should cause us to appreciate it all the more. Similarly our knowledge of astronomy and physics should increase our appreciation of the great events described by the simple words, "the sun stood still."

Reference

¹Hanson, James N., 1978. Against catastrophic rationalism: gravitational attitude deflections of the Earth's axis. *Creation Research Society Quarterly* 15 (1):55-68 and 72.

Sincerely yours,
Harry Akers, Jr.
826 "K" Street, Apt. 4.
Anchorage, Alaska 99501
Received 11 January, 1979

Reply to Akers' Letter

In reply to Mr. Harry Akers' comments:

1) I surely am suggesting a geocentric model for the whole Universe. Specifically, one wherein the earth does not spin nor does it translate through space but is at the center of Creation just where the Bible puts it.

2) The Bible in no way requires one to view anything from a heliocentric framework. One may argue with me that certain verses are not geocentric but he will not find a single verse or even allusion to heliocentricity.

3) I am confused by the phrase "deceleration of about 0.0lg." This is a linear acceleration measured in units of length per unit time squared whereas angular acceleration must be measured in units of angular displacement per unit time squared. In any event, whatever is meant, it is an unsubstantiated conjecture that such deceleration and reacceleration would have negligible effect. I should like to see such computations. The fact is that very small accelerations do produce and would produce cataclysmic effects (see Editor H. Armstrong's note in my paper). One need only investigate water tides, and even earth tides, as developed e.g., in Lamb's *Hydrodynamics* in order to discern this.

4) If Mr. Akers can "imagine a pattern of torques applied to the entire earth and decreasing continuously with decreasing distance from the earth's axis," an assumption not at all found or alluded to in Scripture, then I must, similarly, ask him to consider an earth not moving in the first place and a diurnally moving sun

and moon which God caused to stop at Joshua's command, and which *is* to be found in Scripture. I regard such an assumption as fanciful, not in evidence and unsupported by any theoretical development, save saying it is so.

5) Joshua's long day is indeed a miracle and in my paper I did not rationalize it, in fact, my whole paper, was against such rationalizations, e.g., as Mr. Akers' assumption.

6) Mr. Akers seems to have missed the main point of my analysis, to wit, that the requirements that the sun and moon remain stationary in the sky (with respect to the local horizon) precludes any possibility for the earth to be rotating in that no rotation would preserve the sun's and moon's immobility in the sky above Gibeon.

James N. Hanson
Department of Computing
and Information Science
Cleveland State University
Cleveland, Ohio 44115
Received 2 February, 1979

The Mature Creation

(Continued from page 72)

⁴Smith, Elske V.P. and Kenneth C. Jacobs, 1973. Introductory astronomy and astrophysics. W.B. Saunders Co., Philadelphia, PA. Ch. 20.

⁵Panofsky, Wolfgang K. and Melba Phillips, 1962. Classical electricity and magnetism. Addison-Wesley Publishing Co., Reading, MA.

⁶Jackson, John David, 1962. Classical electrodynamics. John Wiley & Sons, Inc., New York, NY, p. 490.

⁷Panofsky, Wolfgang K., and Melba Phillips, *Op. cit.*

⁸Wehr, M. Russell and James A. Richards, 1978. Physics of the atom. Addison-Wesley Publishing Co., Reading, MA.

⁹Zweig, George, 1978. "Quark catalysis of exothermal nuclear reactions." *Science* 201(4360):973-979.

¹⁰Jackson, *op. cit.*, section 1.6.

¹¹Bjorken, James D. and Sidney D. Drell, 1964. Relativistic quantum mechanics. McGraw-Hill, New York, NY, p. 84.

Pangaea Shattered

(Continued from page 15)

⁴Molnar, Peter and Paul Tapponnier, 1977, The collision between India and Eurasia. *Scientific American*, 236 (4): 30-41. See especially p. 32.

⁵Jamieson, Robert, A. R. Fausset and David Brown, 1961, Commentary on the Whole Bible. Zondervan Publishing House, Grand Rapids, Michigan, p. 866.

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 about 500 voting members (with graduate degrees in science) and over 1600 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 \$10.00 (Foreign, \$11.00 U.S.) 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 \$10.00 (Foreign, \$11.00 U.S.) 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: \$13.00 (Foreign, \$14.00 U.S.).

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. Gish, 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; *Engineering*: D. R. Boylan, Ph.D., Dean, College of Engineering, Iowa State University, Ames, Iowa 50011; *Genetics*: John W. Klotz, Ph.D., Director of Graduate Studies, Concordia Seminary, St. Louis, MO 63105; William J. Tinkle, Ph.D., Timbercrest Home, North Manchester, IN 46962; *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., Bob Jones University, Greenville, SC 29614; 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.

Music

(Continued from page 74)

*Morris, H. M. Language, creation, and the inner man. In Reference 1, pp. 286-298.

*Reference 2, p. 159, also pp. 158 and 160-173.

*The fact that Jubal was a descendant of Cain does not mean, as some seem to have supposed, that instrumental music is an invention of the devil.

*Genesis 4:21.

*Genesis 4:20 & 22.

*Reference 2, pp. 158 et seq.

*Reference 3, pp. 26 & 27.

**Ibid.*, p. 27.

*Schirmacher, Thomas, 1977. The art of Greek vases. Giessen (Unpublished.)

*Schaeffer, Francis, 1977. How should we then live? London.

*This is not to say, of course, that every criticism which is written today is utterly without standards. But the fact that critics can so often disagree so completely shows that there is no generally accepted set of standards.

*Rookmaker, H. R., 1978. Art needs no justification. Inter-Varsity Press, Leicester.

*For instance, music which increases the chaos, or destroys, or is inspired by the devil, can then be recognized for what it is, and called what it is. And one thing which it is is dangerous.

*S. D. G., meaning "To God alone the glory" was written by Johann Sebastian Bach on every piece of music which he wrote.

*Genesis 1:26 & 27.

Cover Illustration

(Continued from inside front cover)

ice age. One piece of such evidence is shown on the front cover; it is one of the "flowerpots" or stacks on the eastern shore of Flowerpot Island in Georgian Bay, Ontario. The base of the stack has been undercut by wave action. Three of these stacks were present when explorers first visited the region, but only two remain today. The instability of the stacks is evidence against the theory of a great ice sheet excavating the basins of the Great Lakes. For stacks such as this would surely have been swept away by the supposed glaciers.

On the other hand, Mr. Michael J. Oard proposes, elsewhere in this issue of the *Quarterly*, a way in which a short ice age might have occurred after the Flood. It is desirable that all the possibilities be considered; in that way we are most likely to arrive at the truth.

It may be that there is truth on both sides: that there was, after the Flood, a time of much snow and cold weather in what are now temperate regions, but that many of the geological features commonly ascribed to the glaciers were really caused by something else.