

EDITORIAL

BEYOND DESIGN

When one steps into a new position somewhat unrelated to past work experiences, it is most natural to take furtive glances around one's new environment to determine what has gone on before, the present state, and the future goals of the organization just joined. In the case of an executive editor, one also reads what other similar publishers are producing, making a conscious or unconscious evaluation of one's present publication with the "competitors." Details such as type styles, layout design, and a handful of other procedural items demand immediate comparison. A thoughtful period later develops as one reads the articles found in the various publications. Comparisons here are not so easily made.

Since opening my office several weeks ago, I have spent considerable time reading the various creationist publications. Our files contain examples of a worldwide production, some with slick, professional copy, others obviously printed in the basement of the editor's home.

A review of these various publications causes one to form several generalizations. Some of the following have arisen. 1) There seems to be a strong attempt to relate creationism with Christianity and certain faith statements about Christ. This bothers me somewhat, for could there not be Jewish or other non-Christian creationists? 2) There seems to be a pervading feeling that the evolutionary scientist is somehow dishonest with the data that surrounds him. These scientists are sometimes pictured as vindictive, loaded with bias, and, though not spoken but certainly implied, out to destroy church, morals, family, and other noble ideas.

These implications cause me some discomfort. After six years of graduate school and five postdoctoral years, I can remember no such incidences in which these characteristics arose. I have seen strong views held, to be sure, but attempts to destroy what others hold dear were remarkably absent.

A third theme that seems to dominate is the idea that creationism is more scientific than is evolution. While holding similar views, I am deeply troubled by what is sometimes presented as scientific proof. Perhaps the most dominant argument is that of design. Examples of complexity are cited and compared with present technology. Since a wide gap exists, the conclusion is quickly drawn that a Designer was responsible. While the argument from Design has real validity, it is freighted with certain problems. When what was complex and not understandable at one time becomes ordinary as technology advances, there is a reaction among the general populace to reduce the original force and sophistication of the observation.

One needs only to observe the bewildering pace of events occurring in the area of recombinant DNA to see how quickly the knowledge that was once the purview of the most educated is now spoken of freely by the common man. Indeed, the common man loses his sense of awe in the complexity and demands new miracles to satisfy his needs.

Creationists have been strongly criticized recently in scientific and popular literature for cloaking religious views in scientific skins. Perhaps some of the accusations are true. The basis of all science is an attempt to understand the universe that surrounds us. Since nature only grudgingly discloses its secrets, one must probe with tools hoping to get at how things were, are, and will be. Science thus examines the surrounding universe by proposing hypotheses and then testing them. This active process demands that nature is predictable and that from these tested hypotheses and theories, general descriptions of the properties of the surrounding universe can be made. It is here that many creationists think that science ends, when in reality it is merely the beginning. For it is the theory that is the wonder of science in that it allows one to predict results in as-yet-untried experiments. The better the theory, the more accurate the prediction. This is indeed science at its best.

Proponents of evolutionary theory claim that evolution is a testable hypothesis. In the areas of microevolution (i.e., speciation, adaptation, etc.) much success has been achieved. Creationists have generally taken these data and have found them compatible with their views. This is peripheral, however, to the general observation that creationists at any level of their theory have largely failed to provide testable hypotheses that originated with a model that includes the Biblical record. Until we who hold to the creationist views can demonstrate that creation/flood theory can better predict results in unknown areas, that the theory allows one to design better experiments, then we must accept, at least partially, the charge that we are not really scientists.

Origins is a journal devoted to creation/flood theory research. In it we have attempted and will continue to attempt to make a sound contribution toward a rational and careful development of theory with predictive value. Failure to do so will result in having a group of people talking to themselves about meaningless things.

Richard D. Tkachuck

REACTIONS

Readers are invited to submit their reactions to the articles in our journal. Please address contributions to: ORIGINS, Geoscience Research Institute, 11060 Campus St., Loma Linda, California 92350 USA.

RE: SMITH: QUESTIONS ON THE METHODOLOGY OF GEOLOGY (ORIGINS 6:85-87)

In the middle of Dr. Smith's review of Kitts' book are two paragraphs about flood geology, sort of wedged into the discussion of the book. These two paragraphs raise the question whether flood geologists can define a methodology for the study of a miraculous event. The answer to that question is neither obscure nor complicated.

If we ask the question "Did God cause a worldwide flood?" we have asked a question that science cannot answer. Many scientists assume that there has never been any supernatural invention in earth history, but that assumption is really just an untested hypothesis, not a fact that has been demonstrated or ever can be demonstrated by scientific data. Not only can science never prove that God *has not* influenced our geologic history, but it is equally impossible for science to prove that He *has* influenced our geologic history. These are philosophical questions of ultimate causation that we cannot test by any conceivable experiment. However, there are valid, testable questions that a flood geologist can ask — testable hypotheses that can be drawn up.

The approach of the flood geologist is to propose that at some time in the past there was a disturbance in the earth's crust that temporarily disrupted the normal relationships between land and water bodies, initiating a period of rapid geologic activity on a worldwide scale, and this period of rapid erosion and sedimentation produced a significant portion of the geologic column. According to this hypothesis the geologic and geophysical processes occurring during that event produced the characteristics of the rock formations formed at that time, including the distribution of fossils and the orderly arrangement of the levels of radioactivity in those minerals used in radiometric dating.

Any alert person would probably guess that the idea for this theory came from the book of Genesis, but where it came from is beside the point. A flood theory expressed in this form is a simple descriptive statement and says nothing about the untestable question of whether God was involved in initiating this geologic event. It does not attempt to explain any process or event that may have operated outside the known laws of chemistry or physics. This descriptive theory can be used as a basis for defining specific hypotheses concerning the sedimentary processes and the amount of time involved in depositing individual formations, or the processes that produced various other geologic features. These hypotheses can be tested in the same way that any geologist tests his hypotheses.

Two geologists could be doing research on the same rock formation, perhaps one of the Paleozoic formations in the Grand Canyon. One geologist believes that the formation (like other geologic formations) must have had a long time — thousands or millions of years — in which to be deposited. The other geologist believes that the formation must have been deposited far more quickly than that. They both look for the same general type of data as they study the rocks. Each one must analyze the data that he finds, as well as other published data, and interpret what they mean. When they disagree, each geologist will analyze the other's work and his own work, and try to determine what additional data are needed to clarify the issue. If both are doing good work, each one will then publish his findings in a scientific journal so that other scientists will benefit from their work. In time, as more data accumulate, hopefully the conflict will be resolved, and the total body of data will clearly favor one explanation — it will point to rapid deposition or very slow deposition of the formation.

Both flood geologists and other geologists believe that if we are completely fair with the data, *eventually* the data will tell us which theory is true (*unless* we are not able to collect the types of data that can give us the information without being able to go back in time and directly observe what happened in the past). Both types of geologists will also use the same observational and experimental procedures in their research. There is only one real difference in the research of flood geologists and other geologists. The flood geologist believes that when all, or at least a significant portion, of the data are in, they will indicate that much of the geologic column was deposited in a short time. A conventional geologist approaches his research with the conscious or unconscious belief that when the data are all or mostly in, the data will indicate that all of the geologic column was deposited very slowly, or in rapid spurts with long periods of time in between. The flood geologist notes with interest the definite trend toward catastrophism that is evident in geology in recent years, but judging from the history of other fields of science, it could take many decades, or hundreds of years, before there are adequate data to fully resolve the issue.

The suggestion in Dr. Smith's review that flood geologists are methodologically uniformitarian (i.e., they assume that natural laws have always been the same) is definitely correct. Furthermore, that is not an inconsistency in flood geology methodology; it is simply being realistic and recognizing that science can study only those aspects of the flood process that have followed known natural laws. That is why we can study the erosional and depositional processes occurring during the flood, but not any "miraculous" processes used to initiate the flood.

As I mentioned earlier, science cannot demonstrate whether God was or was not involved in influencing our geologic history. Even if research eventually demonstrates that the best explanation for the geologic column is rapid sedimentation of most of the column in one short spurt of geologic activity,

that would not prove that God caused a flood. But it would demonstrate that it is perfectly reasonable to believe the flood story if our confidence in Scripture leads us to do so. God never promised us proof; He only promised us reasonable evidence on which to base our faith.

There is another important aspect of this topic that cannot be experimentally studied but can only be dealt with on a philosophical level. The scientist understands the universe as a complex physical system that functions according to natural laws. Many scientists would insist that for God to miraculously cause a worldwide flood is contrary to natural law, and thus unscientific. That would be a reasonable assertion only if we are willing to believe that science has discovered all natural laws; i.e., that there could not be any undiscovered laws which God could use to perform His “miracles.” To make that claim is hardly even rational! There is much about the universe that we do not know. Another aspect of this same issue can be best explained with an example. I can hold a book in the air and drop it, and the law of gravity dictates that it will fall to the floor. However, since I am a mobile, reasoning being, I can decide to stick out my hand under the falling book. I have interjected an outside force into the system and changed the course of events, but I have not broken any laws. God could decide to interject an outside force into Earth’s balanced geologic systems and change the course of events to bring on a flood, without breaking any laws of nature. One has only to be willing to admit that such a powerful and knowledgeable Being could exist in the universe — a Being who understands all natural law, and, in fact, made all natural law.

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RE: BROWN: THE INTERPRETATION OF C-14 DATES (ORIGINS 6:30-44)

Brown’s article provides a long overdue attempt to deal with the geochemical mass balance problem implicit in flood geology modeling of the C-14 dating method. Brown mentions in passing the pioneering work 17 years ago of Henry Pearl in this area. Pearl covers much the same ground as Brown does. Brown goes beyond Pearl in estimating quantitative adjustments to the “apparent” pre-flood C-14 ages, caused by possible differences between pre-flood and contemporary environments. However, Pearl attempts to deal quantitatively with the problem of the apparent orders of magnitude greater pre-flood carbon exchange reservoir, a problem that Brown superficially passes over in his short paper.

Brown’s use of the term “biosphere carbon inventory” may lead to confusion in some readers’ minds. The term “active carbon exchange reservoir” would be more appropriate and is really what he means. More than 90% of the contemporary “biosphere” carbon in Brown’s Table 1 is actually inorganic CO₂ and dissolved carbonate and bicarbonate, not organic carbon.

It should be emphasized that Brown's postulated 130× increase in the pre-flood carbon exchange reservoir must largely be sought in a much larger increase in the pre-flood organic carbon reservoir. Although reasonable limits on the possible size of a pre-flood biosphere may be a matter of conjecture, the simple chemical principles governing the size of the inorganic carbon exchange reservoir are well known and rule out a large increase over the present inorganic exchange reservoir listed in Brown's Table 1 (35.83×10^{12} metric tons). The primary limitation is the low solubility of carbonate minerals under environmental conditions suitable for most living organisms. Making some rough calculations, if the acidity of the oceans were increased $10 \times$ (1 pH unit) the total inorganic exchange reservoir would be increased to about 210×10^{12} metric tons, or less than six times the present inorganic carbon exchange reservoir. This is 12.5 times less than the figure adopted by Brown in Table 3 for precipitated carbonates. Even this small increase is questionable unless one can postulate a mechanism for maintaining this increased acidity in a pre-flood ocean. The problem is compounded if we adopt the common picture of greatly reduced pre-flood ocean areas and volumes.

Given the above limitation on increases in the inorganic exchange reservoir, the required increase in the active organic carbon reservoir is nearly 2000 times the present biospheric carbon inventory. Until some plausible model is presented for such a huge increase in the antediluvian organic carbon exchange reservoir, Brown's conclusion that "these considerations ... provide *justification for confidence* that C-14 age data for time prior to approximately 3500 B.P. are associated with a transition between the pre-biblical-flood biosphere and the contemporary biosphere" should be judged somewhat premature. In the meantime, Brown's straightforward statement of the problem provides much material for student research projects and master's theses for our new geology program at Loma Linda University.

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BROWN'S REPLY

Confusion regarding the term "biosphere carbon inventory" may be avoided by making specific that whatever term one may use for the concept, it is clearly understood to designate the active carbon inventory in the region of the planet that supports organisms.

Although the $^{14}\text{C}/^{12}\text{C}$ ratio in the surface layer of the ocean is typically about 5% below that in air, freshwater, soil surface, and the organisms which populate them, for the purposes of the treatment in ORIGINS 6:30-44, it is convenient and satisfactory to treat these four regions as one subregion of the general biosphere, designated "upper biosphere" in the treatment cited. The active carbon exchange reservoir, to use Dr. Barnes' choice of terminology, in this subregion is reliably estimated to be 4.03×10^{12} metric tons (Table 1, Item 9).

Air and water contain 37.2% of this inventory in inorganic form; living and dead organic material represent the remaining 62.8%, 60.6% of which is associated with land and 39.4% is in the ocean (calculations from data in Table 1).

Assuming that flood sediments were formed about 5000 real time years ago, and that at their initial formation these sediments had a $^{14}\text{C}/^{12}\text{C}$ ratio no greater than the minimum detectable by current conventional gas or scintillation counting techniques, requires that 45,000-50,000 years of ^{14}C age be accounted for on some basis other than that given by a simplistic uniform conditions model, as discussed in ORIGINS 6:30-44. This range of ^{14}C age represents 7.85-8.73 half-lives for ^{14}C . The reduction in $^{14}\text{C}/^{12}\text{C}$ ratio over this half-life range is in the range 231-425 ($2^{7.85} - 2^{8.73}$). For the task at hand one can postulate that before the flood the ^{14}C production rate in the atmosphere was *less* in this ratio, the upper biosphere carbon inventory (active carbon exchange reservoir in the upper biosphere) was *greater* in this ratio, or any appropriate combination of intermediate factors for lower ^{14}C production and greater inventory. In the following discussion the “upper limit” factor 425 will be used, recognizing that the true situation might be approximately twice as easy (231 factor) to accommodate.

We can speculate that the CO_2 concentration in the preflood atmosphere was near 1%, approximately 20 times its contemporary value, since plants generally exhibit more vigorous growth as CO_2 levels are increased up to this level, and the atmosphere becomes toxic at higher levels. It may be assumed that the carbon concentration in the water components of the upper biosphere, being in contact with the atmosphere, would be identified with a similar increase. Accordingly the factor F by which living and dead organic material must be increased to secure a total upper biosphere carbon inventory increase by a factor of 425 is given by

$$0.372 \times 20 + 0.628 \times F = 425,$$

from which $F = 665$.

To model a preflood biosphere that might meet these requirements, one can postulate a 665-fold greater number of contemporary-sized plants and animals, worldwide total, assuming a constant ratio of living to dead organic material; or one can postulate a net 665-fold increase in the volume of the average individual organism. A 665-fold increase in volume is associated with an 8.71-fold ($\sqrt[3]{665}$) increase in lineal size. [Recall 30-inch wingspan of fossil dragonflies, the size of fossil *Equisetum*, etc.]. Doubling the average lineal size of organisms would require only an 83-fold increase in their numbers to provide a 665-fold increase in biomass.

I know of no objective basis for confidence that a particular model for the preflood biomass, land/water surface ratio, or ^{14}C production rate is “correct,” but the development presented in this note seems to provide justification for confidence that models can be developed which are appropriate and also

contribute to an understanding of ¹⁴C age data that is consistent with the chronological witness of Scripture.

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P.S. For the benefit of the students who may wish to look more closely into the modeling suggested in this note, I will append a tabulation of calculations I have made from data given in Table 1 of the paper by G.M. Woodwell et al., Science 199:141-146 (1978).

Ecosystem Type	% of Present World Surface Area, 510×10⁶ Km²	Present Average Plant Carbon Content in 10³ Metric Tons per Km²
Tropical rain forest	3.33	20.2
Tropical seasonal forest	1.47	15.6
Temperate evergreen forest	0.98	15.8
Temperate deciduous forest	1.37	13.6
Boreal forest	2.35	9.0
Woodland & shrubland	1.67	2.6
Savanna	2.94	1.8
Temperate grassland	1.76	0.70
Tundra & Alpine meadow	1.57	0.29
Desert scrub	3.53	0.33
Rock, ice & sand	4.71	0.008
Cultivated land	2.75	0.45
Swamp & marsh	0.39	6.7
Lake & stream	0.39	0.01
TOTAL CONTINENTAL	29.2	5.55
Open ocean	65.1	0.001
Upwelling zones	0.08	0.01
Continental shelf	5.2	0.005
Algal bed & reef	0.12	0.90
Estuaries	0.27	0.45
TOTAL MARINE	70.8	0.005
GLOBAL TOTAL	100	

ARTICLES

SOME RECENT DATA FROM VENUS AND JUPITER: IMPLICATIONS FOR COSMOGONY

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WHAT THIS ARTICLE IS ABOUT

Views of unexplored areas, be they in science or geography, are constructed either from extrapolation of known experiences or from wild fantasy. Earthbound cosmologists have viewed our solar system from both perspectives. With the advent of unmanned probes, results have been obtained which have forced the abandoning of supposed similarities with our own earth as well as causing the destruction of several fantasies. The solar system appears not to be homogeneous in its composition and structure. These results are puzzling in view of a supposed similar source of raw materials. Atmospheric compositions are uniformly hostile to known life forms. Elemental and molecular studies indicate great variance in apparent ages. These results provide little confidence in any naturalistic model of a cosmology for our solar system.

A collection of planetary bodies clustered around a medium-sized star constitutes man's backyard in this vast universe. After millennia of wistful gazing with the naked eye and centuries of squinting through earth-bound telescopes, man in the last two decades has arrived at the grand moment when he can study neighboring worlds in unprecedented detail from comparatively close-up positions.

The era of unmanned planetary missions began in December 1962, when the spacecraft Mariner 2 flew by Venus and measured that planet's surface temperature and the strength of its magnetic field. This initial exploration was followed by more than three dozen missions of varied complexity to other parts of the solar system.¹ As of early 1980, seven American planetary spacecraft were in operation: two Viking landers on the surface of Mars, two Voyagers cruising toward Saturn, the Pioneer 10 vehicle leaving the solar system and carrying a "cosmic greeting card," the Pioneer 11 craft traveling between the orbits of Saturn and Uranus, and a Pioneer-Venus satellite in orbit around Venus.

Most students of the solar system believe that it was formed four to five billion years ago out of a large rotating cloud of gas and small rocky particles named the "presolar nebula." After the sun condensed out, the planets formed at various distances from the sun. The composition of each planet was influenced by the concentration of matter in that portion of the nebula and by the timing of its aggregation. According to this hypothesis, the early-forming planets (i.e., Jupiter and Saturn) scooped up more matter than late-forming ones such as Earth and Mars.^{2,3,4}

Currently recognized components of our solar system consist of the sun, nine planets and their thirty-five satellites, numerous comets, thousands of asteroids, plus countless meteoroids. Ninety-seven percent of the solar system's mass is located in the sun, a seething caldron of largely ionized hydrogen.

Nearest to the sun revolve the four small "inner" or "terrestrial" planets, Mercury, Venus, Earth and Mars. All have high densities varying from 3.93-5.52 times that of water. Beyond the orbit of Mars is an asteroid belt 300 million km wide which separates the inner planets from the large, gaseous outer planets, Jupiter, Saturn, Uranus and Neptune. Pluto, the farthest known planet from the sun, is anomalous in that position because it resembles the inner planets in size and density. Some have suggested that Pluto is a runaway satellite of Neptune.

The two gas giants Jupiter and Saturn are surrounded by numerous orbiting moons of various sizes and makeup. Each planet mimics the larger solar system in its form, and indeed, some of Jupiter's moons are of planet size.

There is on the whole a prevailing optimism among scientists that increased knowledge of our solar system will clarify the theories of its origins. But there are still dissenting opinions. For example Carl Sagan writes: "Yet even preliminary reconnaissance of the entire solar system out to Pluto and the more detailed exploration of a few planets ... will not solve the fundamental problem of solar system origins. What we need is to discover other solar systems, perhaps at various stages of their evolution."⁵ Prospects of discovering or exploring planetary systems outside the solar system are remote in the foreseeable future.

The reason for this pessimistic view is that the new data from various parts of space necessitated a modification of the theories of the solar system's origin. This article will discuss selected findings of the Pioneer-Venus missions and of the Voyager 1 and 2 missions to Jupiter which have caused this reexamination.

RECENT DATA FROM VENUS

Venus is our nearest planetary neighbor in space, a mere one hundred and twenty-day journey from Earth by modern spaceships. It closely resembles Earth in size and density; hence, according to the "presolar nebula" theory, one would infer similarities in planetary makeup. Though it receives almost twice as much solar radiant energy as does Earth, it actually absorbs only about the same amount of solar energy, due to its highly reflective cloud cover.^{2,6}

Despite these similarities, observed conditions on Venus are singularly unique in the solar system. Its surface is uniformly hot, in the vicinity of

750 K. Its heavy atmosphere is composed largely of carbon dioxide, creating a surface atmospheric pressure of nearly 100 times that on Earth. Conditions on Venus are so inhospitable that none of the half a dozen Soviet spacecraft survived more than a few hours after making a soft landing on the planet.

Venus is continually veiled by an unbroken, pale-yellow cloud cover that appears to be featureless at visible wavelengths. In the ultraviolet region these clouds display a complex pattern of bright and dark swirls. Both the clouds and the planet rotate in the retrograde direction. The upper clouds rotate with a period of about four days, driven by 360 km/hr winds at the equator, while the planet itself moves at the much slower rate of one rotation in 243 Earth days. Venus' slow rotation is thought to be the reason why there is no detectable magnetic field around the planet.

In December 1978 the Venusian atmosphere was extensively analyzed by five Pioneer Venus probes during their short plunges on various trajectories through it. Using radar, the Pioneer "bus" orbiter has produced a complete topological map of Venus. Initial results of these experiments have been published recently.^{4,7}

The Pioneer Venus space probes discovered that the cloud cover enveloping Venus has three distinct layers, extending vertically from 48 to 70 km above its surface. The upper cloud region contains droplets of an 85% aqueous solution of sulfuric acid. There are liquid droplets and solids of various sizes with uncertain chemical composition in the middle and lower clouds. Below the clouds a thin haze of sulfur dioxide and sulfuric acid extends from 48 km to 32 km. There is no particulate matter in the lower 32 km of the Venusian atmosphere, but visible light is so sharply bent here that looking straight down at the planet from orbit, one could see nothing but an empty sky.

These probes also made extensive measurements on the chemical composition and isotopic distribution of the gaseous components of the Venusian atmosphere using ion and neutral mass spectrometers and gas chromatographs.

Interaction between components of the upper atmosphere and the solar wind produces numerous ionic species. Of the 11 ions detected, the most abundant above 200 km are O^+ and some C^+ , N^+ , H^+ and He^+ , whereas at the 150 km level the O_2^+ is the dominant species with minor amounts of NO^+ , CO^+ and CO_2^+ .⁸

As for neutral molecules and atoms, helium is the highest detectable substance, being found as far away as 700 km from the planet. Carbon dioxide appears at 450 km and becomes the dominant species below 200 km. The atmospheric composition at 150 km above the surface is seen in Table 1.

TABLE 1*

Component	Particles/cm³
Carbon dioxide	1.1×10 ⁹
Carbon monoxide	2.4×10 ⁸
Molecular nitrogen (N ₂)	2.1×10 ⁸
Atomic oxygen (O)	6.6×10 ⁸
Helium	2.0×10 ⁶

*Data taken from Endnote 9.

In addition to these, measurable quantities of sulfur dioxide were found at the 70 km level. The composition of the lower portion of the Venusian atmosphere (25-54 km above the surface) is seen in Table 2.

TABLE 2*

Component	Approximate percent of total
Carbon dioxide	96.4
Nitrogen	3.4
Water	0.14
Molecular oxygen (O ₂)	?
Argon	67×10 ⁻⁴
Carbon monoxide	20×10 ⁻⁴
Neon	4.3×10 ⁻⁴
Sulfur dioxide	185×10 ⁻⁴

*Data taken from Endnote 10.

Currently available data analyses do not permit the unequivocal identification of molecular oxygen. Its presence in measurable quantities would be a surprise to scientists who assume that most planets are surrounded by a reducing atmosphere resulting from outgassing processes from the planet's interior. Photodissociation of water and the subsequent escape of hydrogen could conceivably give rise to oxygen on Venus, were it not for the low rate of hydrogen escape, 10⁷/cm² sec. This has prompted the conclusion that "if Venus ever possessed a large amount of water, it cannot have lost it by escape mechanisms known to be operating now."¹¹

A major surprise was the finding of 2-300 times as much ²⁰Ne and ³⁶Ar in the lower atmosphere of Venus than on Earth.^{12,13,14} These particular isotopes of inert gases are not decay products of radioactive elements, and as such they are assumed to have been present since the formation of the planet. At the same time, the abundance of elements lighter than argon, such as ¹⁴N or ¹²C, are about the same in Venusian atmosphere as in our own. These data necessitated a departure from previous thinking, causing scientists to conclude that "primordial" noble gas abundances do not give adequate estimates of other volatiles in a planetary atmosphere.¹²

On the basis of low levels of primordial noble gas concentrations in our atmosphere, evolutionary theorists suggested that the original atmosphere of Earth was lost, followed by outgassing of a secondary atmosphere from the interior of the planet. This widely accepted notion will have to be

reevaluated in the light of the findings above. Earlier studies of the atmosphere of Mars by the Viking probes showed that both the ^{36}Ar to ^{40}Ar ratio and the total abundance of argon are significantly lower there than in Earth's atmosphere, even though the abundances of other gaseous components, such as nitrogen, are comparable. A straightforward application of the "solar nebula" hypothesis would have predicted similar argon concentrations for both planets, since they were supposed to have been condensed out of the same nebula at close proximity.

To account for the actual findings, theorists suggested that perhaps nitrogen was somehow more effectively bound in the interior of Mars than was argon during the formation of the planet. When argon outgassed, it was swept away by an energetic "early" solar wind. By the time the Martian nitrogen was released into the atmosphere, this energetic solar wind had subsided.

This same scenario should also apply to Venus, which, like Mars, possesses only a weak magnetic field, permitting in theory the close approach of the hypothetical, early energetic solar winds. The prediction was that the argon content of Venus would be similar to that of Mars. The actual results were totally unexpected. Compared to Mars, Venus showed an increase in primordial argon content. More recently a new concept has been proposed, postulating that perhaps the temperature of the solar nebula was fairly even during planet formation. This permits the existence of an increase in noble gas concentration toward its center.¹⁵ However, this proposal does not predict the uniform ^{12}C and ^{14}N abundances observed in the atmospheres of Venus, Earth and Mars. There is no known basis upon which we would expect a gradient of noble gases to exist in the absence of the same gradient among other gases.

Another perplexing problem is the extremely hot temperature near the surface of Venus. The obvious explanation that the heavy atmosphere of carbon dioxide, water vapor and sulfur dioxide prevent the loss of absorbed radiant solar energies, a "greenhouse" effect, does not appear sufficient to explain the 750 K surface temperatures. Additional sources of energy are needed. One intriguing proposal suggests that compounds with high bond energies would form high in the atmosphere under the influence of sunlight, then would drift downward and decompose near the surface, releasing their chemical energies. In this way, a portion of the sun's energy would reach the Venusian surface in a chemical form. This decomposition energy is one possible cause of the faint glow observed in the lower atmosphere.¹⁶

The surface of Venus has been mapped by radar from the Pioneer Venus orbiter. A variety of surface features can be seen: volcanoes, plateaus, mountain ranges, craters and great valleys. The craters, however, are few

in number and are very shallow perhaps due to a surface softened by heat. A chain of volcanic prominences running north-south for thousands of miles has been seen, some reaching 4 km above the surrounding terrain. The most prominent mountain on Venus is Maxwell, towering alone 12 km above the surrounding region.

Venus lacks the equivalent of Earth's great ocean basins which account for 70% of our planet's surface. As a result, tectonic forces that gave rise to the Venusian mountains are not yet understood. Horizontal movements of crustal plates which are thought to be responsible for plateaus and mountains on Earth also explain the appearance of the corresponding basins.

RECENT DATA FROM JUPITER

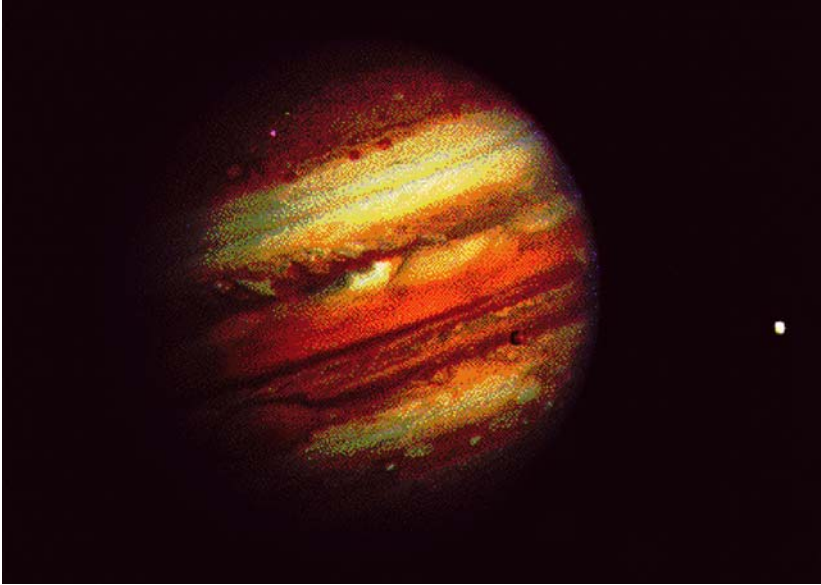
Beyond the orbit of Mars and the asteroid belt, 800 million km from the sun, is Jupiter. Three hundred times more massive than Earth, Jupiter contains about two-thirds of the planetary mass of the solar system. Its elemental composition is thought to resemble that of the sun, but its structure is neither that of a star nor that of an inner planet. It is one-and-one third times as dense as water, presumably composed mostly of gas and liquid with possibly a small solid core of comparatively dense material.¹⁷

Jupiter is surrounded by zones of clouds of alternating light and dark appearance, all oriented parallel to its equator. Infrared measurements by two Pioneer spacecraft reveal that the dark belts are warmer than the light zones. Chemically, the upper atmosphere of Jupiter is made up of hydrogen, helium, ammonia, methane, water and hydrogen sulfide, all colorless substances. Nevertheless, highly colored organic and inorganic compounds and free radicals are believed to form in the upper atmosphere under the influence of the sun's ultraviolet radiation, giving rise to the colored bands that are observed.

In the southern hemisphere is the "Great Red Spot," a 30-40,000 km by 14,000 km reddish vortex, observed by earth-based telescopes to fade and reappear periodically over the past several centuries. It appears to be a gigantic cyclonic disturbance of the atmosphere, hovering over a postulated sea of liquid hydrogen.

Voyager measurements focused on the composition, structure and dynamics of Jupiter's atmosphere, on magnetic field properties, and on the comparative geologies of the Galilean satellites.

The Voyager craft found the dynamics of Jupiter's atmosphere very complex. What appeared from a distance to be a rather stable, multicolored, banded cloud system turned out to be, upon closer inspection, a dynamic system of fast-moving streams, vortices and turbulence undergoing noticeable changes in rotational and lateral motion within hours. Besides the Great Red Spot, a host of light and dark colored spots were observed.



Jupiter, its Great Red Spot, and two of its four largest satellites are visible in this photograph taken February 5, 1979, by Voyager 1. The innermost large satellite, Io, can be seen against Jupiter's disk. Io is distinguished by its bright, brown-yellow surface. At the right of the photograph is the satellite Europa. Picture courtesy of the National Aeronautics and Space Administration.

Some spots were seen to overtake or roll around one another before separating. In view of such turbulence, it is surprising that the Great Red Spot has remained essentially intact for at least the three centuries it has been observed. This unexpected, complex motion invalidates all existing atmospheric circulation models for Jupiter.

Infrared spectroscopy of Jupiter's atmosphere revealed the presence of a wide variety of gases: hydrogen, methane, ethylene, ethane, deuterated methane, ammonia, phosphorus trihydride, water, and germanium tetrahydride. It also showed that the atmosphere above the Great Red Spot is measurably cooler when compared to the areas surrounding it.¹⁸

Pictures taken on Jupiter's night side showed a vast glowing arc over the planet. Huge flashes of light were seen above the cloud tops, each estimated at 10 billion joules of electrical energy. They resemble the "superbolts," seen occasionally above Earth's tropical regions.

Another discovery was a thin flat equatorial ring of particles surrounding Jupiter. Some 30 km thick and 6000 km wide, this ring system appears to reach down to the cloud tops.^{18,19} It consists of particles about 10-100 meters across.

Jupiter's rotation period of just under 10 hours makes it the fastest rotating planet in the solar system, and it is therefore expected to have an intense magnetic field as observed. According to current theories, this magnetic field requires that the planet's interior be a rotating, electrically conductive fluid. Scientists postulate that underneath a 25,000 km deep surface layer of liquid molecular hydrogen, there exists yet another 25,000 km layer of hydrogen in an atomic, liquid, metallic state. This latter layer surrounds the core. This unusual metallic state of hydrogen is brought about by an estimated pressure of three million Earth atmospheres and a temperature near 11,000 K.²⁰

Jupiter has two distinguishable magnetic fields, an inner one which directs particles along a magnetic equator, and an outer field that fans far into space along the rotational equatorial plane of the planet. The inner magnetosphere extends to about 1,400,000 km while the outer field reaches to six and a half million km into space. Both magnetic fields are tilted 11° to the planet's axis of rotation. The strength of the magnetic field at Jupiter's cloud tops ranges from 2-15 G, compared to 0.5 G at Earth's surface. Jupiter's strong magnetic field accelerates electrons and protons to energies thousands of times higher than those observed in the Earth's magnetic belts. The radiation intensities are comparable to those following a nuclear explosion in our upper atmosphere.²¹

Voyager 1 discovered that the inner magnetosphere forms a "flux tube" between Jupiter and one of its moons, Io. Charged particles of oxygen and sulfur flow along this "tube" at the rate of about 10¹⁰/cm² sec, generating a current of about 5×10⁶ A.²²

More than a dozen satellites orbit around Jupiter. The four largest rival the smaller planets in size and are often referred to as the "Galilean satellites." The Voyager missions examined extensively their surface structures. Some of the findings are given in Table 3.

TABLE 3

Satellite	Mean Distance from Jupiter (km)	Density (g/cm³)	Mass (Moons=1)
Io	350,200	3.53	1.21
Europa	559,500	3.55	0.66
Ganymede	998,600	1.93	2.03
Callisto	1,808,600	1.79	1.45

Io is the innermost Galilean satellite, featuring a mottled surface of orange, red, yellow and white, pock-marked with jet-black pits. It is surprising that no impact craters were found on Io, for most planetary bodies devoid of atmosphere are covered with these. Instead, eight active volcanoes were discovered spewing matter 70-300 km into space. The cause of volcanism is suspected to be a gravitational tug of war over Io

between Jupiter on the one hand and Europa plus Ganymede on the other. As Io moves in a slightly eccentric orbit (caused by Europa and Ganymede), tidal bulges on its surface are “pumped” in and out by Jupiter, heating it to temperatures required for volcanism to occur.

Europa appears almost white, reflecting light nearly ten times better than Earth’s moon. Its surface is criss-crossed by stripes and bands, tens of kilometers wide, and some extending thousands of kilometers in length. They appear to be filled fractures in the satellite’s icy crust. This moon’s surface is under a thick mantle of ice which effectively obscures most topographic features.

Ganymede and Callisto have numerous similar features. Both have large areas of dark and bright colors and both are pock-marked with numerous craters, although Callisto’s surface has a greater number of these. One of Callisto’s hemispheres is dominated by a system of concentric rings of grooves. Ganymede’s surface is also covered with ridges and troughs that appear as grooves, except these run in random directions. The grooves on both moons are thought to be caused by tectonic forces.²³

IMPLICATIONS FOR THEORIES OF THE SOLAR SYSTEM’S ORIGIN

The massive amount of new data reveals that the solar system is a much more complex, heterogeneous collection of planets, moons and interacting forces than previously suspected. Venus is a vastly different planetary body than the Earth and Mars. Jupiter and its four Galilean moons also form a complex and possibly unique subsystem.

It is not difficult to perceive that the “presolar or solar nebula” hypothesis neither predicts nor explains many of the recent findings. The very idea of planets condensing out of a cloud of gas and dust is not a secure one. Moreover, it is not at all obvious how planets of such widely diverse properties as Earth and Venus could have condensed out of the same rotating cloud at comparatively close distances to each other. The problem is further compounded when we note the variance in density and apparent composition of Europa and Ganymede, which are theorized to have formed, again at very close range, from the same primordial matter. Since 1644, when Descartes published his vortex theory in *Principia Philosophie*, more than 20 major hypotheses have been advanced to explain the intricacies of the solar system. These are, according to one author, “a record of the versatility of the human mind.”² Another writer summed it up this way:

Each new fact seemed to add to the complexity of the problem. It is clear that the solar system did not originate in a simple manner; in spite of the fact that many of the theories which have attempted to explain it are framed in simple terms. If a theory of the origin of the solar system is to

*be truly complete, it must explain all the facts. This is still extremely difficult, not only because all the known facts amount to such a large and bewildering sum of data, but because many vital facts are not yet known.*²³

Thus we note the frustration of the theorists who attempt to formulate coherent theories of origins in terms of purely natural forces and without invoking the handiwork of a Creator. Yet they press on, convinced that eventually all the data will fall into place.

Creationists observe the orderly orbits of the planets around the sun, the strange admixture of similarities and diversities among the components of the solar system and find harmony between these and their concept of the Creator described in the Bible. Although they too are unaware of the undiscovered aspects of the solar system, given the choice between uniformity and non-uniformity, they would tend to predict that Saturn, Uranus and Neptune will turn out to be quite different from what was seen in the Jovian system. The Creator they know does not use the “assembly line” approach to creation, but rather He is an artist who does variations on a theme.

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ARTICLES

GENESIS 5 AND 11: CHRONOGENEALOGIES IN THE BIBLICAL HISTORY OF BEGINNINGS

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WHAT THIS ARTICLE IS ABOUT

The genealogies of Genesis 5 and 11 have sharply divided biblical scholars into two separate camps. On one side are those who view these chronologies as a descriptive device to demonstrate a lineage from Adam through Noah. By comparing this chronology with others in Scripture, they posit that the time-related statements do not necessarily carry validity. In this paper, the author claims a uniqueness for these chronologies. Calling them chronogenealogies, he postulates that they have special properties and that they are not easily explained away. In his examination of the Masoretic text, the Samaritan Pentateuch, and the Greek Septuagint, he compares the chronologies of each and shows several reasons why each should be considered closer to the original. Because certain manuscripts contain longer time periods between Adam and Noah, these have been adopted by some to add more time to their own studies so that the anomalies they find may be easily fitted into a biblical time frame. Dr. Hasel's study will create uncertainty in this approach.

I. INTRODUCTION

A recent article on biblical genealogies by a scholar who has devoted a doctoral dissertation to the subject of Old Testament genealogies and its ancient Near Eastern setting (Wilson 1977) has stated at the outset:

Both general readers and modern scholars have traditionally neglected biblical genealogies. Most readers have seen the genealogies as unwelcome interruptions in the flow of the biblical narrative, while many scholars have regarded the genealogies as deserts which can be crossed only with great difficulty and which in the end yield little that is interesting or worthwhile (Wilson 1979, p 11).

This statement applies to biblical genealogies in general. An investigation of the so-called genealogies in Genesis 5 and 11 reveals that this is partially true also of Genesis 5 and 11. Yet there are some studies of the modern period (Bosse 1908, p 1-73; Bertheau 1878, p 657-682; Euringer 1909, p 427-459; Jones 1909, 322 p; Fischer 1911, p 241-255; Bork 1929, p 206-222; Jepsen 1929, p 251-255) that must not be neglected aside from the investigations of more recent years (Finkelstein 1966, p 95-118; Malamet 1968, p 163-173; Makloet 1956/7, p 234-236; Meysing 1962, p 26-30; Meysing 1963, p 22-26; Stenring 1965; Johnson 1969; Larssen 1973; Earle 1974, p 15-24; Wilson 1977; Hasel 1979). These investigations indicate a renewed interest in biblical genealogies in general and in Genesis 5 and 11:10-26 in particular.

It is important to consider Genesis 5 and 11 in view of: 1) their unique nature and function in the book of Genesis and in relation to other genealogies, 2) their textual history, and 3) their interpretation. It shall be the purpose of this paper to reflect on the first two of these areas of importance.

II. NATURE AND FUNCTION IN THE BOOK OF GENESIS AND IN RELATION TO OTHER GENEALOGIES

The subject of the nature and function of Genesis 5 and 11:10-26 is of significant importance for a number of considerations. Let us consider several points. It is customary among modern commentators to designate Genesis 5 as the "Sethite Genealogy" (cf. Johnson 1969, p 7-14). In actual fact this is hardly correct for two reasons: a) Genesis 5 is the list of generations from Adam to Noah as verses 1-32 clearly indicate, and b) the superscription informs us otherwise. It reads: "This is the book of the generations of Adam" (v 1). More precisely Genesis 5 is a list of generations of Adam through the line of Seth, his third son.

No genealogy of the generations of Abel is provided in the sacred record, because he appears to have been killed while he was childless. In the case of the oldest son of Adam, namely Cain, the situation is different. In Genesis 4:17-24 the so-called "Cainite Genealogy" is provided. Aside from tracing father-son relationships, it provides information regarding places of settlement (v 17), the introduction of polygamy (v 19), the origin of sheep-breeding (v 20), musicians (v 21) and metal-workers (v 22). In other words it explains the origin of an antediluvian culture in terms of its beginnings. Thus it has its place in the history of beginnings of Genesis 1-11 and beyond. The Cainite line did not survive. It was overwhelmed by the waters of the flood. After Genesis 4 the Cainite line remains outside the purview of the sacred writer, except indirectly in the story of Genesis 6:1-4.

This brief mention of the Cainite genealogy accords with the method of the book of Genesis. However, the carriers of the divine promise receive more detailed treatment than those who do not figure prominently in God's redemptive plan. Let me illustrate this. Later in the book of Genesis the genealogy of the descendants of Abraham through his wife Keturah (Gen 25:1-4) and through his son Ishmael (Gen 25:12-18) are only briefly reported, but a more detailed account is given of Isaac (Gen 25:19-34). Much is reported about him. The same is true of the offspring of Esau in Genesis 36 which provides a succinct listing. The story of the heirs of Jacob is related at length (Gen 37-50), but Esau is never again mentioned in the book of Genesis.

This matter of treatment reveals that the detailed list of descendants of Adam in Genesis 5 has the function of tracing the godly line, the carriers of God's promises from the man God created to Noah, the flood hero, who is the progenitor of the survivors of the flood and thus of postdiluvian mankind (Gen 11:20-26). As such they are the links from creation to the flood and the flood to the Father of Israel, known by the name of Abraham.

It may be suggested that this internal pattern of treatment in the book of Genesis itself is of great importance. This internal function seems more important than the sociological role of genealogies or the function of genealogies in portions of the modern non-Western world (Wilson 1979, p 12-13) or in the ancient Near East (Wilson 1977, p 11-136; Wilson 1979, p 13-18). These latter sources of information are nevertheless valuable and indispensable. They can correct various hypotheses but they can also be misused as exclusive keys to the interpretation of the biblical materials against the setting in which they are found. The view that Genesis 4:17-24, the Cainite genealogy, is a Kenite tribal genealogy (see Ewald 1853-1854, p 5-8; Johnson 1969, p 9-14) can be laid to rest (Wilson 1979, p 19), because of "the relational functions appropriate to linear genealogies" (Wilson 1979, p 19). Nevertheless the methodological issue of the nature of the genealogy within the function in the given text where it is found remains the ultimate norm for its nature and meaning.

A second major aspect relating to the nature and function of the information of Genesis 5 and 11 is a unique feature in these chapters in contrast to the various genealogies in the Old and New Testaments. Genesis 5 and 11:10-26 contain time specifications which provide evidence "for the necessity of distinguishing these from the latter [genealogical] lists" (Johnson 1979, p 28). To be more precise, we have to conclude that among the variety of forms of genealogies in the Old Testament, where we have a great number of them (cf. Gen 22:20-24; 25:1-4, 12-18; 29:31-30:24; 35:16-20; 35:22-26; 39:9-14,40-43; 46:8-27; 1 Sam 14:50-51; 1 Chron 1-9; Ruth 4:18-22), and the New Testament (Matt 1:1-17; Luke 3:23-38; cf. Brown 1977, p 57-95), there are none that have the time features as we find them in Genesis 5 and 11:10-26. In view of this unique phenomenon we must be careful not to interpret the nature of the lists in these two chapters in the same way as in the genealogies in the remainder of the Bible. It may be suggested, therefore, that the designation "genealogy" for the lists in Genesis 5 and 11 does not truly reflect the unique features of these lists which they share with each other in contradistinction to the other biblical genealogies. We suggest a designation that more accurately reflects the nature of the features of Genesis 5 and 11:10-26 by the choice of the name of chronogenealogy. This compound term reflects both the

repeated time elements by means of the word *chrono-* and the linear succession of generations by means of the term *genealogy*.

III. THE NUMBERS AND THEIR TEXTUAL HISTORY

A. Preliminary Considerations

Our attention must turn next to the time elements or chronological aspects of Genesis 5 and 11:10-26 for which there are differing textual recensions. There is a textual history that is evident for these numbers to which we must give attention. This involves primarily an investigation of the Hebrew text (called Masoretic text), the Samaritan Pentateuch and the texts of the Greek Septuagint version.

The informed individual will wonder why we restrict our discussion to the Hebrew text and two major textual recensions of the ancient versions of the Septuagint and the Samaritan Pentateuch when in fact there are other ancient sources from Palestine that contain chronologies that reach back to creation. It has been suggested, for instance, that the Jewish historian of the first century A.D. Josephus “confirms the chronology of the LXX” (Zurcher 1960, p 60) in the sense that the years of the antediluvian patriarchs are 2,656 years (*Ant.* I.3.3-4), which is exactly 1,000 more than in the Hebrew text (MT) and relatively close to the figure of the LXX (Alexandrian text), which has 2,262 years to the flood. In actual fact, however, Josephus contradicts himself at several points. He states in *Ant.* I.3.3:

Now he says, that this flood began on the twenty-seventh day of the second month; and this was two thousand six hundred and fifty-six [2,656] years from Adam the first man; and the time is written down in our sacred books, those who then lived having noted down with great accuracy both the births and the deaths of illustrious men (Whiston’s translation).

It may come as a surprise that the figure of 2,656 years from Adam to the flood is contradicted by Josephus in his enumeration of antediluvian patriarchs and the figures provided which add up for the antediluvian period to 2,256 years (*Ant.* I.2.3-4). Is this but a computational error of 400 years, or is the higher figure actually a reflection of the Hebrew text plus 1,000 years (Jones 1909, p 48)? Is Josephus familiar with the figures of the MT?

A.F. Jones has argued on the ground that the figure 2,656 is but a confusion of the 1,656 of the Hebrew, and that Josephus “was perfectly familiar with the figures of the Hebrew version...[and this] is a testimony to the existence of the Hebrew figures and their being regarded as of value in the first century of our era” (Jones 1909, p 48). Whether or not this is the case, Josephus preserves in the same book (*Antiquities of the Jews*) two more chronologies that conflict with the longer chronology of 2,256

or 2,656 years respectively from Adam to the flood. In a later section Josephus informs the reader that the period from Adam to the flood is 1,662 years (*Ant.* VIII.3.1) and later yet he states that this period is only 1,556 years long (*Ant.* X.8.4-5). This chronological information appears to make it evident that Josephus had knowledge of a longer chronology which corresponds more or less to the LXX recensions of 2,262 (Alexandrinus) and 2,242 (Vaticanus) years *and* conflicting shorter chronologies (Johnson 1969, p 265) which corresponds more or less with the Hebrew text of 1,656 years for the same period of time. Evidently Josephus does not simply confirm the longer chronology of the LXX, but has a long chronology and two conflicting short chronologies which cannot be reconciled with either the LXX or the Hebrew text. We may draw several conclusions at this point regarding Josephus. 1) It seems fairly certain that Josephus was familiar with long and short chronologies. 2) He did not attempt to harmonize them. 3) He may be an indirect witness to both LXX and to the Hebrew text with its shorter chronology. 4) He has contradictory chronological information as regards the time from Adam to his own time. He can speak of a “little short of three thousand years” (*Against Apion* I.8), whereas he has given the time from Adam to the building of the Temple in one place as 2,102 years (*Ant.* VIII.3.1); which was about 1,000 years before his day, and in another place as 3,043 years (*Ant.* X.8.4-5). In short, Josephus does not seem to be of much help in answering the question of the time element in the chronogenealogies of Genesis 5 and 11:10-26.

A brief word shall be accorded to the Book of Jubilees, which is dated from the second century B.C. (Larsson 1973, p 31) to the early Christian centuries. In this work all events from creation to the Exodus are arranged in their chronological order within the framework of jubilees, that is, the periods of seven sabbatical cycles of 49 years. It has been demonstrated that for the period before the flood, the Book of Jubilees follows largely the chronology of the Samaritan Pentateuch (Cassuto 1961, p 265; Larsson 1973, p 59) with a total of 1,306 years (1,307 in the Samaritan Pentateuch), but for the period thereafter it is not in agreement with any other ancient source. The writer of the Book of Jubilees keeps the history within the given frame, i.e., 50 jubilees or 2,450 years from the creation to the Exodus. If the time from the Exodus to Christ is ca. 1,440 years, the total would be 3,890 years, a figure that may be near to that of Josephus' figure of 3,043 from Adam to the building of the Temple, plus 1,100 years from that to the time of Josephus. These figures converge around 4,000 years, plus-minus 200 years from Creation to Christ. But caution is in order in view of the systematization evident in the Book of Jubilees.

B. Biblical Text and Versions

Let us hasten to move on to the biblical text and the ancient versions to which attention is to be accorded from now on. From a methodological point of view we will attempt to follow the basic principle of A. Bosse (1908, p 1-73), F. Thilo (1924), and A. Jepsen (1929, p 251) in contrast to others (Bousset 1900; Fischer 1911, p 241-243) whereby each chronological system is investigated in the form in which it comes to us in relationship to each other without any source reconstruction.

1. The Hebrew Text Compared With the Samaritan Version

The chronology of the Hebrew text is well preserved in the Hebrew textual form. This means that all known Hebrew manuscripts agree in both Genesis 5 and 11:10-26 in the listing of the antediluvian and post-diluvian patriarchs and the respective time information for each one.

The Masoretic Text actually dates in the presently available manuscripts from the ninth century A.D. onward. The famous Dead Sea Scrolls have not yet yielded any manuscript evidence for the relevant sections of Genesis that would predate the MT. This may change once the tens of thousands of fragments from Cave 4 of Qumran are published.

From time to time doubts are entertained regarding the accuracy and faithfulness of the manuscript tradition of the Masoretic text. These can be safely laid to rest upon the discovery of the Dead Sea Scrolls in 1947 and onward, because these discoveries have shown with what meticulous care the books were handed down through the centuries. Thus the age of the manuscripts is not in actual fact a sure sign of the age of the information contained. We have seen already that Josephus seems to witness indirectly not only to the Septuagint version but also to the Hebrew text in his divergent chronological informations.

A unique feature of the Hebrew text is its lack of a scheme or system. The antediluvian patriarchs have relatively long life-spans which do not reflect any pattern, system, or scheme. This is different in the Samaritan Pentateuch, where the life-spans are decreasing (with the exception of Enoch, who is taken to heaven, and thus no life-span from birth to death is available and Noah, whose life-span corresponds more or less to that of Adam). Both share in common their function as the progenitors of postdiluvian and antediluvian mankind.

The year of the first-born again reveals no pattern, system or scheme in the MT. It moves back and forth from Adam to Noah, whereas in the Samaritan text it is decreasing, except for those who are born in the sixty-year range. The figures of the Samaritan text reveal a significant degree of regularity and on this account are much more schematic.

The Samaritan text adapts itself to the flood. The figures from Adam to Mahalalel are identical in the Hebrew and Samaritan texts. But the Samaritan text reduced the great ages for Jared and Lamech by 100 years when they begat their first sons and by 120 years in the case of Methuselah. It adjusted also the life-span of these patriarchs to have them on a declining scale and most of all to have them die before the flood. In the Samaritan system Jared, Methuselah and Lamech died together in the year of the flood.

The evident schematization of the Samaritan recension with the general pattern of decreasing ages of the first-born and decreasing life-spans of the antediluvian patriarchs and the addition of 100 years to the ages of the begetting of the first-born (except for 50 years in the case of Nahor) leads to the supposition that the non-schematic figures of the Hebrew text are original. "So the figures in the Samaritan text may well be explained as alterations from the Hebrew text. But an alteration from the almost perfect Samaritan system to the irregular Hebrew system seems quite incredible" (Larsson 1973, p 57). The scholarly consensus is that "the Hebrew text has preserved the original figures in their purest form" (Euringer 1909, p 15; cf. Jones 1909, p 61; Bosse 1908, p 71-72; Earle 1974, p 23; Jepsen 1929, p 252, only for antediluvian period). Exceptions are those of Bertheau in an essay from 1878, who argues for the priority of the Samaritan Pentateuch over the Hebrew text on account of a system of adding of figures of the first column in the Samaritan text of Genesis 5. One adds from the flood the years of age when the first son was born and arrives at the total age of the respective patriarch (Bertheau 1878, p 664-670). The following chart shows the system:

SAMARITAN PENTATEUCH

	Firstborn	Remaining Years	Total	
Adam	130	800	930	105+90+70+65+500+100
Seth	105	807	912	65+62+65+67+53+500+100
Enos	90	815	905	130+105+70+500+100
Cainan	70	840	910	130+65+62+53+500+100
Mahalalel	65	830	895	130+105+90+70+500
Jared	62	785	847	62+65+67+53+500+100
Enoch	65	300	365	130+70+65+100
Methuselah	67	653	720	67+53+500+100
Lamech	53	600	653	53+500+100
Noah	500			
Flood	100			
	1307 years			

This system only works for the Samaritan text. Therefore, it is said to have priority over the Hebrew text. This is precisely its weakness. The harmonious systematization of the Samaritan text seems to be evidence

for alteration from irregular Hebrew figures. The principle employed for making a decision of priority is that the irregular is prior because there is no reason why something regular is to become irregular.

In 1929 A. Jepsen also argued that the Samaritan text of Genesis 5 has priority over the Hebrew text, because the latter has “the simpler figures” (Jepsen 1929, p 252) when compared with the Samaritan text. We have found this not to be the case. If the system indicated by Bertheau has any value, then the principle of the simpler being the later and the complex being the earlier still holds. Jepsen’s arguments point in the opposite direction and thus he has not found any following (Cassuto 1961, p 254). It appears that the Hebrew text contains the original figures when compared to those in the Samaritan Pentateuch.

2. The Hebrew Text Compared With Textual Recensions of the Septuagint Version

The question before us is whether the textual recensions of the LXX version contain the original figures or whether they are found in the Hebrew text. This is a difficult matter, because scholars who understand the figures of the chronogenealogies of Genesis 5 and 11 to provide guidelines for a short life on earth would, on account of geological, anthropological and primarily historical considerations, wish to adopt the longer chronology of the LXX. These modern concerns are of great importance and provide the key for some interpreters to move into the direction of accepting the longer figures of the LXX, which provide beyond the Hebrew text an additional 1,386 (LXX Alex) or 1,466 (LXX Vat) years respectively from Adam to Abraham. From the flood to Abraham it means 780 (LXX Alex) or 880 (LXX Vat) years in addition to the 292 years given in the Hebrew text. Evidently the LXX figures are attractive for several reasons.

In comparison with the manuscript evidence for both the Hebrew text and the Samaritan Pentateuch for which textual variants are absent (Jones 1909, p 42), the LXX does not fare as well. We have at our disposal two major uncial manuscripts (MSS) of the LXX from the 4-5th century A.D. One MS is that of the Vatican Library called Vaticanus and the other is called Alexandrinus.

It would be well to discuss the variants in these textual recensions. The two LXX MSS disagree in the age at the son’s birth in the case of Methuselah. LXX Alex (also D,E,M and many LXX miniscules) agrees with the MT that Methuselah’s age at the birth of his first son was 187 years, but LXX Vat (pm) deducts 20 years and gives 167 years without reducing the total life-span of 802 years. The end result is that according to LXX Vat, Methuselah outlived the flood by 14 years. Later MSS make a correction of the total life-span to 782 years, “in order to avoid the awkward situation of placing the death of Methuselah after the Flood” (Johnson

1969, p 264, n 2). Jerome (c. 345-c. 419) does not seem to have known any LXX MS with the figures 187 and 782 respectively (Migne S.L 23.3.col.955; Preuss 1859, p.33 as cited by Bertheau 1878, p 671) which seem to have been widely used since the time of Origen (3rd century) (Bertheau 1878, p 671).

A second textual variant involving figures occurs in the postdiluvian period. Nahor's age at the birth of his first son is given as 79 years in LXX Alex, but as 179 in LXX Vat. The additional 100 years reflect the usual custom of adding 100 years. In the cases of both Methuselah and Nahor it is exactly 100 more than the years of birth of the oldest son in the Samaritan Pentateuch, which has 67 and 79 years respectively (see chart below). These additions account for the differing figures from Adam to the flood, namely 2,262 in LXX Alex and 2,242 years in LXX Vat.

Another unique feature of the LXX is the introduction of a Cainan in the list of generations from the flood to Terah. After Shem and Arpachshad a second Cainan is listed who lived 460 years and who was 130 years when his first-born son was born. The puzzle of this Cainan remains largely unresolved.

This Cainan does not appear in the Hebrew text, neither is he found in the Samaritan Pentateuch, Vulgate, or Syriac versions. Josephus does not have him either. He is found in the Book of Jubilees. M.D. Johnson suggests that "the LXX interpolates Cainan between Arpachshad and Shelah" (Genesis 11:13b), making the parallel between the two lists [of Gen 5 and 11] more obvious" (Johnson 1969, p 25, n 2). U. Cassuto regards it as "a later interpolation of no value" (Cassuto 1964, p 251) and refutes the suggestion that the LXX list is the original form of the text in order to arrive at ten generations from Shem to Terah. "The tenth generation is not that of Terah but of Abraham" (Cassuto 1964, p 251 against Bork 1929, p 209). There is apparently no reason to insert this second Cainan in the Hebrew text and the Samaritan Pentateuch (with Euringer 1909, p 445 against Fischer 1911, p 244). Whether he goes back to an ancient tradition (Bork 1929, p 209) remains a moot question. The Book of Jubilees (8:1-5), which is generally thought to be dependent upon the LXX in certain figures, is the only ancient extra-biblical document which has this second Cainan. Whereas the LXX gives the figure of 130 as the age of Cainan at the time of the first-born, the Book of Jubilees assumes the figure of 57 years (Bork 1929, p 222).

Is this second Cainan a historical figure? Why do we find this name in the Septuagint manuscripts? The reason for the insertion of the second Cainan is difficult to come by. In view of the schematization evident in the figures of the LXX, it has been suggested that Cainan was inserted in order to arrive at a figure which comes up with 4,260 years from creation

to the building of the Solomonic Temple (Bosse 1908, p 76). In this case the assumption is that behind the figures in the LXX is a symbolic meaning.

Alternatively it may be suggested that a scribal error is the cause of the second Cainan in the LXX. The eye of a copyist may have inserted from memory after the words “and became the father of...” in verse 12 the name Cainan mentioned in Genesis 5. The figures for Cainan and for Shelah who follows are identical. In this case we have a homoioteleuton for the figures.

The second Cainan of Genesis 11 in the LXX calls for a little further consideration in view of the fact that this name also appears in other genealogical lists of the Old Testament according to the LXX version. In Genesis 10:24 this Cainan also appears in the LXX MSS as a part of the Table of Nations. He appears again in 1 Chronicles 1:18,24, according to a number of LXX MSS, whereas others omit him.

At this time a word regarding the appearance of this Cainan in the genealogy of Jesus in Luke’s list may be in place. In Luke 3:36, according to the majority reading of MSS, we find the words “of Cainan.” It is not certain whether Luke found this name in his source or whether it was later added by copyists. The contemporary first century A.D. authors of Luke, such as Philo and Josephus, do not have this second Cainan. In 1 Chronicles 1:18, 24 the MSS of the LXX are divided; some contain it and some do not. For instance, the uncial Codex D does not have these words. It has, therefore, been suggested that it is likely that the words “of Cainan” were later added (Euringer 1909, p 444) in the Luke MSS.

Turning our attention from textual variants in the LXX MSS to a consideration of the figures in the LXX as compared to the Hebrew text, a number of observations are in order. The LXX has a far greater schematization and regularity than the Hebrew text (and the Samaritan Pentateuch). We observe that in both the antediluvian and the postdiluvian lists the LXX regularly has 100 years more for the ages at the begetting of the first-born sons, except where we have a textual variation between 79 (LXX A) and 179 (LXX B) in the case of Nahor. Consistent exception to the addition of 100 years is found in the cases of Jared, Methuselah, Lamech, Noah, Shem, Terah, and Abraham.

The second point in the systematization of the LXX is observable in the fact that the years of life subsequent to the birth of the first-born son for each patriarch is 100 years shorter in the antediluvian period, but the total life-span in this list (Gen 5) is the same as in the Hebrew text, except for the case of Lamech. The small alteration in the case of Lamech may be due to the LXX desire to place his death and that of Methuselah in the year of the flood.

The third point of systematization is evident in the fact that the LXX has a consistent decrease of ages at the begetting of the first-born son until we reach Jared (230, 205, 190, 170, 165, 162), signifying a “going down” (Cassuto 1961, p 265), and thereafter there is a steady increase until we reach Noah (162,165,187,188, 500). In the postdiluvian period we observe again the same alternating pattern of decrease-increase in the ages at begetting (135, 130, 130, 134, 132, 130, 79 [or 179 for LXX B]), whereas the pattern of total life-span is steadily decreasing with the exception of Eber in LXX A or Nahor in LXX B.

A comparison of the years of death in relation to the births of the patriarchs is also instructive. The Hebrew text does not reveal any pattern or order in this point. Irregularity is the mark of the Hebrew version. The LXX reveals as also the Samaritan Pentateuch that “the deaths of the patriarchs fall in the same approximate order as their births” (Larsson 1973, p 58). For instance, in the Hebrew text, Shem, Shelah and Eber died after Abraham. Likewise Shem was still alive when Jacob was an old man and Noah did not die before Abraham was almost sixty years old. This situation is changed in the LXX. The deaths of the postdiluvian patriarchs occur in the approximate order of their births, which means a relatively regular sequence of the years of death.

What may be the cause for the divergences between the figures of the LXX MSS and those of the Hebrew? On the hypothesis that the LXX preserves the original figures, it is argued that the Masoretic (Hebrew) text used a subtraction method compared to the tradition provided in the LXX chronology (Zurcher 1960, p 50-55). One major reason for the subtraction method is a supposedly six-thousand year millennial speculation of Persian origin. But this has been cited as the very reason for the longer LXX chronology (Bork 1929, p 214-215). It has been suggested by Bork that the chronology of the Masoretic (Hebrew) text argues against Persian speculations, which at the same time would suggest that “it was produced before Alexander the Great” (Bork 1929, p 218), i.e., before the LXX was produced.

However that may be, the majority scholarly opinion holds that the less schematized and the more irregular chronology has claim to originality. It will have to be admitted that the LXX has by far the more symmetrical, schematic chronology. This we are forced to note time and again. The reasons for the addition of time in the LXX version may never be known with any fair degree of certainty. It may be conjectured (see Larsson 1973, p 58-59) that the LXX translators who are known to have produced their work in Alexandria, Egypt, were influenced (also) by the Egyptian chronology of Manetho. Manetho produced his chronology of the Egyptian Pharaohs at least a half a century before the LXX translators began their

		HEBREW				
Gen. 5	Antediluvian Patriarchs	1 Birth A.M.	2 First- Born	3 Rest	4 Total	5 Death A.M.
1	Adam	0	130	800	930	930
2	Seth	130	105	807	912	1042
3	Enosh	235	90	815	905	1140
4	Kenan	325	70	840	910	1235
5	Mahalaleel	395	65	830	895	1290
6	Jared	460	162	800	962	1422
7	Enoch	622	65	300	365	—
8	Methuselah	687	187	782	969	1656
9	Lamech	874	182	595	777	1651
10	Noah	1056	600	—	950	2006
	Date of Flood		1656			
Gen. 11	Postdiluvian Patriarchs		2			
1	Shem	1556		500	600	2156
2	Arpachshad	1658	35	403	438	2096
	Kenan (LXX)	—	—	—	—	—
3	Shelah	1693	30	403	433	2126
4	Eber	1723	34	430	464	2187
5	Peleg	1757	30	209	239	1996
6	Reu	1787	32	207	239	2026
7	Serug	1819	30	200	230	2049
8	Nahor	1849	29	119	148	1997
9	Terah	1878	70	135	205	2083
	Flood to Abra(ha)m	1948	292			
	Creation to Flood		1656			
	Total to Abra(ha)m		1948			

		SEPTUAGINT VATICANUS				
Gen. 5	Antediluvian Patriarchs	1 Birth A.M.	2 First- Born	3 Rest	4 Total	5 Death A.M.
1	Adam	0	230	700	930	930
2	Seth	230	205	707	912	1142
3	Enosh	435	190	715	905	1340
4	Kenan	625	170	740	910	1535
5	Mahalaleel	795	165	730	895	1690
6	Jared	960	162	800	962	1922
7	Enoch	1122	165	200	365	1487
8	Methuselah	1287	167	802	969	2256
9	Lamech	1474	188	565	753	2227
10	Noah	1	662	600	—	—
	Date of Flood	2242				
Gen. 11	Postdiluvian Patriarchs		2			
1	Shem					
2	Arpachshad	2244	135	400	535	2779
	Kenan (LXX)	2379	130	330	460	2839
3	Shelah	2509	130	330	460	2969
4	Eber	2639	134	270	404	3043
5	Peleg	2773	130	209	339	3112
6	Reu	2903	132	207	339	3242
7	Serug	3035	130	200	330	3365
8	Nahor	3165	179	125	304	3469
9	Terah	3244	135	205	340	3549
	Flood to Abra(ha)m		1172			
	Creation to Flood		2242			
	Total to Abra(ha)m		3414			

Figures in bold type indicate textual variants.

SEPTUAGINT ALEXANDRINUS

Gen. 5	Antediluvian Patriarchs	1 Birth A.M.	2 First- Born	3 Rest	4 Total	5 Death A.M.
1	Adam	0	230	700	930	930
2	Seth	230	205	707	912	1142
3	Enosh	435	190	715	905	1340
4	Kenan	625	170	740	910	1535
5	Mahalaleel	795	165	730	895	1690
6	Jared	960	162	800	962	1922
7	Enoch	1122	165	200	365	1487
8	Methuselah	1287	187	782	969	2256
9	Lamech	1474	188	565	753	2227
10	Noah	1662	600	—	—	—
	Date of Flood		2262			
Gen. 11	Postdiluvian Patriarchs		2			
1	Shem	22				
2	Arpachshad	2264	135	430	565	2829
	Kenan (LXX)	2399	130	330	460	2859
3	Shelah	2529	130	330	460	2989
4	Eber	2659	134	370	504	3163
5	Peleg	2793	130	209	339	3132
6	Reu	2923	132	207	339	3262
7	Serug	3055	130	200	330	3385
8	Nahor	3185	79	129	208	3393
9	Terah	3264	70	135	205	3469
	Flood to Abra(ha)m		1072			
	Creation to Flood		2262			
	Total to Abra(ha)m		3334			

SAMARITAN PENTATEUCH

Gen. 5	Antediluvian Patriarchs	1 Birth A.M.	2 First- Born	3 Rest	4 Total	5 Death A.M.
1	Adam	0	130	800	930	930
2	Seth	130	105	807	912	1042
3	Enosh	235	90	815	905	1140
4	Kenan	325	70	840	910	1235
5	Mahalaleel	395	65	830	895	1290
6	Jared	460	62	785	847	1307
7	Enoch	522	65	300	365	—
8	Methuselah	587	67	653	720	1307
9	Lamech	654	53	600	653	1307
10	Noah	707	600	350	950	1657
	Date of Flood		1307			
Gen. 11	Postdiluvian Patriarchs		2			
1	Shem					
2	Arpachshad	1309	135	303	438	1747
	Kenan (LXX)	—	—	—	—	—
3	Shelah	1444	130	303	433	1877
4	Eber	1574	134	370	504	2078
5	Peleg	1708	130	109	239	1947
6	Reu	1838	132	107	239	2077
7	Serug	1970	130	100	230	2200
8	Nahor	2100	79	69	148	2248
9	Terah	2179	70	135	205	2384
	Flood to Abra(ha)m		942			
	Creation to Flood		1307			
	Total to Abra(ha)m		2249			

Legend: 1. A.M. (anno mundi) year of birth; 2. Age at first son's birth; 3. Subsequent years of life; 4. Total years of Life; 5. A.M. (anno mundi) year of death

work. His chronology, which incidentally is also a key in modern chronological schemes by Egyptologists, dated the first "historical" Pharaohs to about 3,000 years earlier, so that the flood could not have been until before that time. This meant a lengthening of the Hebrew chronology which appears to have been achieved by adding the additional 100 years to the patriarchal ages at the begetting of their first-born sons. The extra Cainan in the postdiluvian period also contributed to reaching a period of time approximate to that of the Egyptian chronology. In this process of addition a certain systematization could be achieved which removed the irregularity of the Hebrew text. In this process the period of time from creation to the flood was lengthened by 606 years (LXX A) or 586 years (LXX B) respectively which means that creation took place not in the year 1656 before the flood (MT) but in the year 2262 or 2242 (LXX) respectively. More significant for historical reasons is the longer period of time being added since the flood, which, in place of the short 292 years from the flood to Abraham, in the MT has 1,072 (LXX A) or 1,172 (LXX B) years, thus reaching 3,334 or 3,414 years respectively from creation to Abraham. The Samaritan system is closer to that of the MT by the total figure of 2,249 years from creation to Abraham as compared to the 1,948 years of the MT.

In summary, the conclusion to be reached is that the MT has a non-schematic presentation of figures, whereas the Samaritan Pentateuch and the LXX version give evidence of schematizations with the LXX being the most schematized. If the principle of order and schematization is invoked as that of later reflection, then the systems of figures in both the Samaritan Pentateuch and the LXX versions are later than that of the MT. If it is possible to convince oneself that the purpose of the MT is to bring irregularity and non-system out of regularity, schematization and system, then both the LXX and the Samaritan Pentateuch may be conceived to have priority over the Hebrew text. Unfortunately, at the present it is impossible to decide on the basis of external MS evidence which figures have priority and can claim originality. There is evidence for both systems of figures, the MT and the LXX, for at least to the time of the 1st century A.D. A significant point of weakness in the LXX figures is the textual variation found in certain LXX MSS. On the whole, it does not seem possible to argue with absolute certainty whether the MT or the LXX has priority, even though certain considerations are available that seem to point more strongly in one direction than in the other.

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NEWS AND COMMENTS

GEORGIA HOUSE BILL 690

For more than a year, the State of Georgia has been a battleground for the controversial subject of origins. Representative Tommy Smith introduced a bill into the General Assembly mandating the “teaching and presentation of scientific creationism in public schools if the theory of evolution is taught.” Forty representatives signed the proposal as co-sponsors, and after a public hearing in August, House Bill 690 was sent to the House education subcommittee.

The bill did not represent the first attempt in Georgia to win equal time for creation. Some creationist literature had been included among the textbooks approved by the Georgia Department of Education, and creationism as an alternative theory to evolution had already been introduced into the curriculum of two of the largest public school systems in Georgia — DeKalb and Cobb counties. These inroads resulted primarily from the efforts of CAVE (Citizens for Another Voice in Education), a group organized in large part by Charlie and Kathy Sills of Cobb county. Even while H.B. 690 was pending in the House, eleven other counties joined in endorsing a balanced, two-model approach to origins.

Much publicity was given to the bill. Advocates included the State Parent Teacher Association (representing over 200,000 parents), the Georgia Baptist Convention and other fundamentalist Christian groups, and individuals such as Braswell D. Deen, Jr., Chief Judge of the Georgia Court of Appeals. Repeatedly they stated their concern for the loss of absolute values resulting from the dominance of humanistic principles in the schools. The teaching of evolution, with its concepts of evolving origins and evolving ethics, was cited as the cause of permissiveness which in turn led to an increase in crime.

Although it appeared that H.B. 690 would not encounter some of the difficulties experienced by similar legislation in other parts of the United States, the bill was not completely free from dissenters. As the opening of the 1980 legislative session approached, opposition intensified. In November, the American Atheists Association, led by Madalyn Murray O’Hair, opened an Atlanta chapter to combat H.B. 690. Other opponents included the State Department of Education, the State Board of Education, the Georgia Education Association, and the American Association of University Professors.

Along with accusing H.B. 690 supporters of attempting to include religion under the guise of scientific theory, some opponents also argued that decisions regarding classroom curriculum and instruction should be

made by the local school board instead of the state legislature. Proponents of the bill responded by insisting that because their wishes were being ignored on the local level, the state must mandate the academic freedom to teach alternative views and make provisions in the curriculum by which these views can be taught.

In February the House education subcommittee, chaired by Cas Robinson, sent H.B. 690 to the full committee, but not before making a significant change in the wording: the term “scientific creationism” was replaced by “divine creationism.” Debate in the House produced further changes when the word “divine” was dropped and the phrase “by God” was inserted after the words “creation” and “created.” This revised form was approved in the House by a vote of 136 to 30.

The following month, after a 40-minute debate, the Senate passed H.B. 690 by a vote of 46 to 7. Although some critics protested that the measure was unconstitutional, the debate was dominated by those who saw no church-state conflict. State Senator Hugh A. Carter, chairman of the Senate Education Committee, commented that since the Constitution of Georgia included the phrase “relying on the protection and guidance of almighty God,” he could see nothing wrong with saying “creation by God.”

Other senators also argued for the teaching of creation. State Senator Lawrence Stumbaugh said that school children were not being taught both sides of the story, and State Senator Ted J. Land added that when the children are taught a view of origins that differs from the theory they have learned in church and Sunday school, “they become confused. They don’t know what to believe.”

When H.B. 690 was sent back to the House for approval in its revised form, it came within one vote of passage. It was then sent to a conference committee for a compromise draft. The committee gave parents the option of choosing the two-model approach, and families that objected to having their children taught about creation would be allowed to have them excused.

On the last day of the 1980 legislative session, the Senate approved the compromise version, but the House did not have a chance for a final vote before the session adjourned. Undaunted by this setback, supporters of the two-model approach to origins believe they have amassed enough public interest and support to win legislative passage next year.

Katherine Ching

LITERATURE REVIEWS

Readers are invited to submit reviews of current literature relating to origins. Mailing address: ORIGINS, Geoscience Research Institute, 11060 Campus St., Loma Linda, California 92350 USA. The Institute does not distribute the publications reviewed; please contact the publisher directly.

A METHODOLOGICAL MANUAL

HOW TO THINK ABOUT EVOLUTION AND OTHER BIBLE-SCIENCE CONTROVERSIES. L. Duane Thurman. 1978. Downers Grove, IL: InterVarsity Press. 144 p.

Reviewed by Richard D. Tkachuck, Geoscience Research Institute

There are times when a reviewer questions his own competence. Doubts arise when after finishing the text he finds no significant criticism of the material and in fact wishes he had written it. Thurman has produced such a book.

Thurman's audience is the high-school and college student faced with the teaching of evolution which is in conflict with his/her religious background. Speaking to a Christian audience, the author begins by outlining the political controversies that started with Scopes in Tennessee, then moves to the California and Indiana school board problems. From these and several other examples, he demonstrates that the basis of the controversy is more a result of the two antagonists attempting to develop a position without using the same verbal framework or assumptions. The resulting misunderstandings with the emotional baggage that attends are posited to be the basis of the conflict. The next two chapters are directed towards how science works, data collection, facts, inferences, and interpretation. He clearly states that while facts must be used to gain inferences of information beyond the facts, these necessary inferences are freighted with potential error; thus, the limits of science are defined.

Thurman devotes two chapters to microevolution and macroevolution. These chapters are an excellent case study of the philosophical methods previously outlined. In the microevolution section he shows the factual basis for change within biological systems and establishes an area of wide agreement with those on both sides of the creation-evolution controversy. In the chapter on macroevolution, he brings clearly to the fore the real basis for the differences between the two sides. Using evolutionary authorities he attempts to establish the difficulty of demonstrating change at higher phylogenetic levels and clearly shows the liability

of making conclusions on the basis of incomplete data. In this, as in other chapters, his effort is not an exhaustive explanation of the data, but rather a philosophical framework for dealing with data.

The final chapters discuss the various theories of creation, and the book ends with a plea for the reader to listen to different ideas and to respect other opinions as being honest attempts in the search for truth.

The book might be faulted because it deals mainly with the speciation process and largely ignores creationist problems in such sticky areas as the geologic column and dating mechanisms. However, the author's intent was not to answer problems but to provide a methodology whereby the reader is able to approach any difficult area. In fact, the author emphasizes this facet to the exclusion of mentioning his own personal beliefs. This is a frustrating yet cunning ploy which drives the student to determine for himself what methods he uses to establish his own belief system.

The book is remarkably free from errors with the possible exception being the statement on p 121 that present life forms are largely dissimilar from fossil forms. For many mammals this is not the case. Also, the chart on p 96 seems too simplistic for the concepts presented. These do not distract from the text in a significant manner.

This book is written primarily for creationists, and I hope that Thurman will write a companion volume with the evolutionist as his intended audience. Such a book, if widely read, would do much to eliminate the acrimony and misunderstanding between the two camps.

How to Think About Evolution and Other Bible-Science Controversies is strongly recommended for classes in philosophy of biology and creationism.

GENERAL SCIENCE NOTES

PUBLIC OPINIONS REGARDING CREATION AND EVOLUTION

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A number of polls have been completed by various organizations endeavoring to assess the public's opinion regarding the theories of creation and evolution; specifically, opinions regarding the use of the two-model approach (both creation and evolution) in the schools. Most of these studies show that the vast majority of persons are in favor of teaching *both* creation and evolution in the schools. A handicap of some of these studies is that they were initiated by creationist groups which had a vested interest in supporting their position. Another handicap is that generally phone surveys are used, biasing the sample towards the middle and upper-middle classes — those people who are more likely to have telephones.

Recently, an extensive scientific public opinion poll was carried out by Gallup, one of the most respected poll corporations.¹ Unfortunately, the poll did not directly assess public opinion regarding the teaching of the two-model approach, although it did attempt to assess whether people believe that “God created the first man and woman,” or whether “the first man and woman were descendants of some lower form of primate life.” Specifically the poll asked whether the subject agreed with the following statement: “God created Adam and Eve, which was the start of human life” (Table 1). Presumably, this question separates those who believe that Adam and Eve were distinct creations, from those that feel that mankind descended from a so-called lower form of life.

It was found that about 50% of the population rejected both atheistic evolution and, at least regarding man, theistic evolution. Of those who labeled themselves Evangelicals, 81% agreed with the above quote, and of those who identified themselves as Protestants, 58% agreed. The lowest percent was among Roman Catholics (47% agreed).

Agreement with the poll statement is inversely related to education — the more education one has, the less likely one is to agree with it. Interestingly, the older one is, the more one is likely to agree with the poll statement. These results imply that education may reduce religious values and a belief in creationism. It would follow that the younger persons, because they are, as a whole, better educated than the older persons (and

TABLE 1

**CREATION: Percent of People Who Agree With the Following Quote:
“God created Adam and Eve, which was the start of human life.”**

Comparison by Age	
18 to 29	38%
30 to 49	51%
50 and older	58%
Comparison by Education	
College	33%
High School	55%
Grade School	66%
Comparison by Major Religious Groups	
General Public	50%
Evangelicals	81%
Roman Catholics	47%
Protestants	58%

influenced by the society around them), are *less* likely to believe in creationism. Comparisons by education show a clear difference: 33% of the college graduates agreed with the statement compared to 66% of the grade-school graduates. Nonetheless, as a whole, a significant percent of the population are creationists.

The differences produced by age were not as great as those based on education. Of those in the 18 to 29 age group, 38% agreed with the poll statement compared to 58% of those fifty years of age and older. This supports the contention that the younger people are less religious than the older generation, and because younger people spend more time in school, that education may adversely influence religious beliefs. Such a result would probably be expected, for the textbooks and lectures in secular schools are often negative towards religion and religious values and beliefs. In addition, the social environment of universities tends to be somewhat antagonistic to religion. This indicates that secular schools are successful in reducing the strength of religious beliefs.

Some would argue that acceptance of creationist beliefs decreases with the more intelligence and education one has, because these factors enable one to overcome myths and find out the “truth.” This, however, is a judgment that is probably unwarranted. Because schools are admittedly indoctrination institutions, we could conclude that they were successful in indoctrinating those under their care. This would seem to violate the various Supreme Court rulings which state that the schools must not proselytize for religion, but, on the other hand, *must not be antagonistic towards religion and religious beliefs*. Those who have spent much time

in secular universities find them to be, indeed as a whole, antagonistic towards religion and religious beliefs, and much of their antagonism is based on lack of knowledge and an inadequate understanding of history. For example, many people assume that Galileo's discoveries were opposed by the church solely for theological reasons, and the church has been blamed for attempting to suppress knowledge. Though Galileo was formally convicted on religious grounds, he had many supporters within the church, and some of the strongest opposition stemmed from secular philosophical and political motives.²

On the basis of the above, there seems to be a need for an empirical investigation relative to indoctrination by secular universities. It seems inconsistent that the public would support an institution which openly proselytizes its own belief structure at the expense of the traditional values of society. If the secular schools are to be truly neutral, it would seem that efforts to remove this anti-religious bias should be expanded.

ENDNOTES

1. As reported by: James W. Reapsome JW. 1980. Religious values: reflection of age and education. *Christianity Today* 24(9):23-25.
2. de Santillana G. 1955. *The crime of Galileo*. Chicago: University of Chicago Press.

EDITORIAL

SUPERNATURAL MATERIALISM

In the current climate of charge and countercharge that is so much a part of the “conversations” between creation-oriented and evolutionary groups, much debate centers around the nature of acceptable evidence. Both groups claim to use the scientific method. While the secular scientist bases his views on what is directly observable through experimentation, the creation scientist claims a larger data base that includes, along with experimentation, the revelation of supernatural events. In the final aspects of this controversy the question eventually boils down to what kinds of data one should include in the analysis of a particular problem. It may be an oversimplification, but the separation of evolutionary and creation ideas pivots around the rejection and acceptance of the presence of the miraculous.

The supernatural has always posed a problem. Those who relate miraculous events generally divide their audience into two groups — the believers and the skeptics. Indifference to the claim for the supernatural is indeed rare. Credulity among the believers depends upon the authority of the individual who reports the event and the lack of dissonance the event causes with their belief system. The skeptic, on the other hand, may either doubt that the event occurred, or, if the event cannot be denied, refutes the interpretation by calling into view the possibility of a mechanism which only uses a currently available body of information.

There is presently a group of supernatural debunkers whose aim is to examine paranormal events such as UFO's, ESP, and psychic prediction. Also included in their purview are the creationists. It is claimed that creationist claims of supernatural intervention in the past history of the earth are unnecessary. The following is a typical debunker's proof that an event is not supernatural. If a person claims to be able to bend spoons with only the power of the mind and an investigator does the same by sleight of hand, then the claimant for the miraculous is a fraud. While I hold absolutely no brief for psychics, spoon benders, or the *National Enquirer* accounts of the strange, I do carry one for creation. It is a false assumption to say that if a phenomenon can be explained by natural causes, then there is no need for God to be involved. In other words, this idea states that if I know of a physical (chemical or biological) law which allows a process to occur, then somehow God is not allowed to use it when He acts.

Perhaps this logical problem can be better explained by the following situation. Suppose that a person came into your home and claimed to be God. The question that you would immediately ask is: How would I know if this statement were true? You could ask for some proof, but what would be acceptable? A personal ID card? Letters of introduction? Ridiculous! Would a miracle be convincing? And if this being accepted your request to perform one, what would you ask to be done? Perhaps bring into existence some object or provide instant transport to some desired place? The possibilities are endless. But what would be enough to provide conclusive proof?

I once had the opportunity of conversing with a professional who attempts to debunk the paranormal. At the end of our conversation, I asked what proof would be enough to convince him in the supernatural. He said that he had often considered the question but had come to no answer. I should like to posit that no event could ever be enough to convince a skeptic of unique abilities. It is little appreciated by most that acceptance of the supernatural is based on situations largely outside the miraculous.

To a believer in creation, the acceptance of Genesis 1-11 is based on the remarkably accurate information from Genesis 12 to Revelation. It is based upon confidence in the lifestyle proposed in this literature as well as information available in Nature. Some may dismiss the above as a religious statement and assert that stating the presence of a God or a creator is the practice of religion. It should be quite clear, however, that the stating of the above does not constitute religion. Religion begins only when man responds to the data. It is unfortunate that some individuals who have responded to the data act out their beliefs in ways that are biased and bigoted. The fact remains, however, that the basic data need be no less valid and useful.

Richard D. Tkachuck

REACTIONS

Readers are invited to submit their reactions to the articles in our journal. Please address contributions to: ORIGINS, Geoscience Research Institute, 11060 Campus St., Loma Linda, California 92350 USA.

RE: TKACHUCK: BEYOND DESIGN (ORIGINS 7:4-5)

The editorial, "Beyond Design," leaves me with a mixed bag of agreements and disagreements, plus a vague feeling that I am being talked down to. There are, without question, faults and weaknesses in the approaches and publications of every one of the creationist organizations. None of us has a monopoly on truth, competence or wisdom. Although I do not agree with all positions adopted by those associated with GRI, I greatly appreciate their general policy of careful research and moderation in interpretation and speculation. I think we need to be careful about labeling others and that we should be always ready to acknowledge what is valid and valuable in the work of each individual and organization.

Now let me interact with several statements. Why should Christians not relate creationism with Christianity and faith statements about Christ? I am a creationist, first of all, because I am a Christian and Jesus Christ, therefore, is Lord for me in everything, including science. I did not become a creationist by the power of my intellect perceiving that the evidence sustains biblical creation. It was the other way around for me. Others have been led to Christ through the evidence for creation, and the Holy Spirit in their cases used this information as one of the means of conversion.

On the other hand I agree that it is a serious fault of attitude to accuse all evolutionist scientists of dishonesty with data and conscious enmity toward God and good. Nevertheless, the Scriptures make it clear that every attribute and power of man is corrupted by the fall, including his intellect. Thus, evolutionists are captive to their philosophical presuppositions, i.e., to their faith or faiths, and these suppositions strongly influence their interpretations of the data of science. Christian creationists function with similar influence from their faith presuppositions. It is hoped that scientists of all philosophical persuasions will freely submit both their data and their conclusions to critical evaluation by their peers. This is only proper science. One of our chief complaints in the public school teaching of origins theories is that the evolutionists and the State insist on protecting evolutionary theories, interpretations, and speculations from criticism. This can only be classified as poor science education.

Again with respect to connecting creation to Christ, to my knowledge only the biblical revelation posits creation of space-time-matter-energy by an

infinite-eternal-personal Spirit. And the Hebrew Scriptures clearly identify this One as Messiah. It is quite proper for Christians to tie creation to Christ. At the same time it should be remembered that different creationist publications are often produced with different audiences or markets in view. A book aimed at strengthening the faith of believers will probably be more explicitly theological than one aimed at altering the mind-set of science-oriented unbelievers. But in the final analysis, no theory or model of origins is devoid of theological (or anti-theological) content. In this respect creation and evolution are equally religious, even as they are equally non-scientific because of their essentially non-falsifiable character.

The editor's remarks relative to the argument from design remind me of the stock "God-of-the-gaps" argument against God and creation. Supposedly God becomes progressively less necessary as science fills the gaps in its knowledge of nature. But as I see it, the more science reveals about the natural world, the more evidence the Christian has for creation. The editor seems to imply that scientific knowledge of design and function affords logical reason for concluding that there is no Designer. Michael Polanyi refuted this view by showing that all machine or machinelike design in either inanimate or animate objects "constitutes a boundary condition, which as such transcends the laws of physics and chemistry." He went on to say, "It may seem unbelievable, but it is yet a fact, that for 300 years writers who contested the possibility of explaining life by physics and chemistry argued by affirming that living things are *not*, or not wholly, machinelike, instead of pointing out that the mere existence of machinelike functions in living beings proves that life cannot be explained in terms of physics and chemistry" (M. Polanyi. 1967. Life transcending physics and chemistry. Chemical and Engineering News, 21 August, p 64, 65).

It is both logical and scientifically valid, we contend, to believe that until evolutionists actually demonstrate spontaneous chemical-physical origin of the designs seen in living things, all new discoveries by science of design in biology support the concept of intelligent, purposeful design, i.e., special creation.

Robert E. Kofahl
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RE: ORIGINS

Thanks for another excellent issue of ORIGINS. I certainly appreciate the fact that your journal specializes in field and laboratory research papers.

George F. Howe
President
Creation Research Society

RE: HASEL: GENESIS 5 AND 11: CHRONOGENEALOGIES IN THE BIBLICAL HISTORY OF BEGINNINGS (ORIGINS 7:23-37)

I read through the article in vain for the *data* advertised by its abstract, q.v., “in an attempt to synchronize discrepancies in the geological and archaeological literature with the genealogies of Genesis, some have postulated the accounts in Genesis 5 and 11 to be taken only as lineage statements. The author presents data to challenge this view.”

What Hasel does do (after noting the nature and function of these genealogies) is to review the well-known data that makes it difficult to claim priority for the longer patriarchal ages of the LXX over against the shorter patriarchal ages of the MT. That is the author’s contribution which should have been highlighted in the abstract.

Lawrence T. Geraty
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ARTICLES

THE MEANING OF THE CHRONOGENEALOGIES OF GENESIS 5 AND 11

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WHAT THIS ARTICLE IS ABOUT

In Origins 7:23-37, Dr. Hasel presented arguments showing that the genealogies found in Genesis 5 and 11 were unique to biblical literature and that they should be read as given. This companion article further examines these chronogenealogies and the meaning of the literary figures used in the text. Using literary and archaeological-historical data, Dr. Hasel compares the biblical text to extrabiblical literature and history. Also included are analyses of other theories of interpretation.

I. INTRODUCTION

The study of Genesis 5 and 11 reveals that the question of the meaning of the genealogies is very complex. This complexity is highlighted by the fact that there are various textual recensions of the chronological data and numbers (Hasel 1980) and by the fact that “the principal sources” (Kitchen 1966, p 35) of the chronological data for both the antediluvian and post-diluvian periods are present only in these two chapters. Furthermore, the comparative material relating to genealogies within and outside Scripture renders Genesis 5 and 11 unique in the Bible and the ancient Near East (Hartman 1972; Hasel 1978), because in no other case is the literary form “genealogy” joined with chronological information as it is in these two chapters. This phenomenon has led scholarship to distinguish Genesis 5 and 11:10-26 from later genealogical lists (Johnson 1969, p 28) in both the Old (cf. 1 Chron 1-9; Ezra-Neh) and the New Testaments (cf. Matt 1:1-17; Luke 3:23-33). In recognition of this unique literary form with time specifications, these genealogies in Genesis 5 and 11 are designated as “chronogenealogies.” The joining of the lines of descent with time aspects has had and still has a determining function in the discussions of the meaning of these chapters. This must continue to be important on methodological grounds, because a unilinear comparison of genealogies — whether biblical or nonbiblical — that lack the combination of line of descent and life spans with Genesis is an inadequate procedure for uncovering the true meaning of Genesis 5 and 11:10-26.

Today’s scholarship has a radically new attitude toward chronological data provided in the Bible. The critical attitude of an earlier generation of scholars, such as was typical of Julius Wellhausen and his followers at

the turn of the century who viewed chronological information in the Bible as mere window dressing to enhance the verisimilitude of the historical vehicle of Bible writers for their expression of faith, is no longer in vogue. The change was caused by the fact that in the past five decades the accuracy of the chronological information in the Bible, particularly in the Old Testament, was verified repeatedly. "The most impressive example of this is seen in the work of E. R. Thiele on the records of the kings of Israel and Judah" (Oswalt 1979, p 673), who has demonstrated that the mysterious numbers of the Hebrew kings (Thiele 1965, 1977) reveal an "uncanny accuracy of the recorded figures" (Oswalt 1979, p 673) and provide correlations with dates and events in the history of the ancient Near East.

The fantastic breakthrough in the chronology of the Hebrew kings that had defied any kind of real solution for two millennia may serve as an encouragement not to dismiss too easily chronological data in other parts of Scripture, including the figures of Genesis 5 and 11. The chronological information in Genesis 5 and 11 is data that must not be completely disregarded (see Wilson 1977, p 158-168). It is one of three types of chronological data in the Old Testament. The other types consist of 1) royal annals and chronicles and 2) random chronological statements (e.g., Gen 15:13; Exod 12:40; and 1 Kings 6:1). This article will discuss the meaning of the chronological data in Genesis 5 and 11. A significant number of suggestions have been made about the meaning of the figures and thus about these two chapters, and we will strive to describe and evaluate these attempts. This will mean that both internal (the matters of line of descent and biblical genealogical lists) and external (various archaeological and historical phenomena) data will have to be considered. Once these types of data have received some attention, we will be able to describe briefly and to assess various prominent nonhistorical and historical interpretations of Genesis 5 and 11.

II. DATA RELATING TO THE LINE OF DESCENT

One of the most basic issues in the assessment of the meaning of Genesis 5 and 11 is the question of whether these chapters contain a continuous or discontinuous line of descent.

A. Internal Literary Data: the Formula of Descent

In the words of K. A. Kitchen the formula "'A begat B' may often mean simply that 'A begat (the line culminating in) B'; in this case, one cannot use these genealogies to fix the date of the flood or of earliest Man" (Kitchen 1966, p 39). However, the biblical formula in Genesis 5 and 11 is not simply "A begat B." Instead, with the exception of a few minor variations, it is consistently, "When PN₁ had lived *x* years, he fathered

PN₂. And PN₁ lived after he fathered PN₂ y years, and he fathered other sons and daughters. And all the days of PN₁ were z years.” A reduction of this stereotyped literary formula with its inseparable interconnection of line of descent and years before the birth of the named son followed by the subsequent years of life to simply “A begat B” is an oversimplification. It distorts drastically the components of the formula. This unwarranted procedure leads Kitchen and other interpreters (cf. Green 1979, p 49-50, and followers) to argue that the line of descent in Genesis 5 and 11 is discontinuous.

The formula of descent in Genesis 5 and 11 manifests a rather fixed literary structure that does not yield to a minimalist reduction. It manifests interlocking components such as descent information with spans of years that are correctly computed in each instance. Indeed, this interlocking nature of the information provided is forceful internal evidence that, instead of having a broken or discontinuous line of descent, the material in Genesis 5 and 11 presents a continuous line of descent. In view of this internal evidence, certain scholars seek time and again to bring external data to bear on the issue. It is mandatory to look at some of the argumentation from archaeology and history.

B. Archaeological-Historical Data

In straightforward language it is noted that the date of the flood at
...about 2300 B.C....is excluded by the Mesopotamian evidence, because it would fall some 300 or 400 years after the period of Gilgamesh of Uruk for whom...the Flood was already an event in the distant past. Likewise the appearing of earliest men...in about 4000 B.C., would seem to clash rather badly with not just centuries but whole millennia of preliterate civilizations throughout the Ancient Near East...(Kitchen 1966, p 36-37).

Before we give attention to the “Mesopotamian evidence” it may be advisable to consider the suggestion that the flood took place at about 2300 B.C. The latter date roughly reflects a computation of the spans of time of the textual recension preserved in the Hebrew text as transmitted by the Masoretes. However, the Hebrew Masoretic text (MT), some major manuscripts of the Septuagint (LXX) versions (manuscripts Alexandrinus and Vaticanus), and the Samaritan Pentateuch have divergent figures. The Jewish historian Josephus of the first century is known to quote from the shorter Hebrew figures as well as from longer ones (Hasel 1980), testifying to the existence of both the Greek and “the Hebrew figures and their [the latter] being regarded as of value in the first century of our era” (Jones 1909, p 48). By adding up the ages of each patriarch at the time of the birth of the named son, the following figures are obtained in the respective textual versions (allowing one year for the flood and one year to the birth of Shem’s son).

CHART A

	MT	LXX (Alex.)	LXX (Vat.)	Sam. Pent.	Josephus
Adam to Noah	1656	2262	2242	1307	2256
Shem to Abraham	292	1072	1172	942	983
Adam to Abraham	1948	3334	3414	2249	3239

Some scholars add another 60 years to the time from Shem to Abraham, figuring that Terah was not 70 years old when Abraham was born (cf. Gen 11:26); rather, he was 130 years old, for Abraham was 75 when he left for Palestine after Terah's death at the age of 205 (Gen 11:32; 12:4; Acts 7:4). In order to determine the date of the flood, we must also know the date of Abraham's birth. Several items of chronological information in Scripture aid in arriving at his approximate birth date. The first appears in 1 Kings 6:1 where it is stated that Solomon's temple was begun 480 years after the Exodus. Since this occurred in the fourth year of Solomon in ca. 971/970 B.C. (on the basis of a four-year co-regency with David), the Exodus would be dated ca.1450 B.C. In the Hebrew text of Exodus 12:40 it is reported that the Israelites dwelt for 430 years in Egypt.

Let us parenthetically refer briefly to the textual variation in Exodus 12:40. Depending on whether one follows the reading of the Hebrew text (MT) for this verse ("the sons of Israel lived in Egypt 430 years") or the Greek (LXX) translation ("the sojournings of the sons of Israel in the land of Egypt and in the land of Canaan was 430 years"), an early or late chronology for the birth of Abraham can be determined. If one follows the Greek version, then one figures usually 215 years in Egypt and 215 years of Israel in Canaan. In other words, the Egyptian period is only 215 years long, whereas in the MT it is 430 years long. According to the Hebrew text Abraham's birth is 215 years earlier. If one takes the 430 years of an Egyptian sojourn of the MT and adds them to the year 1450 B.C. for the Exodus, one arrives at a date of ca. 1880 B.C. for the descent into Egypt. Then, by adding Jacob's age at the entry into Egypt (130 years, Gen 47:9), Isaac's age at Jacob's birth (60 years, Gen 25:26) and Abraham's age at Isaac's birth (100 years, Gen 21:5), the year of ca. 2170 B.C. is reached for the date of Abraham's birth. If one follows the Septuagint (LXX) reading of Exodus 12:40, one will arrive at a later time for Abraham's birth, because the Egyptian sojourn according to this text is 215 years shorter. Thus this shorter reckoning would lead to the birth of Abraham at ca. 1955 B.C. Without allowing for the co-regency of Solomon with David (1 Kings 6:1) one can arrive at the birth of Abraham at ca. 1950 (Horn 1960, p 8).

A reckoning of the date of the flood depends on the year of the birth of Abraham. If one selects the late date for the birth of Abraham at ca. 1955 B.C. and adds the 292 years from his birth to the flood according to the Hebrew text (MT), the flood would have occurred at ca. 2247 B.C. But if one follows the MT and calculates the birth of Abraham at ca. 2170 B.C., then the flood would have occurred in ca. 2462 B.C. on the basis of the 292 years in the MT between the birth of Abraham and the flood. Or, if one takes the figures of either 1072 or 1172 of the Septuagint manuscripts for the span of time between Abraham's birth in ca. 2170 B.C. and the flood, the date of the flood would be reckoned accordingly to have taken place either in ca. 3242 B.C. or 3342 B.C. The Samaritan Pentateuch and Josephus have slightly shorter time spans for the same periods, namely 942 years for the former and 983 years for the latter. These figures would lead to a date for the flood in either ca. 3112 B.C. for the Samaritan Pentateuch and ca. 3153 B.C. for Josephus (see Chart B).

CHART B

	MT	LXX (Alex.)	LXX (Vat.)	Sam.Pent.
Flood	2462	3242	3342	3112
Creation of Adam	4118	5504	5584	4419

If Abraham was born when Terah was 130 years old, as may be indicated in Genesis 11:32; 12:4; Acts 7:4 (because Abraham was 75 years old when he left Haran after Terah had died at the age of 205), then one needs to add in each case 60 years to the B.C. years of the flood. Accordingly the flood would have occurred at ca. 2522 B.C. (MT), 3302 B.C. (LXX Alex.), 3402 B.C. (LXX Vat.), 3172 B.C. (Sam Pent.), and 3213 B.C. (Josephus) (see Chart C).

CHART C

	MT	LXX (Alex.)	LXX (Vat.)	Sam.Pent.
Flood	2522	3302	3402	3172
Creation of Adam	4178	5564	5644	4479

The respective dates for the flood are figured on the information of the textual recensions of the biblical text (MT and two major LXX manuscripts) and the Samaritan Pentateuch as well as the ancient historian Josephus. The problem of the priority of the differing figures in these recensions has been discussed in an earlier essay (Hasel 1980). No simple solution is presently known.

Without doubt, the figure and dates obtained from the Septuagint texts are the most attractive from the viewpoint of currently known historical data from Egypt and Mesopotamia. An awareness of the problems of the shifting of Egyptian chronology (Horn 1959) is important:

Generally, the more distant the time, the more imprecise and inaccurate are the dates....Before about 2200 B.C. the margin of error is roughly \pm fifty years and the date for the beginning of the dynastic period (First Dynasty) stills shows wide variation among historians (DeVries 1976, p 254).

Despite these immense problems, Egyptian history is generally believed to begin at about 3000 B.C., \pm 100 years. The Egyptian chronology for this early period is but a "relative chronology." The same is true of the early chronology of Mesopotamia. R. D. Tindel remarks cogently, "It is not possible to establish a coherent chronology for the period prior to Sargon of Akkad" (Tindel 1976, p. 161), who founded the Akkadian Empire at ca. 2350 B.C. As far as Mesopotamia is concerned, "it is not until about 2500 B.C. that there are sufficient records to permit a coherent history" (Tindel 1976, p 158), because the cultures that employed the cuneiform (wedge-shaped) system of writing "never developed a uniform system of dating" (Tindel 1976, p 158). Scholars have to construct a coherent chronology from various systems and bits of information, then fit everything together and date the whole in terms of years B.C. These scholarly reconstructions are but relative. No absoluteness must be assigned to them. They are subject to change as new discoveries alter old relative chronological suggestions. Thus scholarship of the ancient Near East speaks of "relative chronology" for this early period. An "absolute chronology" is not to be had before ca. 2000 B.C., depending on sightings of Venus or various eclipses and the like. Thus caution is in order so that biblical materials are not prematurely judged inaccurate or invalid on grounds which scholars are careful enough to regard as relative.

The reconstructions of prehistoric periods of time are even more relative and hypothetical. They lack scientific controls needed for absolute dating. Even refinements in radiocarbon dating methods have not achieved reliable correlations. "As a result, specimens whose age can be fixed beyond doubt historically have produced radiocarbon dates centuries outside the allowable margins of error" (Tindel 1976, p 158). A truly scientific approach to early world chronologies will not accord to "relative chronology" an absolute status which may serve as a sound basis for decisions concerning personal faith and confidence in the fidelity of the Bible.

Some students of Genesis have suggested that Genesis 5 and 11 are dependent upon ancient Near Eastern genealogies (Cassuto 1961, p 254-267; von Rad 1961, p 69; Speiser 1964, p 41; Johnson 1969, p 28-31; Wilson 1977, p 166). Recent discoveries of genealogies show that the Israelites were not the only ancient people who kept genealogical records. There are royal and nonroyal genealogies from Mesopotamia and genealogies of other peoples (Wilson 1977, p 56-136). Scholars are largely in agreement that the closest parallel to Genesis 5 and 11 is the Sumerian

King List (SKL) which arranges dynasties in linear succession. The date of SKL is the first dynasty of Isin (ca. 2000 B.C.) or possibly earlier (Rowton 1960, p 158-162). Several scholars have claimed that Genesis 5 and 11 is dependent on SKL and thus cannot be regarded as a reliable index of time. Such claims have led to careful examinations of the relationship between SKL and Genesis 5 and 11.

The results of these investigations are summarized as follows: 1) Genesis 5 and 11 contain Semitic names, but SKL has non-Semitic names which cannot be harmonized with each other; 2) the biblical genealogies in Genesis 5 and 11 have numbers for “years of life,” whereas SKL has numbers for “years of reign,” i.e., the contrast is between longevity and years of rulership; 3) the line of descent in the genealogies in Genesis 5 and 11 is opposed by the succession of kings in SKL; 4) Genesis 5 has ten antediluvian patriarchs, whereas SKL in its various recensions has seven, eight, nine, or ten antediluvian kings; 5) Genesis 11 has nine postdiluvian patriarchs but SKL has thirty-nine postdiluvian kings; 6) Genesis 5 and 11 trace ancestors in terms of line of descent, while SKL emphasizes that kingship can reside in only one city at a time; 7) Genesis 5 and 11 are chronogenealogies, whereas SKL is a list of city dynasties with their respective rulers; 8) the structure of Genesis 5 and 11 is not identical with the structure of SKL; and 9) Genesis 5 and 11 are line of descent genealogies containing chronological information, but SKL is a list of (successive) dynasties to which genealogical notices are attached for several kings, usually for only two or three generations and only twice for five generations.

These and other differences (Hasel 1978, p 361-374) confirm that SKL is not a source directly or indirectly for Genesis 5 and 11 (Hartman 1972, p 32). Indeed, Genesis 5 and 11:10-26 is without a parallel in the ancient world. Thus it is most precarious and methodologically unsound to interpret the biblical chronogenealogies on the basis of ancient Near Eastern materials. The proper function and meaning can be determined in their own contextual settings in Genesis 1-11 and the Bible as a whole.

C. Biblical-Genealogical Data

Is it true that the genealogical data in the Bible clearly prove that Genesis 5 and 11 has a discontinuous line of descent? A number of students of the genealogies of the Bible have used the discontinuous nature of certain biblical genealogies to argue that the same holds true for Genesis 5 and 11 (cf. Horn 1960, p 196; Kitchen 1966, p 37; Geraty 1974, p 9-12). There are several considerations that call for comment.

It is suggested that the structure of Genesis 5 and 11 with ten antediluvian and ten postdiluvian patriarchs is an intentional arrangement, just as the genealogy in Matthew 1:1-17 has three sets of fourteen ancestors

each. This symmetry is thought to suggest an intentional arrangement and not a true continuous line of descent.

As far as the genealogy in Matthew is concerned, the schematization is apparent and can be supported by comparison with genealogical data in the OT. Can the same be demonstrated for Genesis 5 and 11? Is there a ten-plus-ten scheme in Genesis 5 and 11? A simple counting of patriarchs in Genesis 5 and 11 reveals that there is no schematic ten-ten sequence. In Genesis 5 there is a line of ten patriarchs from Adam to Noah who had three sons, but in Genesis 11:26 the line of patriarchs consists of only nine members from Shem to Terah who “became the father of Abram, Nahor and Haran” (Gen 11:26, NASB). If Abraham is to be counted as the tenth patriarch in Genesis 11, then consistency requires that Shem is counted as the eleventh patriarch in Genesis 5, because each genealogy concludes with a patriarch for whom three sons are mentioned. It appears that a comparison of Genesis 5:32 and 11:26 reveals that there are no grounds to count one of the three sons in one instance and not in the other, when in fact the formula is the same. Thus, if one counts in Genesis 5 ten patriarchs, consistency demands the counting of nine patriarchs in Genesis 11, or, vice versa, if one counts eleven in Genesis 5, then one needs to count ten in Genesis 11. The figures 10/9 to 11/10 respectively can hardly qualify as an intentional arrangement or a symmetry. In short, the alleged “symmetry of ten generations before the Flood and ten generations after the Flood” (Kitchen 1966, p 37; cf. Geraty 1974, p 15) is non-existent in the Hebrew text. Thus the analogy with the three series of fourteen generations in Matthew 1:1-17 is a *non sequitur*.

Let us return briefly to the matter of the “second” Cainan (Kenan) which is found in certain Septuagint manuscripts, making ten generations in the Greek translation alone (and in the pseudepigraphical book of Jubilees). The Septuagint assigns to Cainan (Kenan) 130 years before the birth of his son and 330 years thereafter. The fact that these figures are identical with the ones of Shelach who follows him makes the existence of this Cainan suspect. The question as to what text is original is assessed by J. Skinner as follows: “That this is a secondary alteration [in the LXX] is almost certain, because (a) it is wanting in 1 Ch 1:18,24 LXX; (b) Kenan already occurs in the former genealogy (5:9ff.); and (c) the figures [assigned to Kenan] simply duplicate those of Shelach” (Skinner 1930, p231). It seems reasonable to assume that this “second” Cainan (Kenan) is a later scribal addition in the Septuagint. It may be occasioned by an attempt to schematize, which is characteristic of the Septuagint version in Genesis 5 and 11.

The genealogy of Jesus in Matthew 1:1-17 is selective and discontinuous. For example, in Matthew 1:8 it is stated that “Joram begat Uzziah”

but passages such as 2 Kings 8:25,11:2; 14:1, 21 indicate that the continuous line of descent from Joram to Uzziah was Joram-Ahaziah-Joash-Amaziah-Uzziah. Three intermediary generations were omitted. The intent of Matthew 1:8 according to Kitchen is thus “Joram begat (the line culminating in) Uzziah” (Kitchen 1966, p 38). As far as Matthew is concerned, this is quite correct, but the chronological conclusion drawn from this genealogical data, namely that “A begat (the line culminating in) B” as far as “chronology is concerned” (Kitchen 1966, p 38) is unwarranted. The data of Matthew do not support a chronological argument because the Matthean genealogy lacks in toto any kind of chronological or time information. Matthew speaks of father-son or ancestor-descendant relationships, but it does not contain a genealogy with time specifications. The literary form of Matthew’s genealogy is not that of a chronogenealogy. This point is too obvious for the careful reader and does not need to be belabored.

The formulae used in Matthew and Genesis 5 and 11 are radically different. We have noted already that Genesis 5 has a consistent formula, with few minor exceptions, that reads, “When PN_1 had lived x years, he fathered PN_2 . And PN_1 lived after he fathered PN_2 y years, and he fathered other sons and daughters. And all the days of PN_1 were z years.” Genesis 11 has essentially the same formula, but omits consistently the last clause, “And all the days of PN_1 were z years.” The formula in Matthew on the contrary is simply, “ PN_1 begat PN_2 ” with slight variations when the mother of PN_2 is also mentioned.

Those who suggest an analogy between Genesis 5 and 11 and Matthew 1 (or other genealogies in the Bible) are faced with momentous difficulties: 1) Genesis 5 and 11 do not have a ten-ten schema that would correspond to Matthew’s fourteen-fourteen-fourteen generation schema. Genesis 5 lists ten generations and Genesis 11 only nine. 2) The structures of the formulae in Genesis 5 and 11 are diverse from the ones in other genealogies. 3) Only Genesis 5 and 11 have time specifications, and they reflect the literary form of chronogenealogy. 4) The supposition that Genesis 5 and 11 are discontinuous “leaves the Bible’s detailed list of figures as generally pointless and also posits an unusually high proportion of omitted links” (Payne 1976, p 831).

Our considerations of the biblical evidence regarding the question of the continuous line of descent in Genesis 5 and 11:10-26 has indicated that the arguments against the apparent continuous line of descent in these chapters are far from compelling. The fact that some biblical genealogies have a discontinuous line of descent and in turn lack any interlocking chronological information of spans of life can hardly function as a key to determine that Genesis 5 and 11 are also discontinuous. The internal nature

of Genesis 5 and 11, the usage of their own formula, and the interlocking nature of the time specifications do not allow that these chronogenealogies are anything but presenting a continuous line of descent. Where this is denied, it has to be frankly admitted that it is done at the expense of the unique nature of the material in Genesis 5 and 11 when compared to similar material in the Bible and the ancient Near East. In other words, the uniqueness of Genesis 5 and 11 in both their literary forms and contents must be disregarded and leveled out to bring these chapters to the place where a one-by-one correspondence with other genealogies or lists can be meaningful. We question the soundness of this methodological procedure.

As regards the archaeological-historical and prehistorical time frames that stand in tension with the computation of the chronological information of Genesis 5 and 11, the issues turn around the validity and force of one over the other. Here the question of the historicity of Genesis 5 and 11, the authority of the biblical materials when in conflict with historical reconstruction and/or scientific interpretations, and related matters appear in full force. There is a scholarly tradition that argues that wherever and whenever the conclusions of historians, scientists, sociologists, etc., are in disagreement with the Bible, the Bible will have to be reinterpreted to be brought into harmony with these conclusions. Another scholarly position is not so ready to yield everything outside of faith and conduct to the norms of the investigator, but maintains that where the Bible impinges on subjects such as history, geography, ethnology, botany, astronomy, etc., it is trustworthy. Thus the Word of God is seen to impinge on historical, scientific and other phenomena. For them the subordinating of biblical reports to modern scientific reconstructions and interpretations remains highly problematic and reverses the structure of authority.

III. INTERPRETATIONS OF CHRONOLOGICAL INFORMATION IN GENESIS 5 AND 11

There are two major types of interpretations of the chronological information in Genesis 5 and 11. These types of interpretation are closely associated with the stance taken by the respective interpreters on the textual, historical-archaeological, biblical-genealogical, and literary forms. It will be our attempt to describe succinctly positions for both the non-historical and the historical interpretations. In addition to being descriptive, we will attempt to be evaluative, indicating respective strengths and weaknesses wherever possible.

A. Non-Historical Interpretations

There are several interpretations of Genesis 5 and 11 which are non-historical. They share in common the view that the figures or time specifi-

cations have meaning, but that this meaning is found in either a system or schema and lacks any historical-chronological significance for the construction of a chronology.

1. The “Great Year” System

A schematization of Genesis 5 and 11 as well as all Old Testament chronology was popularized by the famous OT critic Julius Wellhausen. He, as with others before him (e.g., T. Noeldeke & A. Dillmann), suggested that the figures in Genesis 5 and 11 along with other OT chronological information reflect an artificial schema. These critics shared a generally low view of the historical value of the OT and particularly its chronological data which they believed reflected a schematization of exilic origins. Following earlier scholars, Wellhausen suggested that the schema of a “Great Year” of 4000 years is followed, i.e., the period from Adam to the Exodus is 2666 years or $26\frac{2}{3}$ generations of 100 years each. This is $\frac{2}{3}$ of a world cycle of 4000 years (Wellhausen 1965, p. 308). The remaining $\frac{1}{3}$ of the “Great Year” of 4000 years is accounted for from the building of Solomon’s temple 480 years after the Exodus (1 Kings 6:1), i.e., A.M. 3146, and an additional 430 years assigned to the kings of Judah reaching down to the fall of Jerusalem (see Curtis 1898, p 401-403). To this must be added 50 years for the exile. The computation of these years add up to A.M. 3626 which is correlated with the edict of Cyrus in 538 B.C. From there to the rededication of the Temple by the Maccabees in 164 B.C. is 374 years and completes the “Great Year” of 4000 years (cf. Johnson 1969, p 32; Kuhl 1961, p 62).

This schematic hypothesis is very problematic, because of difficulties in computing in order to arrive at certain spans of time needed for the “Great Year.” Several such problems may be mentioned. 1) The year A.M. 2666 from Adam to the Exodus is incorrect. The Masoretic text provides from Adam to Abraham 1948 years to which must be added the 430 years of Exodus 12:40 and 290 years of Genesis 21:5; 25:26; 47:9. The total amounts to 2668 years and not 2666 years. In other words, the year of the flood is missing as is the time to the birth of Shem’s son. 2) The period of the Judean kings from the building of the Temple in 970 B.C. down to 586 B.C., the destruction of Jerusalem, is 384 years and not 430 years. There is a discrepancy of 46 years. 3) The captivity did not last 50 years but 70 years (Jere 25:1), the first 19 years of captivity having begun in 605 B.C. (Dan 1:1), are concurrent with the period of Judean kings. From 586 B.C. to 538 B.C. there are but 48 years. 4) It does not fit the best chronological evidence at hand for the schema to come out to 164 B.C. 5) Furthermore, the assumption that the biblical chronology was revised in the Maccabean period is without textual and

historical support (Johnson 1969, p 32-33) and contradicted by the canonization of the OT (Leiman 1976). This and similar schematic systems (cf. Skinner 1930, p 234-235) hardly recommend themselves on the basis of the current state of archaeological and historical information.

2. The “Secret System”

Two Swedish scholars have attempted to correlate the entire OT chronology from creation to the return from Exile on the basis of what they consider to be a “secret system” which they believe Hebrew scribes devised. They believe that these scribes corrected the Hebrew text of the OT to suit their scribal schematization (Stenring 1966; Larsson 1973).

Stenring’s study is influenced by Jewish cabalistic speculations. His hypothesis is built upon the view that there was originally a twelve-book canon of the OT which contained only the Pentateuch, the historical books (Former Prophets) and 1-2 Chronicles, including Ezra 1:1-3:7, and Jeremiah and Ezekiel. This supposedly original canon experienced a scribal redaction with a “chronology [that] seems to have been deliberately hidden” (Larsson 1973, p 3). The chronological dates were correct, “not always historically, of course, but as part of a system” (Larsson 1973, p 7). The secret system of the scribes consisted of the taking of the lunar calendar of 354 days, a solar calendar of 365 days, and the Canopus intercalated calendar of 366 days. These three calendars started from the first day of creation and ran parallel thereafter (Stenring 1966, p 8-10). The test for this hypothesis was applied by the mathematician Larsson on the basis of statistical probability.

The figures of Genesis 5 and 11 are part of the “secret system” of Hebrew scribes as is all chronological information in the OT. The figures that Stenring and Larsson have for Genesis 5 are 1657 years with the lunar calendar, 1607 with the solar calendar, and 1606 years with the standard (intercalated) calendar (Larsson 1973, p 104). The birth of Abraham took place respectively in the years 1880, 1823, and 1822 from creation (Larsson 1973, p 106). These figures are part of the “secret system” and are not to be correlated with historical dates.

Among advantages of this “secret system” is the fact that the chronological information in Genesis 5 and 11 as well as the entire OT is taken seriously and consecutively computed. Among the weaknesses are: 1) Its failure to correlate the information with extrabiblical data (DeVries 1976, p 162); 2) the lack of evidence for the large-scale revision of the chronological information of the OT by Hebrew scribes; 3) the lack of evidence for the supposed twelve book canon; 4) the alleged arbitrariness of Hebrew scribes with this type of information when the OT has by and large a strong sense of history; and 5) the fact that the most difficult chronological

area in the OT, i.e., the numbers of the Hebrew kings, has been successfully solved in recent years by sound correlations with extrabiblical literary and historical data. The Bible's chronology is not systematically schematic. It demonstrates itself to be historical time and again.

3. Systems of Figures

Various scholars attach meaning to the figures in Genesis 5 and 11 on the basis of a variety of systems. In some instances the systems of figures are part of numerology and in others they are not.

The famous Jewish exegete U. Cassuto suggests that the figures in Genesis 5 (and 11) "are multiples of five with the addition of seven" (Cassuto 1961, p 260). An earlier attempt notes that the figures for the antediluvian patriarchs can be computed by 39×42 years and the period of time from creation to Abraham's entry into Canaan by $6 \times 7 \times 7 \times 7$ or 42×49 years (Fischer 1911, p 242, 251). It is striking that in the latter case the textual information has to be adjusted to fit the scheme.

Another scholar builds his system on the sum of certain numbers such as 735 which is 15×49 , i.e., the ages of begetting Noah, Shem, and Arphachshad total $500 + 100 + 135 = 735$ or 15 jubilees of 49 years (Meysing 1962, 1965). According to this system Abraham was born "exactly 40 jubilees after 1 A.M." (Meysing 1962, p 28). For this system to work, because there is a discrepancy of computation, the child needs to be born in each instance exactly nine months, or $\frac{3}{4}$ of one year, after it was fathered according to the biblical text. Even if this precision were granted — and the text knows nothing of this — there is still a computational discrepancy of several months that has to be left out of consideration. The text also gives no hint why one should add the ages of but three — and why these three — patriarchs to arrive at the $15 \times 49 = 735$ years.

Other attempts suggest a symmetrical or symbolical system of the number "seven" (Makleot 1956/7, p 234-236) or claims that there is a "seventh generation" convention (Sasson 1976, p 355).

These systems of figures share in common the view that there is some kind of meaning behind the figures, the key of which has to be recovered. The suggested keys do not fit as easily as one thinks. At times the text is adjusted to make the key fit; at other times the suggestion is forced to add time information outside Genesis 5 and 11. The disparity between the various systems has not recommended them to many scholars. Yet they are serious attempts to find meaning in the figures of Genesis 5 and 11. The figures are not simply dismissed as meaningless.

4. The Discontinuous System

The discontinuous system holds that the lists of the patriarchs in Genesis 5 and 11 is discontinuous. It "assume[s] that a number of links

have dropped out and that only a number of patriarchs are listed” (Horn 1975, p 340). Based upon this assumption is the conclusion, “We see in the genealogical lists of Genesis 5 and 11 no absolutely complete records, but only selections or excerpts of longer lists of generations” (Horn 1975, p 341). Those who accept the hypothesis of a discontinuous system without a direct succession of one generation to another, from father to son, do so because the creation of man in the near past “is untenable in the light of attested archaeological facts” (Unger 1960, p 202) and/or because anthropological study does not support it (Kitchen 1966, p 35-36). Scholars adopting the hypothesis of a discontinuous system deny that the length between creation and flood can be determined by the figures provided in Genesis 5 (cf. Horn 1975, p 340) so that “a theory of disconnected patriarchs could thus allow Adam to be dated 100,000 B.C. or earlier” (Payne 1976, p 831).

Among the advantages of the discontinuous system of interpreting Genesis 5 and 11 is the unlimited freedom it gives to anthropology and archaeology for both historical and prehistorical periods and “the deductions of science” (Green 1979, p 50). There are also major problems. 1) The theory that Genesis 5 and 11 are selections or excerpts of longer lists of generations is built on historical and scientific premises not present within Scripture. 2) The alleged analogy with other biblical genealogies is dubious on account of the different forms, structures, and purposes of the genealogies in Scripture (see above II.A,C). 3) There is an inability to account for the meaning of the numbers to the birth of the named son. If the sole purpose of the figures had been to indicate the loss of vitality due to sin, then the fathering of the first-named son would be unnecessary. 4) The invitation to add up the numbers is implicit because in the case of each antediluvian patriarch the figures provided before the birth of the named son and the figures provided for the subsequent life-span is added up to provide the total life-span. It is not unreasonable to continue that lead and add up the numbers for the entire periods from Adam to Noah and then from Seth to Terah.

B. Historical Interpretations

At present there are two major historical interpretations, i.e., interpretations that do not dismiss the figures in Genesis 5 and 11 as non-historical. We will describe the more recent approach first and then depict the standard historical interpretation.

1. Successive Method of Reckoning

This method of reckoning counts the years of successive patriarchs. It follows an observation of W. F. Albright who suggested that ancient Near Eastern peoples “dated long periods of lifetimes, not by generations” (Albright 1961, p 50). An application of this “counting by ‘successive’

patriarchs [in Genesis 5] would mean, e.g., that while Adam begat an ancestor of Seth when he was 130 (Gen. 5:3), Seth (5:6-8) actually arose as Scripture's next prominent figure only after Adam's full life of 930 years (5:4)" (Payne 1976, p 831). According to this "successive" reckoning the flood occurred 3284 years before Abraham and the creation of Adam 8225 years before the flood (Payne 1976, p 831), i.e., in 5458 B.C. and 13,683 B.C. respectively, if the birth of Abraham is dated to ca. 2170 B.C.

The successive method of reckoning is an accommodation to the needs of current historical study of the ancient world. History based on written records began in both Mesopotamia and Egypt at ca. 3000 B.C. This approach accounts admirably for the historical periods of the ancient Near East. However, the first indications of sedentary life in the Near East is presently dated between 9000 and 7000 B.C. The relative chronology also dates the beginnings of Jericho to ca. 7000 B.C. Thus a flood at about 5500 B.C. is of help, but if the dating procedures for the prehistoric period, i.e., before ca. 3000 B.C., are accepted, then this successive method of reckoning would still not be long enough.

A distinct difficulty of the successive method of reckoning is evident in the biblical text. The repeated phrase "and he fathered PN" (*wayyôled* P^{et} -PN) appears fifteen times in the OT — all of them in Genesis 5 and 11. In two additional instances the names of three sons are provided (Gen 5:32; 11:26). The same verbal form as in this phrase (i.e., *wayyôled*) is employed another sixteen times in the phrase "and he fathered (other) sons and daughters" (Genesis 5:4, 7, 10, etc.; 11:11, 13, 17, etc.). Remaining usages of this verbal form in the Hiphil in the book of Genesis reveal that the expression "and he fathered" (*wayyôled*) is used in the sense of a direct physical offspring (Gen 5:3; 6:10). A direct physical offspring is evident in each of the remaining usages of the Hiphil of *wayyôled*, "and he fathered," in the OT (Judg 11:1; 1 Chron 8:9; 14:3; 2 Chron 11:21; 13:21; 24:3). The same expression reappears twice in the genealogies in 1 Chronicles where the wording "and Abraham fathered Isaac" (1 Chron 1:34; cf. 5:37 [6:11]) rules out that the named son is but a distant descendant of the patriarch instead of a direct physical offspring. Thus the phrase "and he fathered PN" in Genesis 5 and 11 cannot mean Adam "begat an ancestor of Seth." The view that Seth and any named son in Genesis 5 and 11 is but a distant descendant falters in view of the evidence of the Hebrew language used.

2. Overlapping Method of Reckoning

This approach is one that is employed for about two millennia. It counts for each patriarch only the years prior to the birth of his named son. The most famous system of "overlapping" reckoning is that used by Archbishop James Ussher as advocated in his *Annales Veteris et Novi*

Testamenti (1650-54). His system met with so much success that the dates he presented have been entered into the margins of English Bibles since 1679. Ussher calculated the birth of Jesus to have occurred in 4 B.C. and fixed the date for creation at 4004 B.C. Although many NT scholars today subscribe to Ussher's date for the birth of Jesus, the fact that his chronology places the beginning of creation exactly 4000 years before the birth of Jesus has led to the suggestion that Ussher's calculation of 4004 B.C., although dependent upon his reconstruction of OT chronological material, may have been influenced by a Jewish midrash quoted twice in the Babylonian Talmud (Sanhedrin 97a; Abod. Zar. 9a). This midrash speaks of two times two millennia (i.e., 4000 years) before the age of the Messiah was to begin, an age that also is to last two millennia (Leeman 1977). However this may be, Ussher did not yet understand the period of the Hebrew kings and thus dated the building of the Temple in Solomon's fourth year (1 Kings 6:1) to 1012 B.C., whereas current knowledge makes it possible to pinpoint it to 970 B.C. He dated the Exodus to 1491 B.C., whereas we reckon it to have taken place in ca. 1450 B.C. The birth of Abraham is dated to ca. 1995 B.C. which means that Ussher followed the Septuagint reading for Exodus 12:40. Reckoning back from this date by means of Genesis 11, Ussher arrived at this date and at the date of 2349 B.C. for the flood. In arriving at this date and at the date of 4004 B.C. for creation, Ussher selected data from the Hebrew text and the Greek Septuagint translation. Ussher's date of 4004 B.C. can no longer stand, because there is no sound rationale for the selective use of chronological data from the Hebrew text (MT) and/or the Greek translation (LXX).

Approximate dates for the flood as derived from the overlapping method have already been shown in Charts B and C above. The figures and dates in Charts A-C have been presented to indicate the variations in the major textual recensions. The difficult matter of the priority of the respective figures has been discussed previously (Hasel 1980). Many Christians still believe that reckoning by the overlapping method is the one most consistent with the biblical text.

The major weakness of the overlapping method of reckoning is its head-on conflict with standard interpretations of time needed for prehistoric and historical reconstructions. These kinds of conflicts have led certain scholars to posit gaps in the chronogenealogies of Genesis 5 and 11 and to argue for a discontinuous line of descent. Serious problems in these approaches and the dubious nature of the arguments used in their support were analyzed above. In this writer's opinion the basic issue is whether modern reconstructions of ancient history and prehistory are an authoritative norm for the interpretation or reinterpretation of the Bible. If this is the case, then modern man's historical and scientific endeavors are raised

to the level of an absolute norm. It follows that the Bible must yield in these areas of conflict. A contrary view is that ultimate authority for knowledge and faith is provided in the superior revelation of God in the Bible, and whenever biblical information impinges on matters of history, age of the earth, origins, etc., the data observed must be interpreted and reconstructed in view of this superior divine revelation which is supremely embodied in the Bible.

Some would argue that Genesis 1-11, including the genealogies, are but theology and not history, that is, these chapters are primeval history in the sense that they do not provide us verifiable history, but rather testimonies that emphasize that God is Creator, Sustainer, Savior and Judge. This view is also an accommodation to the physical and life sciences and is the result of an acceptance of modernistic and/or evolutionary patterns of the origin and history of our planet and life thereon.

IV. CONCLUSION

There is no doubt that time and its progression functions in a most profound way in the Bible. This is evident from the beginning. Genesis creation is intended to be the beginning or opening of history. History begins with time and space and consists of functions in time and space. The Genesis creation account is part of a history which contains numbers and time sequences. The genealogies in Genesis 5 and 11:10-26 contribute to the progression of time in Scripture. They trace humankind in time and through time forward to two heroes: Noah, who survives the flood with his family, and Terah, who becomes the father of the progenitor of God's people. The succession from father to son together with the spans of time indicates God's blessing and grace in view of sin and death. People spread to the farthest reaches of time (Gen 5 and 11) and space (Gen 10). It was God's purpose that humankind proceed in an unbroken chain of generations in space and time. In this sense, Genesis 5 and 11:10-26 is both historical and theological, linking Adam with the rest of humankind and God with man in the realm of the reaches of space and time. Genesis 5 and 11:10-26 provide the time framework and human chain that link God's people with the man whom God created as the climax of the six-day creation event of this planet.

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ARTICLES

IMPLICATIONS OF VARIOUS INTERPRETATIONS OF THE FOSSIL RECORD

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WHAT THIS ARTICLE IS ABOUT

Between the two extremes of a literal six-day creation week and evolutionary theory are a significant number of models for origins. Each has its own unique set of assumptions and problems that it attempts to syncretize. Roth examines ten models for origins and discusses the problems that led to their formulation. Included are the supports that have been mustered for each model, along with a comment as to its difficulties in the light of both science and the Bible. The philosophical implications of these ideas are also examined.

I. INTRODUCTION

Man has long pondered the question of his origin, purpose and destiny. Such queries are of more than mere academic interest, because their answers affect many of the major decisions he makes. The interpretations one places on the fossil record can be pertinent to these questions, since they influence: 1) one's concept of the origin of life and more specifically the origin of man, 2) one's belief in God and the kind of God He is, and 3) ideas regarding the truthfulness and authority of the Hebrew-Christian Scriptures including their accounts of origins.

As a basis for discussion of these issues, this essay will assume that truth is to be found in nature and in the Bible. These are not blind assumptions. Science, which is an explanation of nature, has had a gratifying measure of success; combined with technology, it has produced some very impressive achievements in the past decades. The Bible has demonstrated a gratifying degree of historical reliability and has endured for millennia as a respected guide for life.

Interpretations of the Bible and of scientific data are not always in agreement. Probably the most important conflict involves the history of past life on earth as it is represented by the fossils found buried in many of the sediments of the earth. Many different interpretations have been given to these fossils. We shall consider several of the more important ideas and their implications.

Fossils, which are evidence of past life, are found almost exclusively in the sedimentary rocks of the earth's crust. These rocks form layers of

strata that sometimes reach several kilometers in thickness. The sequence of these strata forms the geologic column. The fact that the lower layers were usually deposited before the upper ones, and are hence older, is self-evident. How much older is an important part of the question we want to consider. Some interpretations postulate a very rapid rate of buildup, while others propose a very slow rate.

The main portion of the geologic column — the Phanerozoic — contains sediments with relatively abundant, unquestioned fossils. This main portion forms about $\frac{2}{3}$ of the total volume of sediments. In the lower $\frac{1}{3}$ (the Precambrian) the fossils in the sediments are very rare and/or questionable. The kinds of fossils found in the sedimentary layers are sometimes unique to their position in the geologic column. For instance, sponge-like Archeociathids are found only in the lower part of the Phanerozoic; grasses and man are found only in the upper part. Fossils such as the lamp shell *Lingula* are found throughout. The simple vascular plants called Psilophytes are found only at the bottom and as living representatives. The abundance of fossils in the sediments varies greatly. Usually none or only a few are found; in rare cases they are extremely abundant.

There are many different kinds of fossils — estimates of the number of different species vary greatly but often run into the millions. Due to problems in variation and identification, the number of fossil species should not be equated with the number of living species. There are probably many more fossil species than true “biological” species.

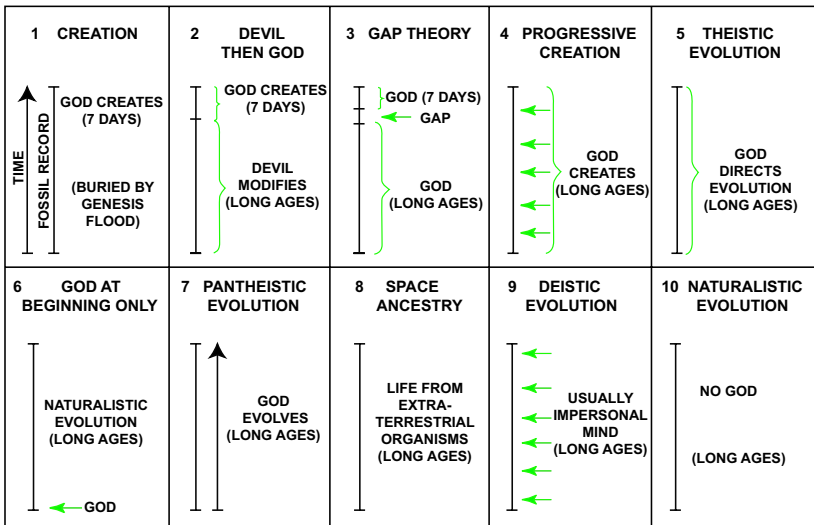
At the opposite ends of the spectrum of interpretations of the fossil record are *creation* and *naturalistic evolution*. The former is the idea that the fossils represent remains of life created by God during creation week and buried during the Genesis flood; the latter views them to be the product of purely naturalistic processes resulting from gradual evolution over millions of years. A significant number of important *intermediate views* between these two contrasting interpretations have been proposed and will be considered.

At present, the intermediate views are the most popular ideas of origins among Christian churches. They are appealing because they permit one to accept a significant proportion of evolutionary theory while still preserving the concept of God as being involved in creation. These intermediate views can be adopted only by yielding a significant degree of scriptural integrity to the concepts of evolutionary interpretation while having to go beyond these latter views to include God. These require one to abandon the purely naturalistic explanations as usually presented in science texts.

Since all these intermediate views reduce the significance of the six-day creation week and the Sabbath, they are of particular concern to such groups as the Seventh Day Baptist Church and the Seventh-day Adventist Church, which place great emphasis on the Sabbath as a memorial of creation week.

The term truth as used in this discussion refers to “ultimate truth,” not what one may think truth is, not relative truth, but that which is ultimate, absolute truth.

FIGURE 1. Ten interpretations of the geologic column.



II. COMMENTS ON VARIOUS INTERPRETATIONS

Figure 1 is a chart representing ten different interpretations of the fossil record, beginning with creation and ending with naturalistic evolution. These are arranged in a sequence that represents an increasing trend towards naturalism and away from creation as described in Genesis. While these trends apply in general, the arrangement of some is debatable. At the left of each interpretation is a vertical line representing the geologic column with comments on the way in which the column fits into various interpretations. The bottom of the line represents the lowest or oldest layers, the top the highest or youngest. Comments on each model follow. Numerous other ideas and intermediates between these ten interpretations could be proposed. We are not dealing with simple black-and-white issues,

but with shades of gray — sometimes very close shades such as dark medium gray compared to darker medium gray! Unfortunately, these various concepts are vague and sometimes ill-defined. There is no standard terminology associated with many, but an attempt has been made to use commonly employed terminology. References related to some of the concepts or use of terms have been included.

Some of the major problems with each model are given so as to facilitate evaluation.

1. CREATION, also called special creation or fiat creation

a. Description of Model

This is the most direct reading of Scripture. Creation was in six literal days with a short period of time (compared to the geologic time scale) between creation and the flood, and a short period thereafter. There was no previous life on earth (Genesis 1:2), or no earth, and the flood was the major catastrophe that has produced most of the fossiliferous sedimentary layers on the surface of the earth. Present estimates of sedimentation rates of a few centimeters to a meter per thousand years would not allow for much sedimentation before or after the flood, although it is expected that at the end of the flood and in subsequent years, sedimentation would have been much more rapid than it is at present. At that time the crust of the earth was more in disequilibrium. The model fits well with the significant degree of design and orderliness that is found in nature. A modification of this model which postulates that God created the fossils as such *in situ* has sometimes been entertained. This idea has no general acceptance at present. One reason for its rejection is that there is conflict between the good and truthful God described in the Bible and the trickery implied in making fake fossils.

b. Problems

The model disagrees with several scientific *interpretations* that specify long ages, especially radiometric dating, rate of cooling of magmatic bodies, rate of formation of fossil reefs, and rate of growth of successive fossil forests.

2. DEVIL, THEN GOD

a. Description of Model

Being jealous of God and His creative power, the Devil took germs of life from elsewhere and long before creation week tried on this earth to imitate God's creation. Most of the geologic column was developed over long ages before creation week, and the organisms in it are the result of satanic experimentation. Following this, creation week took place as described in Genesis, but it was a local creation; hence, the nature that we see about us represents a mixture of God's creation and the Devil's work. This model explains the apparent occurrence of evil, in the form of cruel, predatory organisms, in the lower (early) parts of the fossil record before man who appears in the upper (later) part. See Models 4 and 5 for further discussion of this question.

b. Problems

This particular model excludes the concept of God as the all-inclusive Creator (Genesis 1 and 2; Exodus 20:11; Nehemiah 9:6; and John 1:3). God did not create all. It is also contrary to Moses' description of an original world that was dark (light is necessary for most life) and void before creation (Genesis 1:2). There is no *direct* scientific, scriptural, or other support for the idea itself. Related evidence can be gathered, but it usually fits many models, and evidence for the idea itself is lacking. Any discovery about past life can be attributed to the capriciousness of the Devil. Such a concept is unsatisfying because it is not easily testable. For example, it is difficult to test the idea that we were created fifteen minutes ago with a fully mature environment complete with past memories, etc. We tend to reject such models because we suspect that reality is not that capricious. The testable parts are not.

3. THE GAP THEORY (Fields 1976), also called Ruin and Restoration

a. Description of Model

Life was created by God on this earth in the distant past; however, He destroyed that life following a judgment upon Satan. The Scofield Reference Bible refers to this in connection with Genesis 1:2 (1917 ed.) which says that the earth was a waste place, and with Isaiah 45:18 (1967 ed.) which says that God did not create the earth as a waste place. The argument is that

the earth must have become a waste place (ruined) subsequent to an ancient creation not described in Genesis.

b. Problems

As with the previous model, the idea is difficult to evaluate and to test, since almost any data can be fitted into the concept. It has little scientific or scriptural support. There is no evidence of a worldwide gap in the fossil record. One would expect that if there had been a gap (ruin), a distinct blank period (gap) in the fossil record should be evident on a worldwide basis prior to a subsequent creation. One would also expect differences in the fossil record across the gap.

4. PROGRESSIVE CREATION (Gedney 1950, p 45-50; Ramm 1956, p 112, 215; Fields 1978, p 165-179). The “Day-Age theory,” in which each day of creation represents long ages, can also be fitted into this model.

a. Description of Model

God performed multiple creation events over long periods of time. The degree of progression from bottom to top in the fossil record reflects degrees of progress in creative acts. It fits in both with the evidence of gaps in the fossil record which support creation and with ideas of long ages for the geologic column.

b. Problems

Neither science nor Scripture suggests directly that events occurred this way; hence, the *basic idea itself* is unsatisfying because it lacks support. It is difficult to test. It is contrary to the idea of a six-day, all-inclusive creation; however, God is still the Creator of all things. The presence of predation (e.g., *Tyrannosaurus rex*) earlier in the fossil record makes evil appear, in the form of predation, before the advent of man. This tends to negate the Genesis story of a good Creator and creation followed by the fall of man and the consequent evil that ensued. The model implies many errors or lack of successes on God’s part over long periods of time before the advent of evil. Thousands of important taxa present at various levels in the fossil record are not now living on the surface of the earth. Dobzhansky (1973), while criticizing creation, emphasizes the problem of species extinction: “...but what a senseless operation

it would have been, on God's part, to fabricate a multitude of species *ex nihilo* and then let most of them die out!" Progressive creation does not provide a good explanation. One can postulate a God who would create by this method, but it does not fit the God described in the Bible. Genesis explains these on the basis of a major destruction of the earth at the time of the Noachian flood because of man's sin.

5. THEISTIC EVOLUTION (Ramm 1956, p 113; Key 1960, p 21-22). This is what Marsh (1950, p 53-54) calls teleological evolution. Modifications of this view placing special emphasis on the creation and nature of man have been proposed by Teilhard de Chardin (1956, p 63) and Bube (1971). This latter author calls his idea biblical evolutionism.

a. Description of Model

God directed the continuous progress of evolution from simple to complex. The idea fits fairly easily with many concepts of the general theory of evolution and still permits one to have God. Also, God is available to bridge some of the difficult barriers that evolution faces, such as the problem of the origin of life, the gaps in the fossil record, development of the higher mental characteristics of man, etc.

b. Problems

The gaps in the fossil record do not suggest a continuous process of evolution. The model appears demeaning to God in contrast to the all-powerful Creator described in the Bible. Here, He uses the crutch of evolution to produce advanced forms. The problem of numerous created errors implied by extinct taxa (see Model 4 above) and the slow progress and competition implied in an evolutionary model challenge God's creative power, knowledge, and goodness. Competition seems out of character with the God described in the Bible who does not forget the sparrow (Luke 12:6) and whose ideal for life includes the wolf and the lamb living peacefully together (Isaiah 11:6; 65:25). As is the case for progressive creation, we also have the appearance of evil in nature before the fall of man — a logical difficulty.

6. GOD AT BEGINNING ONLY (Klotz 1955, p 477)

a. Description of Model

This model has sometimes been called theistic evolution. Here, God starts life, then naturalistic evolution takes over without God's help. This particular model solves the problem of the origin of life on earth, which is perhaps the most difficult problem that evolution faces (Bonner 1962). Following this, naturalistic processes produce advanced forms of life.

b. Problems

The problems outlined above for theistic evolution apply here also, to which one can add the problems of naturalistic evolution without the help of God. For instance, how would inept, intermediate stages survive competition in a system of survival of the fittest while changing from one functional type to another? The forelimb of an organism evolving into a wing (to make a bird) in its inept, intermediate stage would not provide the necessary survival required by evolution. When the intermediate stage is neither a good organ for running nor for flying, survival would not be expected, because competition would eliminate it.

7. PANTHEISTIC EVOLUTION (Key 1960, p 22)

a. Description of Model

God progresses with evolution. It is a more naturalistic evolutionary philosophy than the previous case, in that God is evolving. Nevertheless, He is still God.

b. Problems

The problems are the same as those given for the previous model. In addition, it is very demeaning to the concept of God's greatness, as described in the Bible. There is no direct data in either Scripture or science to indicate that this is God's past history.

8. SPACE ANCESTRY (Arrhenius 1908; von Däniken 1971; Crick & Orgel 1973)

a. Description of Model

Under this heading can be included a variety of ideas that have gained some popularity in recent years. Basically they conceive of extraterrestrial life forms originating or modifying terrestrial

life. Some ideas postulate that only simple life was passively transferred to earth, while others postulate direct transfer or even hybridization between super beings and earth forms to produce more advanced forms of life. Such models solve some of the problems of naturalistic evolution by invoking the use of organisms from outer space. One is not bound to terrestrial limitations for the origin of life.

b. Problems

Probably the most serious problem of these models is the same as for many of the others presented above — namely, a lack of support for the ideas themselves. While they can solve many problems, the high degree of conjecture invoked makes them unattractive. Also, there is some doubt regarding the facilitation of organismal interplanetary space travel by naturalistic means.

9. DEISTIC EVOLUTION (Key 1960, p 20-21)

a. Description of Model

Here, an impersonal mind directs evolution. There is some kind of force, some special factor above our present concept of naturalism that has functioned in developing the advanced forms of life on earth. God is usually not involved.

b. Problems

Again, the problems with this model are the same as above; also, because it usually eliminates the necessity of a personal God, it is more difficult to conceive of the origin of those higher characteristics of man such as love, morality, concern, and freedom of choice which are difficult to explain on a naturalistic basis.

10. NATURALISTIC EVOLUTION (Ramm 1956, p 113), also called evolution, atheistic evolution (Key 1960, p 20), or mechanistic evolution (Marsh 1950, p 53)

a. Description of Model

Advanced forms of life have developed strictly as a result of the operation of natural law. This idea suits those who limit the concept of reality to tangible, natural laws. No intelligent design or supernaturalism is involved.

b. Problems

This model does not answer important questions such as the following: How do very complex life systems originate on earth without a designer? How do inept, intermediate forms survive the competition of naturalistic evolution? How can one bridge the gaps in the fossil record? How do you originate man's higher characteristics such as consciousness, free will, morality, and love in a purely mechanistic system?

III. GENERAL COMMENTS

A. Relation of Interpretations to Bible

None of the interpretations considered above, except the creation model, have good biblical support. They suggest progress while the Bible speaks of degeneration (compare Romans 8:22 to Genesis 1:31). That many involve the concept of a God is often their only serious link to Scripture. The Bible describes a short creation period (Genesis 1 and 2) of six literal days a few thousand years ago, producing all the basic forms of life. It does not at all suggest long ages for this process. Also, the original earth is described as being empty and dark (Genesis 1:2). Since light is necessary for many of the forms of life found throughout the fossil record, the concept of an extended period for the development of advanced forms before creation week is not entertained.

Those who adopt one of the intermediate views between creation and naturalistic evolution often assume the first part of Genesis to be an allegory. A weakness in this argumentation is that one must also assume the other Scriptural references to this early part to be allegorical. These later references do not suggest this. It is not only Moses, the author of Genesis, who is being questioned by these views, but others including God who dictated the fourth commandment (Exodus 20:11). Christ also refers to the Genesis account of origins (Matthew 19:4) and so does the apostle Paul (1 Corinthians 14:45). The apostle Peter's description (2 Peter 3:3-6) corresponds to Genesis. Hence these ideas tend to raise questions regarding the reliability of Scripture as a whole.

With most of these interpretations the question of God's integrity is serious. Would God state in the fourth commandment (Exodus 20:11) that He created all in six days if this were not the case? If so, He is not the God described in the Bible — the God who speaks the truth, declares what is right (Isaiah 45:19), and never tells falsehoods (Titus 1:2). Acceptance of a non-creation interpretation does more than harm Genesis; it poses a serious threat to God's integrity. This is important.

B. Relation of a Six-day Creation to Time in the Fossil Record

It is seldom appreciated that if one conceives of a significant amount of time for any part of the fossil record, one precludes the concept of an all-inclusive, six-day creation as given in Genesis 1 and 2 and Exodus 20:11. If there are millions of years in the fossil record, it does not seem that all of creation was in six days, since many parts of the geologic column contain unique fossil kinds. This uniqueness combined with the non-uniqueness expected of the process of fossilization seems to exclude the concept of an all-inclusive, six-day creation, if much time is put into the fossil record. Under the concept of an all-inclusive (for the major kinds of organisms but allowing for minor variation), six-day creation, a great variety of plants and animals would be present from the beginning. It does not seem that many isolated, random events of preservation over long periods of time would produce only one type of fossil in a lower level, and another at a different level, if all kinds of organisms are present. The process of fossilization usually requires quite rapid burial in order that preservation take place before degradation. The factors favoring rapid burial (flash floods, volcanic activity, windstorms) are not very selective and act on most of the organisms present.

As an example, if one puts an appreciable amount of time between creation and the worldwide flood described in Genesis, and further states that the lower part of the fossil record represents that long time, one would expect the fossilized organisms to be somewhat representative of the various forms of life present before the Genesis flood, and not just an unrepresentative, unique sample. Yet when one looks at the fossil record, one finds almost exclusively marine organisms in the lower part, while most of the higher forms of life that should have been present are not represented. Conversely, if one postulates a great length of time since the Genesis flood, making most of the upper part of the fossil record a post-flood event, one wonders why the flood event in the lower part of the record does not represent the many types of created life that would be expected. One would not expect the flood to be so selective as to exclude higher forms of life. Hence, if any significant amount of time is put into the fossil record, its uniqueness and the lack of uniqueness of the preservation process precludes an all-inclusive, six-day creation as described in Genesis 1 and Exodus 20:11.

The degree of uniqueness of fossils found in the geologic column is explained by creationists on the basis of processes active during the Genesis flood. These include: 1) sorting by water currents, 2) motility of some

organisms, 3) original ecology buried by gradually rising waters, and 4) sorting by density.

It is also of interest that the present process of accumulation of sediments on the surface of the earth is very slow, averaging at best less than one meter per thousand years (most estimates are much lower but are indirect and based on an assumed age of the earth). Biblical history does not allow much time either before or after the flood for the accumulation of very much sediment under normal conditions. This is a further reason for placing most of the fossil record in the flood when in a biblical context.

C. Relation of Scientific Data to the Various Interpretations

Because so many different views are being considered, a simple general statement is not easily formulated. This depends partially on one's definition of science. Science is usually considered to be explanations about nature. Traditionally, science has not always excluded God or the supernatural. Many of the founders of modern science were seeking for explanations about God's creation and principles He had incorporated therein. During the past century, science has tended more towards naturalism, excluding God and the supernatural. Contemporary research papers and textbooks of science seldom refer to God or other unnaturalistic explanations. Many scientists believe there is tension between an omnipotent God, who can overrule the laws of nature, and science which seeks for consistent explanations within established laws. Therefore, one would expect a scientist to seek naturalistic explanations that exclude God. But if supernatural explanations are a part of reality, such an exclusion would be a tendency towards error. This writer is of the opinion that the tension between God and science is not as serious as envisioned above — that both God and science can co-exist, especially when we are dealing with the non-capricious type of God described in the Bible and when considering science as a search for explanations based on the consistency that God has placed in nature. God and science need not be mutually exclusive concepts.

Should one define science as strictly naturalistic, one would have to exclude all but Model 10 (naturalistic evolution) from science, and many scientists would also be excluded from this strict definition. Many of them believe there to be some kind of God or mind that is responsible for the degree of organization evident in nature. Hence, many of the models proposed above would not be excluded from science if one uses a broad definition of science. Lack of definition of terms precludes a definitive

statement. Suffice it to state that science and naturalism are not always identical.

With reference to the ten specific models described above, some data do not support one idea, while they may be acceptable to another. For instance, the ubiquitous gaps in the fossil record would not support the idea that God had used a continuous process of small evolutionary changes to create the advanced forms of life (theistic evolution). One would expect to find a near-continuous series of advancing forms as evolution is followed through the geologic column. The explanations suggested by evolutionists for this problem, including punctuated equilibrium, are inadequate. The gaps are more in agreement with the idea that there may have been a number of progressive creations. Likewise, creation and various other views can be supported by the scientific data that reveal that the spontaneous origin of the complex integrated biochemical systems of even the simplest organisms is, at best, a most improbable event.

Because the intermediate views (Models 2-9) are so broad, it is difficult to find scientific data that disagree with all of them, thus supporting other ideas. Also, the closer two theories are, the less data that will be available to test the difference. This is as expected. For instance, the difference between multiple progressive creations and a single creation of all basic types is not as easily testable scientifically as is the difference between a theistically guided, continuous process of evolution (theistic evolution) and a single creation.

The difference between creation and all other views given above could be tested by the amount of time one finds for the deposition of the fossil record in the crust of the earth. All the other views propose a long time for the development of the fossil record, while creation does not. Some interpretations of scientific data (e.g., paucity of time-dependent erosional features expected in the fossil record at so-called long time gaps — paraconformities) suggest a brief period for life on earth. One must also remember that with this question, we are dealing with past events that are not at present easily repeatable, hence more difficult to test scientifically. The degree of objectivity is necessarily reduced, as one deals with the past.

In summarizing this section, we can state that scientific interpretations that imply long ages for the formation of the fossil record would fit all but the creation model. The problems of the spontaneous origin of life and of complex integrated life systems are good scientific evidence against the theory of naturalistic evolution and those interpretations closely related to

it. This is not so much the case (depending on one's definition of science) for those interpretations closely related to creation, where God transcends scientific difficulties. Here, science is uncomfortable with such supernaturalistic explanations, because it does not have the facility to test such. This does not mean they are false; it points out one of the limitations of science.

D. Relation of Models to Drifting Patterns of Thought

The influence of the intermediate views given above on the beliefs of many Christian churches has been considerable. Since the popularization of the theory of evolution during the past century, many denominations have in some way accommodated to various ideas of the progressive development of life over long ages. It is disappointing to see churches which usually place a very high priority on "established" truth change their beliefs; yet this occurs, often slowly and insidiously.

Richard Niebuhr in his book *The Social Sources of Denominationalism* (1957, p 19-20) has outlined the traditional history of a religious group. After being organized by the original reformers, the character of the sect is soon changed as a new generation of children is born. This new generation rarely has the fervor of its fathers who fashioned their "convictions in the heat of the conflict." Succeeding generations find isolation from the world more difficult. Wealth and culture accrue as compromise of the original purposes brings in the usual churchy type of morals. Soon the new group becomes a traditional church.

This traditional church is more a social structure than the instrument for reform originally intended. Managerial requirements distract increasingly the church's efforts from religious matters.

That drifting away from the Bible and God is a traditional sociological pattern is also illustrated in Old Testament history, where repeatedly God had to use drastic means to reverse the trend. Such incidents as the Genesis flood, the long sojourn of the Israelites in the desert, and the Babylonian Captivity illustrate how difficult but important it is to resist such trends and move towards God and the Bible.

Modern educational institutions also illustrate this tendency to drift. A large number of institutions of higher learning in the United States (e.g., Harvard, Princeton, the University of Southern California, Auburn University, Boston University, Wichita State University, Wesleyan University) began as religious, church-related institutions but have since moved well down the path to secularization and are no longer church related. It is significant that (at least to the best of the writer's knowledge) no institution

has begun as secular and then became religious. Here the trend also seems to be away from God.

The patterns of drifting in churches, in Old Testament history, and in educational institutions all appear to be trends *away* from God. This is unfortunate. Gradual and sometimes barely perceptible drifting is disturbing to anyone concerned with truth which does not change. One can unconsciously drift from one position to a slightly different one, and so on. The ten models of interpretation of the fossil record given above, and a number of intermediates we could place between them, illustrate how one could slowly and almost imperceptibly drift away from a belief in a Creator to atheism. The path can be a facile way to destroy the Bible and God — painlessly.

E. Trends and Truth

Changes in ideas may not be bad. They certainly are not when the trend is towards truth. But when one moves into less-supported paradigms, caution is warranted. Certainly shifting popular opinion is not a sound criterion for truth, whether it be about the fossil record or any other aspect of reality. More thorough and sound bases must be sought. We need to take cognizance of sociological patterns and not base truth solely on consensus trends. We need to be more concerned about the validity and authentication of certain ideas and what consequences for truth certain patterns entail.

One may argue that the trend away from a direct interpretation of the Bible towards intermediate views or naturalistic evolution may be a trend towards truth. In this writer's opinion this argument has some difficulties. Reasons are the following. 1) One has to deny the high degree of historical validity of the Bible. While the creation account has not been authenticated, it does not appear that the Bible writers invented the historical accounts they gave. The validation of many of those accounts lends support to those ideas that have not been validated. This would include the creation and flood accounts. The fact that many of the Bible writers, including Moses who wrote Genesis, were willing to make great sacrifices for what they believed to be true testifies to their integrity. 2) The intermediate views given above generally lack authoritative support. One does not find in either sacred history or in science the ideas proposed. Neither the Bible nor nature seems to say that God or the Devil acted in one of these particular ways. 3) Naturalistic evolution faces nearly insurmountable problems as defined within its own naturalistic system. See the discussion of Model 10 for details.

In this writer's opinion, creation by a God who established the laws of science and who revealed history in Scripture is the most satisfying model of origins and is best supported by the reality around us.

IV. CONCLUSIONS

The various interpretations of the fossil record given above show how one can gradually change his ideas from a belief in creation as described in the Bible to naturalistic evolution. There are sociological factors that favor a trend in this direction. This writer hopes that efforts will be made to go in the *opposite direction* — closer to God. Man's most important relationship is with his God, and we should do all we can to improve it.

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NEWS AND COMMENTS

ARGENTAVIS MAGNIFICENS: WORLD'S LARGEST FLYING BIRD

Recently the Los Angeles County Natural History Museum displayed parts of a skeleton of the biggest known bird that ever flew. Looming over the entrance hall, a black silhouette of *Argentavis magnificens* spans its wings over 8 m and stands 3.5 m from tip of tail to end of beak. This is almost twice the size of *Teratornis merriami* which, until now, had been considered the largest size to which flying avians could evolve. *Argentavis magnificens* (new genus and species) has now wrested the title of "World's largest flying bird" from *Osteodotornis orri*, the gigantic marine bird from the Miocene of California.

E. Tonni and R. Pascual of the National Museum of La Plata, Argentina, uncovered the fossil remains of *A. magnificens* from the banks of Salinas Grandes de Hidalgo in the Argentine province of La Pampa, 400 miles SW of Buenos Aires. Their collection included portions of the skull, the coracoid, the left humerus (incomplete), a portion of the ulna and right radius, the right tibiotarsus, one end of metacarpal II, a portion of metacarpal III, and a shaft of right tarsometatarsus.

Systematics: Order. Accipitriformes

Family. Teratornithidae

New genus and species. *Argentavis magnificens*

Etymology: Greek *teretos* (wonder) and *ornis* (bird)

Latin *argentum* (silver) and *avis* (bird)

This discovery did not come to the attention of the international scientific world until K. E. Campbell, curator of the Los Angeles County Natural History Museum and specialist in teratorns of Rancho La Brea, visited La Plata's Museum and with Tonni began a detailed study of the collected fossils. Their results have now been published by the Los Angeles County Natural History Museum.

The fossils were found in Argentina's central plain which is characterized by a flat, semi-arid topography. Dated in the Miocene epoch, the current evidence suggests an open grassland based on an abundance of fossil herbivorous animals. A large number were rodents on which the *A. magnificens* is thought to have fed. This latter supposition is based on studies of jaw articulation in comparison with recent similar birds. It is further supposed that the heads were not naked as are those of vultures, but covered with feathers.

The large wing size would limit this bird to more open areas, as maneuverability around trees and shrubs would seem difficult. Feather size is estimated to be 1.5 m long and 20 cm wide. It is not presently known if this teratorn actively flew by flapping its wings or if it mostly soared as do present-day condors.

An expedition to Argentina in 1981 is planned to search for further fossils of this most magnificent bird.

David H. Rhys

LITERATURE REVIEWS

Readers are invited to submit reviews of current literature relating to origins. Mailing address: ORIGINS, Geoscience Research Institute, 11060 Campus St., Loma Linda, California 92350 USA. The Institute does not distribute the publications reviewed; please contact the publisher directly.

WOOD FROM THE ARK — A KNOTTY PROBLEM

WOOD FROM “MOUNT ARARAT”: NOAH’S ARK? L. R. Bailey. 1977. *Biblical Archaeologist* 40:137-146. THE DATE OF “NOAH’S ARK.” R. E. Taylor and R Berger. 1980. *Antiquity* 54:34-36.

Reviewed by Richard D. Tkachuck, Geoscience Research Institute

Few, if any, ideas held by creationists elicit more excitement than the possibility of finding Noah’s ark. For most creationists, this discovery would summon the death knell for evolution. If one could find a very large boat resting on the side of a mountain somewhere in Turkey, one would then seem to have irrefutable proof for the Genesis accounts of creation and the flood. Thus, any report claiming its existence is received with widespread attention in both the religious and nonreligious world. Such statements frequently are picked up by the press, because they make such dramatic reading material.

In recent years, the strongest claim for the existence of the ark has come from a retired French industrialist-turned-explorer named Ferdinand Navarra. In two expeditions, one in 1955 and the other in 1969, Navarra claims to have found the ark, and both times he returned with wood specimens to confirm his statements. That this wood came from Mt. Ararat is not seriously discounted. But disagreement over the age of these wood specimens has not been resolved. This controversy has been discussed in two recent articles in the scientific literature, written by L. R. Bailey (1977) and R. E. Taylor & R. Berger (1980).

The article by Bailey gives a comprehensive picture of the history surrounding the acquisition and dating of the wood. Early claims for an approximate 5000-year age was based on the color and density of the wood specimen, as well as the degree of lignitization of the wood. Bailey convincingly demonstrates that the methods for dating the wood are freighted with a large number of assumptions that cast serious doubt upon the validity of the tests which have given the wood a purported age of four to six thousand years. When dated by ¹⁴C methods, the wood was revealed to be of a much younger age.

Both articles present data from several independent laboratories that dated the wood from the 1955 and 1969 collections. These are shown in tabular form below (see Table 1). As can be seen, the dates for the wood converge around 700 A.D., significantly later than a flood date.

TABLE 1

Radiocarbon dates determined on various Navarra wood samples*

Laboratory Number	Radiocarbon Age	A.D.
NPL-61	1190± 90	770-790
UCR-553	1210± 90	730-760
UCLA-1607	1230± 60	730
P-1620	1320± 50	640
GX-1667	1350± 95	620-640
GX-1668	1690±120	270

*Data taken from Taylor & Berger 1980.

The dates obtained by radiocarbon analysis have been criticized by creationists as being based on incomplete or inaccurate methodology and inadequate sample preparation, along with various geological and geophysical factors that could influence the dates received. For example, it has been said that the Navarra wood contained contaminants of more recent carbon material which gave it a more recent date. However, in some samples, cellulose was extracted, and only the carbon within the cellulose was analyzed. Thus this experiment eliminated the possibility of extraneous contamination.

It has also been suggested that because the wood was obtained at a very high altitude (13,000 feet), the atmospheric condition would allow more ¹⁴C to be produced because of the increased radiation at the altitude. However, Taylor & Berger negate this argument by stating that although the bristlecone pine ¹⁴C data were obtained from specimens at a very similar altitude, they show only a limited variation from tree-ring data. The authors conclude that Navarra's wood samples are from some other ancient structure and not from the ark.

A potentially more perplexing problem of finding ¹⁴C activity in the "ark" wood exists. Should ¹⁴C activity be found in wood from the ark, how would one explain the lack of ¹⁴C activity in the coal and petroleum deposits which were presumably made from wood of a similar source?

Much as one would like to have the ark found and would wish the Navarra wood to be part of it, the cause of creationism is hurt more by faulty scholarship than by absence of data. To convince an individual on the basis of poor or incomplete data that are later shown to be falsely

interpreted is to create cynicism for all data. This cynicism will cause the individual to treat with skepticism and scorn other data that have a much stronger basis in fact and that should be accepted.

GENERAL SCIENCE NOTES

BEETLES INDICATE A FAUNAL CHANGE IN THE ARCTIC DURING CENOZOIC TIME

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Change in the fauna of the polar region during Cenozoic time is suggested by the fact that woolly mammals no longer roam the area but are known only from Pleistocene fossils. Insects may also indicate a faunal change. Presented here are data based on two genera of weevils (Coleoptera: Curculionidae) which, because they are known to exist both as living species and as fossils, may show evidence of a faunal change.

The first genus, *Lepidophorus*, contains about ten species occurring in Siberia, Alaska and in the mountains of western North America and North Carolina. The second genus, *Vitavitus thulius* (Kissinger 1973), was described from a single female specimen collected in 1913 by the Canadian Arctic Expedition north of the Arctic Circle at Bernard Harbour, NWT. Both genera contain small insects between 2.5 and 5 mm in length. The biology of neither genus is known; for instance, we do not know whether the larvae develop in the ground, which may be probable, or develop instead in or on some plant. In any case, the fossils of these genera can be identified with a high degree of certainty.

The fossils mentioned in this note are heavily sclerotized, disarticulated parts of beetles, such as head, pronota and elytra. They are much like museum specimens in quality, except they have been abraded to some extent and in the case of weevils lack scales on surfaces where these would normally occur. Such fragments of Coleoptera make up a good percentage of the fossils of animals found in silts from Alaska.

Matthews (1968) has presented some notes on the Pleistocene silts from Fairbanks, Alaska. It is believed that the silt was removed by wind from the Tanana river flood-plain and deposited as loess on hillsides and valleys near Fairbanks. The valleys may contain loess deposits that are 100 feet or more in depth. The silt of the valleys is different from that of the slopes because it is bedded, perennially frozen and contains much organic material. The miners call it "muck" because it has a bad odor when thawed. The upland silt is like the loess of the mid-continent of North America in that it is oxidized, buff brown in color and contains few

if any fossils (Péwé 1955). Near Fairbanks frozen muck is exposed by cuts caused by placer gold mining. The sediments containing muck overlies early Pleistocene gravels that contain gold.

In the cut described by Matthews the gold-bearing gravel is covered by silt to a depth of 35 m. At points down the face of the cut, various fossiliferous mucks were examined for small mammal fossils. Each sample consisted of several thousand pounds of silt from a two-foot interval at the exposure. This material was screened through 40 mesh per inch screens. A portion of the organic material remaining on the screen was processed for fossil insects. Since the insects were quite abundant, only a small sample was needed to get a larger number of specimens. The residue was washed through 80 mesh per inch screen to remove the remaining silt, then immersed in lightweight oil. The oil-soaked mass was placed in hot water and many insect fragments rose to the surface. These fossils were stored in alcohol, later examined with a binocular microscope, and mounted on slides similar to those used for Foraminifera. This procedure facilitated storage and examination of the fossils.

Fossils of *Vitavitus thulius* Kissinger were found at four widely separated areas in sediments considered to be of Pliocene to late Pleistocene age, 5.7 million to 27,000 years before the present (BP) according to Matthews 1972. *Lepidophorus lineaticollis* Kirby was present in the last two assemblages.

SITE 1

Lava Camp Mine, Inmachuk River Valley, northern part of Seward Peninsula, Alaska, near the Bering Strait; see Hopkins et al. (1971) for details about the Pliocene flora and insect fauna from this site. The alluvium is typically 3-4 m thick. The lower part consists of gravel and grades upward into interbedded sand, silt and peat containing lenses of fine gravel and abundant wood. The alluvium rests on an irregular bedrock surface carved in schist and metalimestone. It is covered by 95 m of basalt which was dated by the potassium-argon method at 5.7 million years BP. The alluvium contains gold and has been prospected and mined since 1900. The wood in the alluvium includes logs as large as 23 cm in diameter and 2 m long. Some of the logs are recumbent. Other wood fragments representing roots and rooted stumps project downward from the lava roof. Peat and wood that lie within a few centimeters of the base of the lava are baked to charcoal. At lower levels some of the wood is relatively fresh, but other wood fragments have a brown lignitic appearance. The alluvial sequence evidently consists of basal gravel deposited in an open river channel and an overlying mass of finer sediment deposited on a

forested flood-plain. The base of the lava shows pillow-like convexities which suggest that the lava flowed across a moist surface. Samples of lava showed negative magnetic polarization and may have been deposited when the earth's magnetic field was oriented opposite to the present state.

Pollen and plant megafossils from the Lava Camp Mine include such items as sitka spruce (*Picea sitchensis*), hemlock (*Tsuga* spp.), fir (*Abies*) which today exists 850 km or more to the southeast, and hazel (*Corylus*) which reaches its northern North American limit in British Columbia and Newfoundland. It is concluded that tundra was not represented by the Lava Camp assemblage.

Along with plant fossils, the beds exposed in the Lava Camp Mine contain fossils of predacious and plant-feeding insects and oribatid mites. Some of these species now apparently are extinct; others show a relatively wide distribution in Alaska and Canada. A conclusion is that a similar assemblage of living insects and mites could not be collected on the modern tundra of Seward Peninsula nor in the boreal woodlands of present-day interior Alaska. A comparable assemblage of insects probably could be collected in southern British Columbia or northern Washington.

SITE 2

Cape Deceit Formation exposed near Deering, north coast of Seward Peninsula, Alaska. Sediments from this site contain fossil insects, plant macrofossils, and pollen spectra which indicate tundra conditions (Guthrie & Matthews 1971). A large series of more than 290 isolated heads, pronota, and elytra of *Vitavitus* was found in unit 2 of the Cape Deceit Formation which is dated at 400,000 to 700,000 years BP (Matthews 1972). One of the specimens was an articulated mesothorax, metathorax, and abdomen. The abdomen contained female genitalia which were very similar to the female genitalia of the type specimen.

SITE 3

Old Crow River, northern Yukon Territory. J. V. Matthews, Jr. (Geological Survey of Canada) is in the process of studying this assemblage. Preliminary evidence indicates that the site represents a flood-plain environment within a region of open spruce forest. Some fossils of tundra insects are present in the assemblage. Carbon-14 dates suggest that the age of the assemblage is greater than 40,000 years BP (Matthews 1972). Remains of *Lepidophorus lineaticollis* Kirby are present in this assemblage along with fragments of *Vitavitus*.

SITE 4

Watino, north central Alberta (Westgate et al., personal communication). The fossil assemblage represents a flood-plain containing ephemeral ponds. Age of the unit containing *Vitavitus* fossils is approximately 27,400 years BP (Matthews 1972). *L. lineaticollis* Kirby and *Vitavitus* fragments were found in the assemblage.

Interested in documenting changes of the tundra fauna during the Pleistocene, Matthews considered small mammals (Guthrie & Matthews 1971), carabid beetles (Matthews 1968) and staphylinid beetles (Matthews 1970). In a letter, he stated that one of the few examples of qualitative taxonomic difference in composition was the occurrence of *Vitavitus* without *Lepidophorus* in the early Pleistocene assemblages in contrast to late Pleistocene assemblages which contained *Lepidophorus* without *Vitavitus*. For the most part the difference between early and late Pleistocene assemblages involved differences in the abundance of taxa found in both.

In general the four assemblages mentioned here appear to contain the kind of insects that one would expect to collect at a particular location. The nature of the condition of the fossils and their taxa seem to preclude the possibility that the assemblages represent some distant fauna which was transported somehow to the present location. A second conclusion is that the apparent time sequence of the assemblages suggests that the range of *Vitavitus* was invaded and possibly replaced by members of a second genus, *Lepidophorus*. Hopkins et al. (1971) suggest that the Lava Camp Mine assemblage represents the situation when there may have been a land connection between Alaska and Siberia. Possibly *Vitavitus* represents a portion of the fauna which may have come across such a bridge. The apparently late appearance of *Lepidophorus* on the other hand may indicate that it was arriving from a southerly route, possibly across any newly established connection between South and North America. The current distribution of the species of *Lepidophorus* in the high altitudes of the United States may indicate that such populations are relics of the time when the climate of the southern part of the North American continent was cooler and such dispersal was possible.

In conclusion, the data presented above provide further evidence that significant climatic change has taken place in post-flood times. The evidence seems to indicate an ecological succession. It is interesting to speculate as to what geophysical events would allow an apparently warmer climate to exist where presently there is a colder one. In addition, the potential for microfossils, such as described above, as a marker for climatic change may not yet have been fully utilized.

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