The Proceedings of the International Conference on Creationism

Volume 2
Print Reference: Volume 2:I, Pages 43-56

Article 12

1990

Scientific Creationism and Radiocarbon Dating

R.H. Brown
Loma Linda University

SCIENTIFIC CREATIONISM AND RADIOCARBON DATING

R. H. Brown
Geoscience Research Institute
Loma Linda University
Loma Linda, California 92350, U.S.A.

ABSTRACT

Although scientific creationism is widely perceived as an instrument for establishing the correctness of testimony in the Bible concerning history and natural science, the author contends that its proper function is the application of rigid scientific analysis to the interpretation of data concerning the natural world from the perspective of the testimony given by writers of the Bible. Success in developing such interpretations will contribute to the confidence which is necessary for enjoyment of the benefits for which the testimony in the Bible has been provided, and may also contribute to the understanding of some natural phenomena.

The chronological data in the book of Genesis, and the available data concerning carbon-14 concentrations in the biosphere can be harmonized in a model which specifies an increase on the order of 100-fold in the biosphere carbon-14/carbon-12 ratio over the time between the Flood (Genesis 6-8) and the migration of Jacob and his family into Egypt (Genesis 46). The data on carbon-14 age profiles indicate that during at least a portion of the time in which the carbon-14/carbon-12 ratio was increasing, there was a decrease in the rates of peat growth and of erosional transfer from land to the ocean, and a decrease in the mixing of surface and bottom water of the ocean.

INTRODUCTION

What do we mean, or intend to mean, by "scientific creationism"? There is widespread opinion that the term is nonsense, that any presentation which involves a creation concept should be kept outside respectable scientific circles, that no reference to creation concepts should appear in science textbooks.

Scientific activity involves both application and explanation. In an explanation one concept or observation is described in terms of other simpler, or more fundamental, concepts. No chain of explanation can extend without end. Eventually a basic starting point is reached that must be assumed as unprovable and unexplainable. Through an evolutionary model, all natural phenomena can be explained as the ultimate consequence of the innate properties of elementary matter, the origin of which is assumed and unexplainable. A creation model accounts for all natural phenomena in terms of design by an intelligence which is unexplainable. The degree to which any specific explanation is "scientific" is determined by the thoroughness and logic with which the relevant data are collected, categorized, and organized,-- not by the unexplainable basic viewpoint which is chosen. From this perspective evolutionism is no more scientific, or unscientific, than is creationism. To assert that one of these viewpoints is scientific, and the other unscientific, is a misuse of terminology, in my judgment. Either of these viewpoints can be applied in a scientific, or an unscientific manner.

Many individuals want the naturalistic evolution viewpoint classified as "science", because the term science is popularly identified with "truth". But in the determination of ultimate truth one must go outside the domain of natural science. It should be kept in mind that the creation viewpoint is supported by evidence outside the domain of the natural sciences, by evidence which must be accessible to individuals who either are unacquainted with observations unique to modern scientific endeavor, or are incapable of judging the validity of a scientific essay.

Since the creation concept is promoted almost entirely by individuals who are Biblically oriented, Biblical Creationism is generally considered to be "Creationism", rather than only a subcategory of creationism as a general concept. The most distinguishing feature of Biblical Creationism is in specifications regarding time.

Scientific Creationism is widely perceived as an instrument for establishing the correctness of the testimony in the Bible concerning history and natural science. I am convinced that we would accomplish much more toward establishing respect for the Bible, toward establishing confidence in the testimony of the Bible, if we let the Bible prove our work, rather than attempting to make our work "prove" the Bible. I see the proper function of Scientific Creationism as the application of rigid scientific analysis to the interpretation of data concerning the natural world from the perspective of the testimony given by the writers of the Bible. In the final consideration, an individual's choice between the two basic viewpoints concerning causality, at least his choice regarding the Biblical Creationism subcategory of creationism, will depend on his confidence in purported eyewitness testimony. Three illustrations will clarify this contention.

After the events described in the first 35 verses of the book of Genesis, investigation strictly confined within the interpretive capabilities of the scientific domains of ecology and geology would have called for explanation involving long periods of time (as is the case today). Confidence in the accuracy of the Genesis creation account has always been based principally on confidence in eyewitness testimony (the testimony of an observer, either directly or indirectly to the author of Genesis).

Geologic investigations following the events described in the seventh and eighth chapters of the book of Genesis would clearly indicate major catastrophe (as they do today), but no scientific investigation could independently arrive at the time frame given by the author of Genesis for this catastrophe. Confidence in the associated time frame, the manner in which the Ark was loaded, and in the repopulation of the planet by survivors from the Ark, must be based entirely on confidence in eyewitness testimony.

Every conceivable scientific analysis of the twelve baskets of garbage noted in the gospel of Matthew, chapter 14, verse 20, would classify that refuse as products of grain harvested from fields in the vicinity, and fish that were caught in normal fishing activity. The truth regarding the origin of those chunks of bread and pieces of fish could be apprehended only through confidence in the testimony of eyewitnesses.

The scientific credibility of a particular subcategory of creationism (Biblical creationism, e.g.) is established by success in the development of scientifically sound explanations *from* the creationist perspective. A treatment that is perceived to have been presented as a scientific "proof" *for* a creation viewpoint may accomplish its author's objective only among individuals who are not competent to evaluate the science which is treated. Scientific evolutionism has a better reputation in scientific circles, partly because of antagonism toward the religious aspects of creationism, and partly because the peer review process has been more effective in preventing publication of unsound treatments from a uniformitarian, evolutionistic viewpoint, than it has been in preventing publication of unsound treatments which categorized creationism. As editors of creationist publications make increased use of a competent review process, the stature of creationism will be enhanced in scientific circles.

THE RADIOCARBON DATING CHALLENGE TO SCIENTIFIC CREATIONISM

The greatest difficulties in making Biblical Creationism respectable among scientifically informed individuals have developed over radioisotope age data. This is especially the situation with respect to radiocarbon age data, because a radiocarbon age for plant or animal remains is a characteristic of organic material which was once actually a component of a living organism.

When radiocarbon dating was first developed it met with skepticism in the scientific community, principally among anthropologists and archaeologists, because ages in excess of 3000 years were too young to agree with widely held views concerning human history. In his report to the twelfth International Radiocarbon Conference in Trondheim, Norway, on 25 June 1985, C. W. Ferguson referred to the challenge he faced to "straighten the situation out" and bring harmony among the various lines of evidence when he began his work on radiocarbon dating.

A radiocarbon age for a specimen merely specifies the amount of time that would be required for radioactivity to diminish the modern concentration of carbon-14 to the concentration found in the specimen. An interpretation in terms of real time requires an *assumption* concerning the concentration of carbon-14 in that specimen at a specific time in its previous existence. A specimen which initially had a higher than modern concentration of carbon-14 would have a radiocarbon age less than its real-time age. A specimen which initially had a lower than modern concentration of carbon-14 would have a radiocarbon age greater than its real-time age.

With confidence that independent lines of evidence should be in agreement when properly understood, Dr. Ferguson developed a Bristlecone Pine dendrochronology that provided tree ring sequence dated wood which could also be dated by carbon-14 analysis (1). His dendrochronology indicated radiocarbon ages in excess of 4000 years to be less than the corresponding real-time age, and overcame much of the initial reluctance to accept the radiocarbon method for age determination.

Archaeologists are now finding uncalibrated radiocarbon ages for sites in Eastern Europe to be more acceptable than conversion values obtained from Ferguson's dendrochronology (2,3). Additional question concerning the dendrochronology paradigm for interpretation of radiocarbon ages has come from analysis of organic material in the mortar that was used in the construction of the Egyptian pyramids (4).

The difficulties within the scientific community over radiocarbon ages which were less than acceptable expected values have not been nearly as great as the difficulties among Biblical creationists over radiocarbon ages in the 6000-60,000 year range. The suggestion that radiocarbon ages in excess of 6000 years are due to a decrease of over ten-fold in radioactive decay rates within the past 6000 years does not have scientific credibility, because of the lack of evidence for such change. The sharpness and identifiability of radiohalos indicates that radioisotope decay rates have been essentially constant throughout the existence of the minerals that are found presently in the crust of our planet (5,6).

BIBLICAL TIME CONSTRAINTS

The chronological data in the Bible impose definite, though not precise, constraints on the interpretation of radiocarbon age data. The Old Testament in popular modern versions of the Bible is based on translation of the ninth century Masoretic Hebrew text. The data in this text place the end of the Flood at 2522 B.C. and Creation Week at 4197 B.C., if the construction of Solomon's Temple was undertaken in 970 B.C. and the Hebrew sojourn in Egypt lasted 430 years (7). With reference to the conventional radiocarbon zero time at 1950 A.D., these dates specify 4472 years to the Flood, and 6147 years to Creation Week. To accommodate the contention that the Hebrew sojourn in Egypt lasted only 215 years these time intervals would be adjusted to 4257 years and 5932 years.

The sacred scripture used by the early Christian church was the Septuagint version of the Old Testament. All the early Christian Fathers, with the exception of Jerome, preferred the Septuagint to the text which became known as the Masoretic. It is still the approved version in the Eastern Church (8). With a Hebrew sojourn of 430 years, the data in the Septuagint place the end of the Flood at 3402 B.C., and Creation Week at 5665 B.C. (9). The corresponding time intervals are 5352 years to the Flood, and 7615 years to Creation Week.

As far as this discussion of the constraints on the interpretation of radiocarbon age data is concerned, it is adequate to place the Flood about 4500 years ago according to the Masoretic text, about 5500 years ago according to the Septuagint text, and in the vicinity of 5000 ± 500 years ago on the basis of Biblical testimony.

RADIOCARBON AGE CONSTRAINTS

Within the precision of measurement, radiocarbon ages agree rather closely with validated real-time age as far back as 1500 B.C., and possibly even to the early second millennium B.C., i.e., to circa 1900 B.C., the approximate time when Jacob and his family moved to Egypt (10).

The new accelerator mass spectrometry (AMS) technique for directly counting carbon-14 atoms, rather than only radioactive decay events, yields a finite radiocarbon age in the vicinity of 43,000 years for fossil organic material which we can confidently consider to have been buried at the time of the Flood (11). An example of such material is anthracite coal that has been assigned a conventional geological age greater than seventy million years (12). Individuals who wish to retain the long-ages concept for life on planet Earth consider this 43,000 years value as the result of contamination, a consequence of young material coming in contact with material which is over 100,000 years old. The clustering in the 41,000-45,000 year range for a wide variety of samples, with consistent results from all the AMS laboratories that have been in operation, clearly indicates that the contamination hypothesis is inadequate.

An organism that died about 5000 years ago, and now has a radiocarbon age in the vicinity of 43,000 years, at the time of its death would have had a carbon-14/carbon-12 concentration about 1/100 of that which characterizes the contemporary environment. Consequently there is a solid scientific basis for considering the pre-Flood organic world to have had a carbon-14/carbon-12 concentration about 1/100 of that which has characterized the environment over most of the last 4000 years, and for presuming that the time between the Flood and the early second millennium B.C. was a period of readjustment during which carbon-14/carbon-12 concentrations increased. This readjustment period is represented by radiocarbon ages from around 43,000 to about 3800 years. The real-time interval involved is about 600 years according to the Masoretic

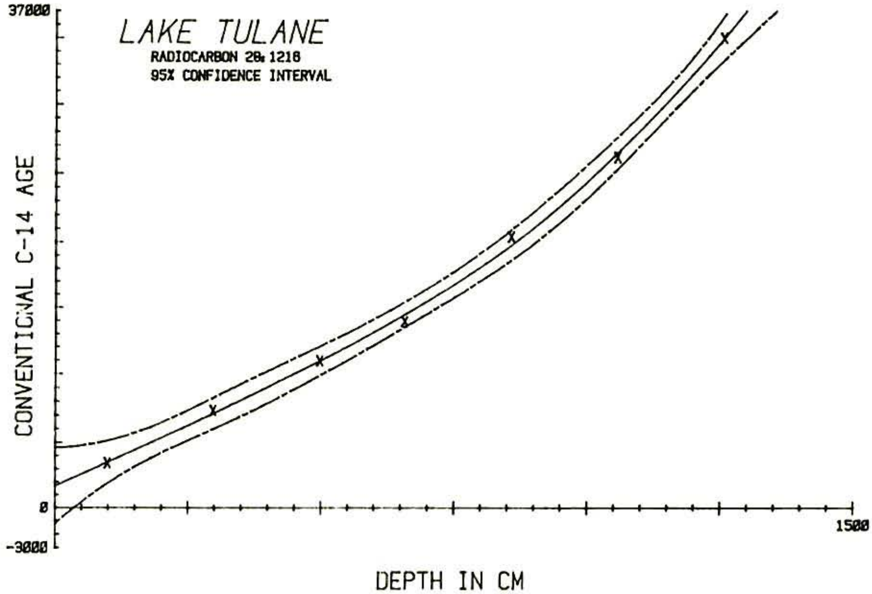

Figure 1 - Continental sediment from Lake Tulane, Florida. Data from RADIOCARBON, Vol. 28, No. 3, p. 1216. Depth axis shifted 2400 cm. Coefficient of Determination 0.999. Boundary lines mark the region of 95% confidence for the regression line.

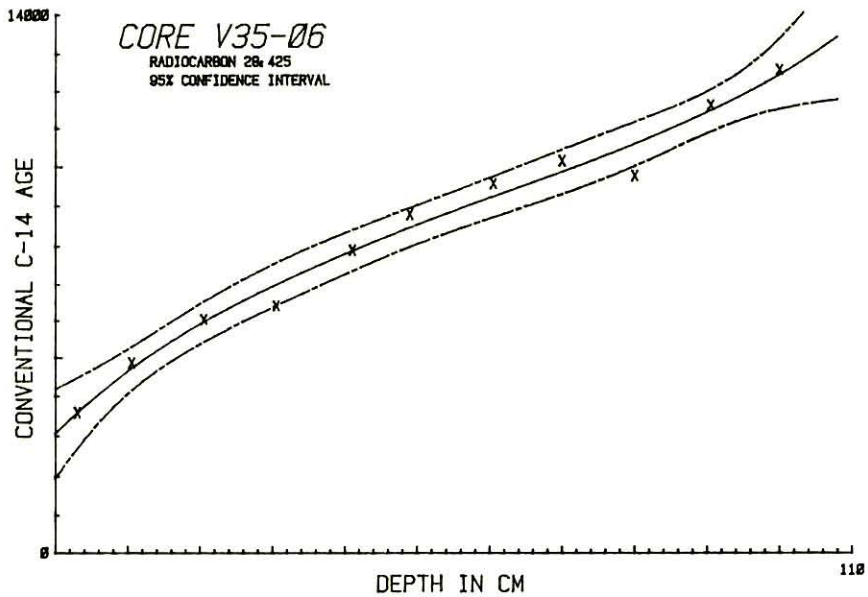

Figure 2 - Ocean sediment from South China Sea. Data from RADIOCARBON, Vol. 28, No. 2A, p. 425. C-14 age for *G. sacculifer*. Coefficient of Determination 0.983. Boundary lines mark the region of 95% confidence for the regression line.

text, or about 1500 years according to the Septuagint text. (215 years less if the Hebrews lived in Egypt only 215 years prior to the Exodus.)

A 100-fold lower carbon-14 concentration could indicate carbon-14 generation at 1/100 of the average modern rate, making 1/100 as much carbon-14 available for distribution over the world. Carbon-14 is produced from nitrogen gas by interactions in the upper atmosphere with cosmic rays from outer space. A lower carbon-14 production could be the result of a lower cosmic ray intensity. Since cosmic rays are deflected by a magnetic field, lower carbon-14 production could also be a consequence of a stronger magnetic field about our planet. A 100-fold lower concentration of carbon-14 could be produced also by distributing the carbon-14 in 100 times as much carbon as is now contained in the active biosphere. In view of the large amount of fossil carbon that now exists in coal, petroleum, natural gas, and fossil shell material, a pre-Flood world with 100 times as much active carbon as the biosphere now contains is not unreasonable.

EVIDENCE FOR A CARBON-14/CARBON-12 RATIO TRANSITION

Is there good evidence for an episode of increasing carbon-14 concentration, as called for by the Biblical time constraints? The answer is strongly affirmative. The time available for this presentation permits only a brief consideration of this evidence.

A musk ox carcass that had been preserved since the Ice Age by permafrost in Alaska had radiocarbon ages of 17,200 for hair, and 24,000 for scalp muscle tissue (13). No one would propose that musk oxen lived 7000 years; so the difference between these radiocarbon ages indicates that the carbon-14 concentration in the vegetation on which this animal fed was increasing rapidly during its lifetime. Hair is replaced relatively more rapidly than is muscle tissue, and should have a carbon-14 concentration very close to that of the immediate food supply.

A mammoth skeleton found in Wyoming gave an 11,300-year radiocarbon age for the most recently formed ivory in its tusks. This datum establishes the time of death at close to 11,300 radiocarbon years ago. The skeleton was buried in gravel which contained wood fragments with a 5000-year radiocarbon age (14). It is unlikely that a skeleton would lay around for 6000 years in an articulate relationship before final burial, but the bones could remain in an articulate relationship for several decades until the carbon-14 concentration doubled. So it appears that this animal died and was eventually buried during a time of major increase in the biosphere carbon-14 concentration.

Additional examples of this type are given in Volume II of Proceedings of the First International Conference on Creationism (15). In this presentation I would like to give major attention to the evidence that can be obtained from radiocarbon age profiles.

RADIOCARBON AGE PROFILE DATA

Figure 1 gives the profile of radiocarbon age for sediment in Lake Tulane, Florida. In this figure sediment depth increases from left to right, and associated carbon-14 age increases upward. The x-marks designate the associated values of carbon-14 age and sediment depth. The seven data points cover a range of sediment depth from about 100 cm to about 1300 cm. The carbon-14 age range extends back to about 35,000 years. The solid line is the best third-order mathematical smooth fit to the data points. A first-order fit would be a straight line. It is obvious that a straight line would make a poor fit to this set of data. The 0.999 Coefficient of Determination is a mathematical statement that a third-order equation gives an almost perfect fit. (A 1.000 Coefficient of Determination specifies a perfect fit.) The dot-dash boundary lines designate the region within which we can have 95% confidence that repeated observations would fall, i.e., if we were to make 100 additional observations, 95 of them would most likely be represented between these dot-dash lines, and 5 would likely give points either below the lower or above the upper line.

The significant feature of this profile plot is that it becomes steeper with increasing depth. The difference in carbon-14 age across one centimeter of sediment in the deeper portion is greater than it is in the upper portion. Such a trend would be produced if the sediment accumulated more slowly in the past, or if the carbon-14 concentration in the sediment was increasing as the sediment accumulated. From this example we can see that radiocarbon age profiles have a potential for indicating periods of increasing carbon-14 concentration in the biosphere.

Figure 2 gives a similar profile plot for ocean sediment from the South China Sea. In comparison with Figure 1 the data points are more scattered, and the third-order mathematical smooth fit to the data is not as good (Coefficient of Determination 0.983, rather than 0.999). The lower curved portion of this plot could be interpreted as evidence that the upper 35 cm of sediment accumulated more slowly than the deeper portion; but the profile does not suggest that there was a period of increasing carbon-14 concentration. I show this plot to demonstrate that wide potential local variation in the factors which determine profile buildup rate make it necessary to average a large number of profiles to determine any universal trend that might be revealed.

In Figures 1 and 2 zero age does not coincide with zero depth because depth is measured from an arbitrary reference point.

If a profile buildup rate is constant in real time, and if the carbon-14 concentration in the supporting environment is constant, a plot of radiocarbon age versus profile depth will follow a straight line which maintains the same number of carbon-14 years per centimeter of depth throughout. A change in carbon-14 concentration during profile buildup will alter the radiocarbon age, producing a change in the number of carbon-14 years per centimeter that can cause curvature of the profile plot. Investigation of world-wide averages for carbon-14 profile years per centimeter as a function of age may be expected to yield information concerning the carbon-14 concentration in the biosphere.

Figures 3, 4, and 5 reproduce graphic summaries of world-wide averages for carbon-14 profile years per centimeter of depth that have been published previously (16, 17). Figures 6, 7, and 8 give corresponding summaries for additional profile data that have become available between the preparation of the 1986 report and the preparation of this report. The numbers above the vertical bars in these figures are the number of individual profiles that contributed to the average represented by that bar. The shaded areas represent the region of uncertainty within which we can have 68% confidence that the represented average value would fall, i.e., the region which we can expect would include 68 out of 100 similar determinations. Figures 6, 7, and 8 are consistent with Figures 3, 4, and 5, and demonstrate the need for a large data base in investigations of this nature.

Figure 6 represents 20 continental sediment profiles from Africa, Bermuda, Europe, India, and the U.S.A.; Figure 7 three soil profiles from Missouri, Sudan, and Tunisia; and Figure 8 twenty-two peat profiles from Europe, the Falkland Islands, Japan, and the U.S.A. Figures 10 and 11 represent 27 sediment profiles from eight widely scattered regions of the world's oceans. (The data in Figures 3-5 represent 160 continental sediment, 25 soil, 10 ocean sediment, and 114 peat profiles.)

To assure sound conclusions, each of the profiles on which Figures 3-11 are based meets the following restrictions: at least seven carbon-14 versus depth data pairs, Coefficient of Determination greater than 0.75 for a third-order (cubic) mathematical smoothed profile representation, no suggestion of disturbance during profile buildup, and carbon-14 age range covering at least two adjacent multiples of 2500 years. The latter restriction is necessary to exclude data sets which might illuminate only differences between localities without providing information concerning trends in carbon-14 age per centimeter. As exceptions to these restrictions, one continental sediment and two peat profiles that are defined by only six data points, but for which the data points are evenly spaced and tightly constrained within 95% confidence boundary limits, have been included in the supplementary data analysis. For this group the average number of data points per profile is 9.77 for continental sediment, 8.33 for soil, 14.17 for ocean sediment, and 11.32 for peat. The corresponding Coefficient of Determination average is 0.970, 0.925, 0.976 for ocean sediment profiles less than 51 cm long, 0.981 for ocean sediment profiles greater than 51 cm long, and 0.979.

In both the initial and the supplementary graphic analyses all profiles that could be represented better mathematically by a straight line than by a third-order (cubic equation) plot were treated as having a constant carbon-14 years per centimeter characteristic. In the supplementary group two continental sediment profiles, one ocean sediment profile with length less than 51 cm, two ocean sediment profiles with length greater than 51 cm, and three peat profiles came under this classification.

RADIOCARBON AGE PROFILE EVIDENCE FOR CARBON-14/CARBON-12 INCREASE

From Figures 3-9 it is clearly evident that the available data for continental sediment, soil, and deep ocean sediment radiocarbon age profiles can be readily interpreted as indicative of an increase in the biosphere carbon-14/carbon-12 ratio during an extended period of time up to the early second millennium B.C. (between the 2500 and 5000 year C-14 age bars in these figures). There are insufficient data for determining when this increase began, either in real-time years or radiocarbon years.

It would be desirable to have an estimate for the magnitude of this increase. Lack of information concerning real-time profile buildup rates over the period in which radiocarbon age cannot be converted with certainty to real-time age prevents an estimate of this magnitude on the basis of physical evidence alone. We are dependent on data from the Bible for an estimate placing the increase in the probable vicinity of 100-fold.

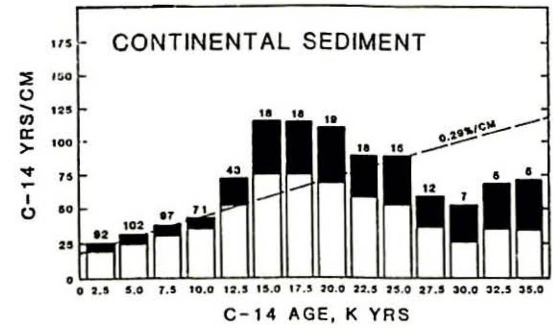

Figure 3 - Graphic summary for global slope characteristics of continental sediment profiles (1986 report). In Figures 3-11 the shaded areas represent the standard deviation range of uncertainty in the location of the mean.

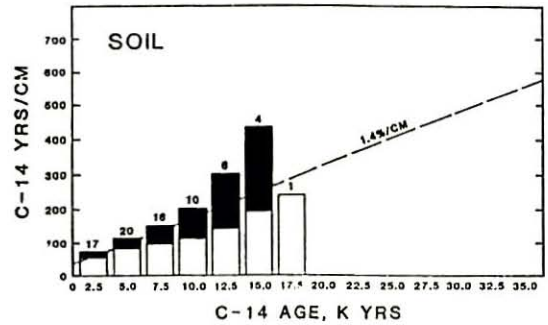

Figure 4 - Graphic summary for global slope characteristics of soil profiles (1986 report).

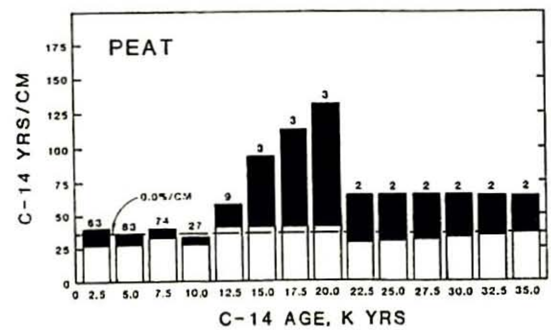

Figure 5 - Graphic summary for global slope characteristics of peat profiles (1986 report).

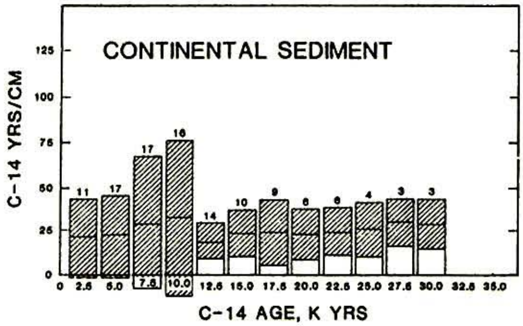

Figure 6 - Graphic summary for global slope characteristics of additional continental sediment profiles.

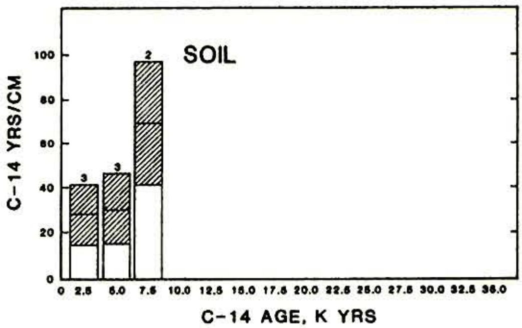

Figure 7 - Graphic summary for global slope characteristics of additional soil profiles.

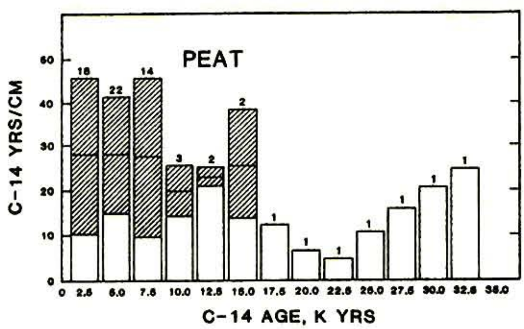

Figure 8 - Graphic summary for global slope characteristics of additional peat profiles.

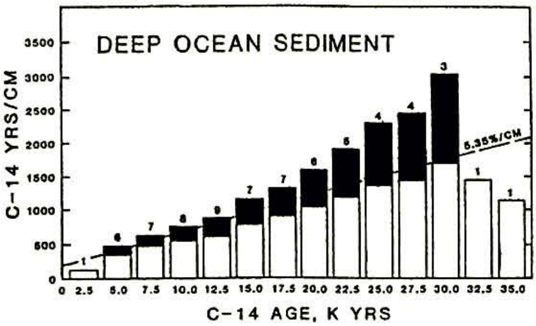

Figure 9 - Graphic summary for global slope characteristics of deep ocean sediment profiles (1986 report).

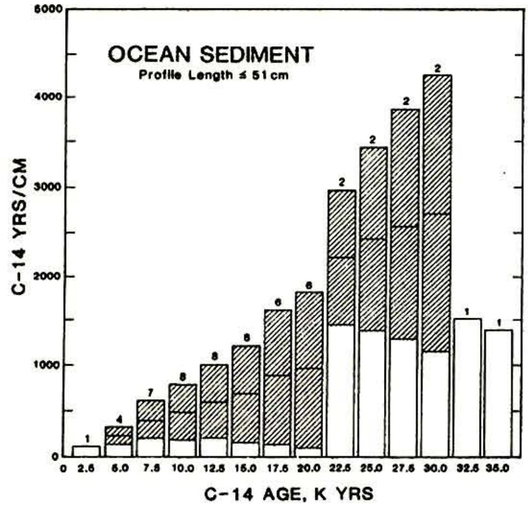

Figure 10 - Graphic summary for global slope characteristics of additional ocean sediment profiles with total profile depth less than 51 cm.

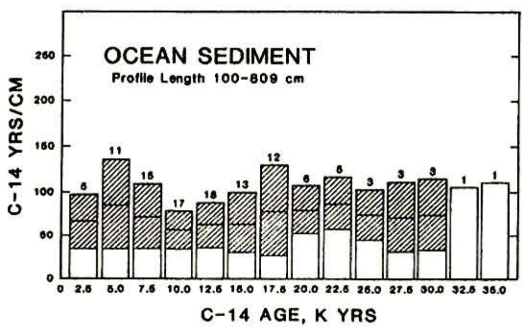

Figure 11 - Graphic summary for global slope characteristics of additional ocean sediment profiles with total profile depth greater than 51 cm.

CARBON-14 PROFILE BUILDUP RATES; OCEAN MIXING

When all the ocean sediment profiles in the supplementary set were taken together there was excessive statistical uncertainty due to the involvement of two distinct subsets. To obtain a more refined treatment of carbon-14 years per centimeter trends these groups were analyzed separately. One group had maximum profile length data ranging from 14.5 cm to 50.5 cm, and is represented by Figure 10. The other group, represented by Figure 11, had maximum profile length data ranging from 100 cm to 809 cm. In seeking an explanation for the marked distinctions between these two groups it was discovered that the core for each of the greater than 51 cm length group was obtained near a river mouth, the mouth of a gulf, or an island uplift, or from a shallow basin between large land masses (South China Sea). It is significant that the carbon-14 years per centimeter trend for the greater than 51 cm ocean group resembles that for peat profiles (Figures 5 and 8) more closely than those for the other profile categories. The diverse characteristics of these two profile categories, in comparison with the other profile categories, can be explained as a consequence of decreasing peat bog growth rates and decreasing rates of ocean sediment accumulation near large land masses. Such decreases would produce profile curvature opposite to that resulting from an increase in the carbon-14/carbon-12 ratio, as shown in Figure 13.

With the AMS technique it is possible to make radiocarbon age determinations on milligram-sized samples. Such capability makes it possible to obtain a radiocarbon age for a microscopically isolated sample of a particular variety of foraminifera shells. A comprehensive list of carbon-14 age profiles for foraminifera tests in ocean bottom drill cores has recently become available (18). These data conform to the pattern of two subsets, one for deep areas in the open ocean (profile lengths less than 51 cm), and one for shallower areas that may be expected to have received relatively large amounts of sediment from a nearby land mass (profile lengths greater than 90 cm). They also indicate two additional subsets, one for planktonic (surface dwelling) foram tests, and another for benthonic (bottom dwelling) foram tests.

For a particular drill core, the carbon-14 age profile for benthonic foram tests tends to be less concave toward the age axis than the associated profile for planktonic tests. In the summaries depicted in Figures 10 and 11 data for planktonic and benthonic forams were averaged together. If the benthonic data had been excluded these summaries would have indicated a somewhat more pronounced increase in carbon-14 years per centimeter with carbon-14 age.

Figure 12 shows D, the difference between the carbon-14 age for benthonic species (mixed) and planktonic species (mixed) as a function of A, the carbon-14 age for planktonic species (mixed) in the data given by Broecker, et al. (18). The vertical bars straddling the data points represent ± one standard deviation of uncertainty (region of 68% confidence concerning the probable "correct" location of the data point), as crudely estimated from the standard deviation data given by Broecker, et al. Each of the three profiles reported by them with sufficient benthic foram age data for an analysis of trends indicates that, on the average, with the passage of time the carbon-14 age of benthic forams becomes increasingly greater than the carbon-14 age of planktonic forams.

It is additionally significant that for the Oontong-Java Plateau(Core V28-238, depth 3120 m, 01 deg 01 min N latitude, 160 deg 29 min E longitude) the difference, and also the rate of increase of difference, is greater than for the South China Sea (Cores V35-05 and V35-06, depth 1953/2030 m, 07 deg 11.7/13.0 min N latitude, 112 deg 04.6/09.0 min E longitude). Since the data for Core V35-05 cover twice the carbon-14 age range covered by the data for Core V35-06 (15,185 vs 7620 C-14 years), and the data points have considerable scatter, there is no significant difference between their plots in Figure 12.

From these observations it can be inferred that in the past there was more complete (i.e., more prompt) vertical mixing in the world's oceans than there is at present, that since at least 20,000 carbon-14 years ago ocean bottom water has been increasingly isolated from (less promptly mixed with) ocean surface water, and that these differences are most pronounced in the deeper regions remote from large land masses. These inferences are supported also by morphological and oxygen isotope data for brachiopods from the next-to-the-lowest geological layer that contains multicellular fossils (Ordovician, which has been assigned a geologic age in the 450 million years vicinity) (19).

It is at least interesting that the Core V28-238 line in Figure 12, which was drawn by computer as the best straight-line average for the data, extrapolates to zero difference between benthonic and planktonic foram carbon-14 age in the vicinity of 43,000 carbon-14 years. The limitation of only eight data points, their wide scatter, the large extrapolation required, and the improbability of linear relationships, make it unwise to consider this as more than a chance agreement with a probable radiocarbon date for the Flood.

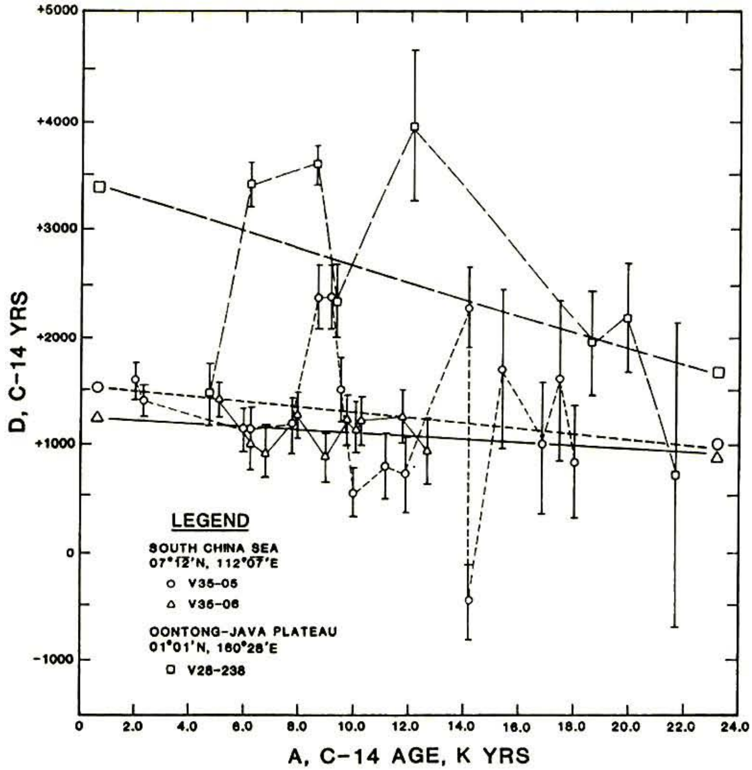

Figure 12 - C-14 age of mixed benthonic foraminifera tests minus corresponding C-14 age of mixed planktonic foraminifera tests, D, as a function of corresponding C-14 age of mixed planktonic foraminifera tests, A.

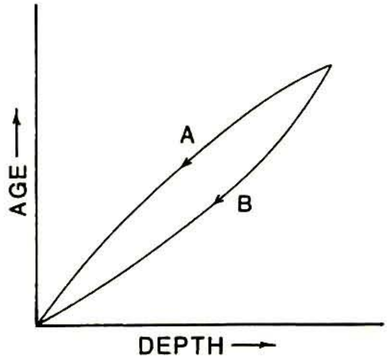

Figure 13 - Nonlinear growth patterns.

A - Constant biosphere C-14 concentration, with decreasing accumulation rate. C-14 age would plot linear against real time.

B - Constant accumulation rate, with increasing biosphere C-14 concentration. Real time accumulation plot would be a straight line, but C-14 age is increasingly greater than real time age.

CONCLUSIONS

A constant cosmic ray intensity would produce a higher carbon-14/carbon-12 ratio in the active biosphere after a large amount of carbon had been removed by burial of plants, animals, and carbonate sediments in a world cataclysm. Following such a cataclysm the carbon-14/carbon-12 ratio in the active biosphere would increase until the average combined loss rate of carbon-14 due to radioactive decay and transfer of carbon-14 to inactive sediment, principally the latter, became equal to the average rate of carbon-14 production by cosmic radiation. During this carbon-14/carbon-12 ratio increase the number of conventional carbon-14 years per centimeter of sediment and peat accumulation would decrease, providing sediment accumulation and peat growth rates remained constant.

During a reestablishment of vegetation cover and a recovery from Ice Age climate, conditions may be expected which would favor a decrease in peat bog growth rates and also a decrease in the rate of transfer of eroded material from land masses into the ocean. These decreasing rates would tend to produce carbon-14 age versus depth profiles concave toward the depth axis, contrary to the tendency for an increasing carbon-14 concentration to produce profiles concave toward the age axis (convex toward the depth axis), as portrayed in Figure 13. In some cases the two tendencies could neutralize each other, producing approximately linear profiles. In other cases one or the other tendency could predominate. The evidence indicates that the effect of increasing carbon-14 concentration predominates in most cases.

From the data treated in this report it is also apparent that over at least a span of time covered by radiocarbon ages up to 20,000 years the world's oceans have been in a transition stage in which bottom water has become increasingly old with respect to corresponding surface water.

These conclusions do not "prove" the chronological specifications given in the Bible. But I hope that they do establish that the carbon-14 data can be interpreted in a sound scientific manner from the viewpoint of these specifications. Whether anyone who is acquainted with radiocarbon dating techniques and data accepts the model presented in this treatment will depend on how successful it is considered to be in comparison with other models, and on how much evidence concerning the dependability of testimony given by writers of the Bible is accepted.

REFERENCES

1. Ferguson, C. W., "Bristlecone Pine: Science and Esthetics", SCIENCE, Vol. 159, No. 3817, 1968, pp. 839-846.

2. Willkom, Horst, "Comparison of ^{14}C Dates and Other Age Estimates Between 2000 BC and AD 100", RADIOCARBON, Vol. 22, No. 2, 1980, pp. 286-290.

3. Kohl, G., "Problems of the Radiocarbon Chronology of Early Bronze Age", 12TH INTERNATIONAL RADIOCARBON CONFERENCE, ABSTRACTS, Trondheim, Norway, 1985, p. 107.

4. Weinstein, James, "Book review of CHRONOLOGIES DU PROCHE ORIENT, CHRONOLOGIES IN THE NEAR EAST, RELATIVE CHRONOLOGIES AND ABSOLUTE CHRONOLOGY, 16,000 - 4,000 BP (edited by Oliver Aurenche, Jacques Evin, and Francis Hours; Oxford, 1987)", RADIOCARBON, Vol. 31, No. 1, 1989, pp. 101-103.

5. Brown, R. H., Coffin, H. G., Gibson, L. J., Roth, A. A., and Webster, C. L., "Examining Radiohalos", ORIGINS, Vol. 15, No. 1, 1988, pp. 32-38.

6. Brown, R. H., "Radiohalo Evidence Regarding Change in Natural Process Rates", CREATION RESEARCH SOCIETY QUARTERLY, in press.

7. Brown, R. H., "Chronological Constraints of the Patriarchal Period", manuscript available from Geoscience Research Institute, Loma Linda University, Loma Linda, California 92350.

8. Horn, Siegfried H., "The Old Testament in Antiquity", MINISTRY, November 1987, pp. 4-8.

9. (See No. 7)

10. Libby, Willard F., RADIOCARBON DATING, 2nd edition, The University of Chicago Press, Chicago, Illinois, 1955.

11. Brown, R. H., "The Upper Limit of C-14 Age?", ORIGINS, Vol. 15, No. 1, 1988, pp. 39-43.

12. Lowe, David C., "Problems Associated with the Use of Coal as a Source of ^{14}C-Free Background", RADIOCARBON, Vol. 31, No. 2, 1989, pp. 117-120.

13. "Fairbanks Creek Musk Ox", RADIOCARBON, Vol. 12, No. 1, 1970, p. 203.

14. "Union Pacific Mammoth", RADIOCARBON, Vol. 8, 1966, pp. 172, 173.

15. Brown, R. H., "Radiometric Dating from the Perspective of Biblical Chronology", PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON CREATIONISM, Vol. II, Creation Science Fellowship, Pittsburgh, Pennsylvania, 1987, pp. 31-57.

16. Brown, R. H., "^{14}C Depth Profiles as Indicators of Trends of Climate and $^{14}C/^{12}C$ Ratio", RADIOCARBON, Vol. 28, No. 2A, 1986, pp. 350-357.

17. Brown, R. H., "Implications of C-14 Age Versus Depth Profile Characteristics", ORIGINS, Vol. 15, No. 1, 1988, pp. 19-29.

18. Broecker, Wallace, Klas, Mieczyslawa, Ragano-Beavan, Nancy, Mathieu, Guy, Mix, Alan, Andree, Michael, Oeschger, Hans, Wolfli, Willy, Suter, Martin, Bonani, Georges, Hofmann, H. J., Nessi, Marzio, and Morenzoni, Elvezio, "Accelerator Mass Spectrometry Radiocarbon Measurements on Marine Carbonate Samples from Deep Sea Cores and Sediment Traps", RADIOCARBON, Vol. 30, No. 3, 1988, pp. 261-295.

19. Railsback, L. Bruce, Ackerly, Spafford C., Anderson, Thomas F., and Cisne John L., "Paleontological and Isotope Evidence for Warm Saline Deep Waters in Ordovician Oceans", NATURE, Vol. 343, 1990, pp. 156-159.