RADIOLOGICAL DATING AND SOME PERTINENT APPLICATIONS OF HISTORICAL INTEREST

DO RADIOLOGICAL "CLOCKS" NEED REPAIR?

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Radiocarbon dating is bused on the incorrect assumption that C-14 is in equilibrium, the rate of formation equaling the rate of decay. But recent data show rate of formation is 18.4 and rate of decay 13.3 so that a non-equilibrium condition exists. This situation telescopes all radiocarbon ages to about 10,000 years or less. Consideration of uraniun-thorium-lead age determinations show at least six basic difficulties involved in determining true age. Most serious is evidence for artificial aging by the so-called "neutron-gamma" reactions. A number of crucial examples are given. Thus the uranium ore at Shinkolobwe, Katanga contains no thorium or common lead, but .08% Pb-208! If it came from "neutron-gamma" reactions, the likely explanation of this ore, it is a modern ore, far younger than the assigned 640 million year old age of conventional dating!

Potassium-argon dating does not take into account the relatively great amount of argon-40, branching ratio data, and uncertain half-life of some isotopes. Pure guess work is required to ***establish the actual concentrations of the isotopes*** *involved in the rubidium-strontium "time clock" at the beginning of a particular mineral.*

An extensive (discussion of radiocarbon dating in relation to a global sea level cycle is given. Also dates of various civilizations based on an equilibrium radiocarbon model are shown to be seriously older than reality.

In a recent book, *Prehistory and Earth Models,* [1] (abbreviated in this article: PEM) the prominent radioactive "time clocks" were examined including radiocarbon, the six uranium-thorium-lead methods, and the potassium-argon and rubidium-thorium rock dating methods.

The conclusions are summarized below, along with more, recent findings and interesting applications of radiocarbon dating. They may be further summarized by the simple statement that there are really no reliable long-time radiological "clocks," and even the short-time radiocarbon "clock" is in serious need of repair.

The Foundations of Radiocarbon Dating

The radiocarbon (or C-14) method of dating biospheric (dead) specimens, and other carbon-containing substances that have lost contact with the carbon cycle at some point in time, is based on the incorrect assumption that C-14 is in steady state (or in equilibrium) in the earth as a whole—in the sense that its overall rate of formation is equal to its rate of decay. Direct, reconfirmed observations show that the rate of decay is only about two-thirds as great as the rate of formation, and therefore that C-14 must still be building up in the carbon cycle of the earth.

In analyzing this equilibrium postulate, Libby, the author of the radiocarbon method, himself found evidence for this unbalance, However, he *discounted* the evidence in favor of what he took to be more compelling, albeit hearsay, evidence that the earth is too old for C-14 to be out of balance, because it would, in all practical considerations, come into balance from any conceivable unbalance within about 30,000 years.[2] Libby found the rate of decay R_d to be 15.3 counts per gram per minute for carbon from the living biosphere, and the rate of formation R_f (normalized to the same units) to be 18.8 giving for the ratio $R = R_d / R_f$ the value 0.81.

More recent studies of Hess, *et. al.*[3] on the neutron source strength raised R_f to 21.2. Lingenfelter[4] then recalculated R_f and lowered it to 18.4 ± 4.3. Suess[5] later lowered R_d to 13.3 on the basis of much more extensive data on the decay rate, and gave a more careful analysis of the carbon inventory in the carbon cycle taking into account the ocean circulation lag.

Thus, basing our claim for an unbalance of radiocarbon in this cycle on the most recent findings of Lingenfelter and Suess, the value now assigned to R is 13.3/18.4 = 0.72. Recognizing this evidence for an unbalance, Lingenfelter himself attempted an explanation based on fluctuations, thus carefully avoiding the short age-of-the-atmosphere implication of this non-equilibrium condition—no doubt realizing the difficulties the present writer encountered in attempting to point out this nonequilibrium condition, and its dating implications six years earlier.[6]

It is, of course, natural that creationists would adopt the seemingly obvious nonequilibrium model, and use it to date the atmosphere itself, whereas conventional science would seek to hide this drastic implication of the unbalance of C-14 in the earth's atmosphere.

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Unbalance of Radiocarbon

The suggestion that radiocarbon is still increasing in the earth and that it is appreciably below an equilibrium value, where R = 1.0, was given additional support in a recent symposium participated in by Libby and Suess and reported by Switzer.[7] The latter remarked that "these results (referring to calibrations via tree rings and sedimentation rates) confirm a *change* in carbon-14 concentration (in the atmosphere) that occurred 2500 years ago and *indicate* that the *concentration increases* at least during the past 10,000 years" (Parentheses and emphasis added).

With such reappearing support for an unbalance of radiocarbon in the atmosphere it would appear the only scientific thing to do to discard the equilibrium model in which R = 1.0 and go instead, with the evidence that R is only about two-thirds this great, either to a nonequilibrium model based on the actual value of R observed, or else discard the radiocarbon model of a short time clock altogether. In the nonequilibrium model one has no more difficulty in dating a sample than in the equilibrium model as far as tractability is concerned. Moreover, it would seem to be the only model that can really avoid the necessity of having to discard the radiocarbon method of dating in the face of the compelling and recurrent evidence for an unbalance in C-14 in the carbon cycle–the atmosphere, hydrosphere and biosphere.

Particularly interesting is the fact that the nonequilibrium model brings the results of radiocarbon dating much closer to Bible chronology in "historical" comparisons which is why scientists avoid it so tenaciously. Indeed, the value R = 0.72 **telescopes** all results by this method to about 10,000 years or less! This may be seen only by going through the mathematics of the radiocarbon theory, and it is, therefore, presented below in its most elemental form for the benefit of non-mathematicians. Figure 1 illustrates quantitatively the application of the nonequilibrium model by showing (1) build-up of radiocarbon in the earth as a whole, and (2) the nature of the discrepancy between the equilibrium and the nonequilibrium model as regards radiocarbon dating of biosphere specimens.

When radiocarbon is out of balance in the earth, as it is at present, its concentration C builds up in accord with the equation $R = R_f - R_d$ given by the differential equation of rudimentary calculus: $dC/dt = k_f - k_dC$, in which k_f expresses the constant rate of formation and k_dC expresses the (first-order) rate of decay which, like any radioactive substance, is proportional to the C-14 concentration C.

If the C-14 were in equilibrium, dC/dt would be zero, so that $k_f = k_dC_m$ where C_m is the maximum or steady state concentration, a value 1/0.72 greater than the present value according to the above evidence. The constant k_d is related to the half-life T by the equation $k_d = 0.693/T$. The observed half-life of C-14 is 5760 years giving for k_d the value $1.2 \cdot 10^{-4}$ years^{-1}. Thus, introducing the ratio $x = C/C_m$ in place of C by dividing through the differential equation of the C-14 balance by C_m, we obtain the equation in the simple form

$$dx/dt = 1.2 \cdot 10^{-4}(1-x)$$

(Editors note: Half-life of carbon is an estimate, and 5568 years has been preferred. A more precise value from the mass spectrometer gas counting method is 5760 years.)

We wish to obtain from this differential equation the time interval t_p from the beginning of the carbon cycle to the present. This cannot actually be done without knowing the ratio C/C_m or x at the "beginning" which, of course. we do not know. However we can compute an *upper limit* for this time by assuming that $x = x_b = 0$ at the beginning. The above equation may then be integrated between the limits ($x_b = 0$, $t_b = 0$) and ($x_p = 0.72$, t_p) with the result:

$$-\log_e(1 - x_p)/(1 - x_b) = 1.2 \cdot 10^{-4} t_p \text{ or,}$$

$$t_p = -\log_e(1 - 0.72)/1.2 \cdot 10^{-4} = 10^4 \text{ years}$$

Note also that, if x_b were any finite value less, of course, than x_p the time t_p, computed by this equation would be less than 10,000 years. However, if we take the extremes of uncertainty given by Lingenfelter for R_t, we would have x_b, between 0.59 and 0.94. Then the upper limit for t_p (taking again $x_b = 0$) would be somewhere in the range between 7500 and 23,000 years.

The Foundations of Dating by Radiological "Long-time" Clocks

Uranium-Thorium-Lead (U - Th - Pb) "time clocks" are six in number: the "Lead-Alpha" method, the U-238/Pb-206, U-235/Pb-207, Th-232/Pb-208 methods, the "common lead" method, and the "Lead-Ratio" method. Difficulties in these methods are summarized below with particular emphasis placed on the (circumstantial) evidence for artificial aging by the so-called "neutron-gamma" or (n, γ) reactions.

1. "Time clock" readings from which the oft-quoted 4.51 billion years for the age of the earth have been obtained are inconsistent with observed atom and isotope abundance data understood (at least for atoms without radioactivity or radioactive sources) by the familiar "even-odd" and "magic number" rules. That is, an isotope with mass number A, atomic number Z, and neutron number N all even is expected to occur in greater natural abundance than one with one or more of these numbers odd. Lead-

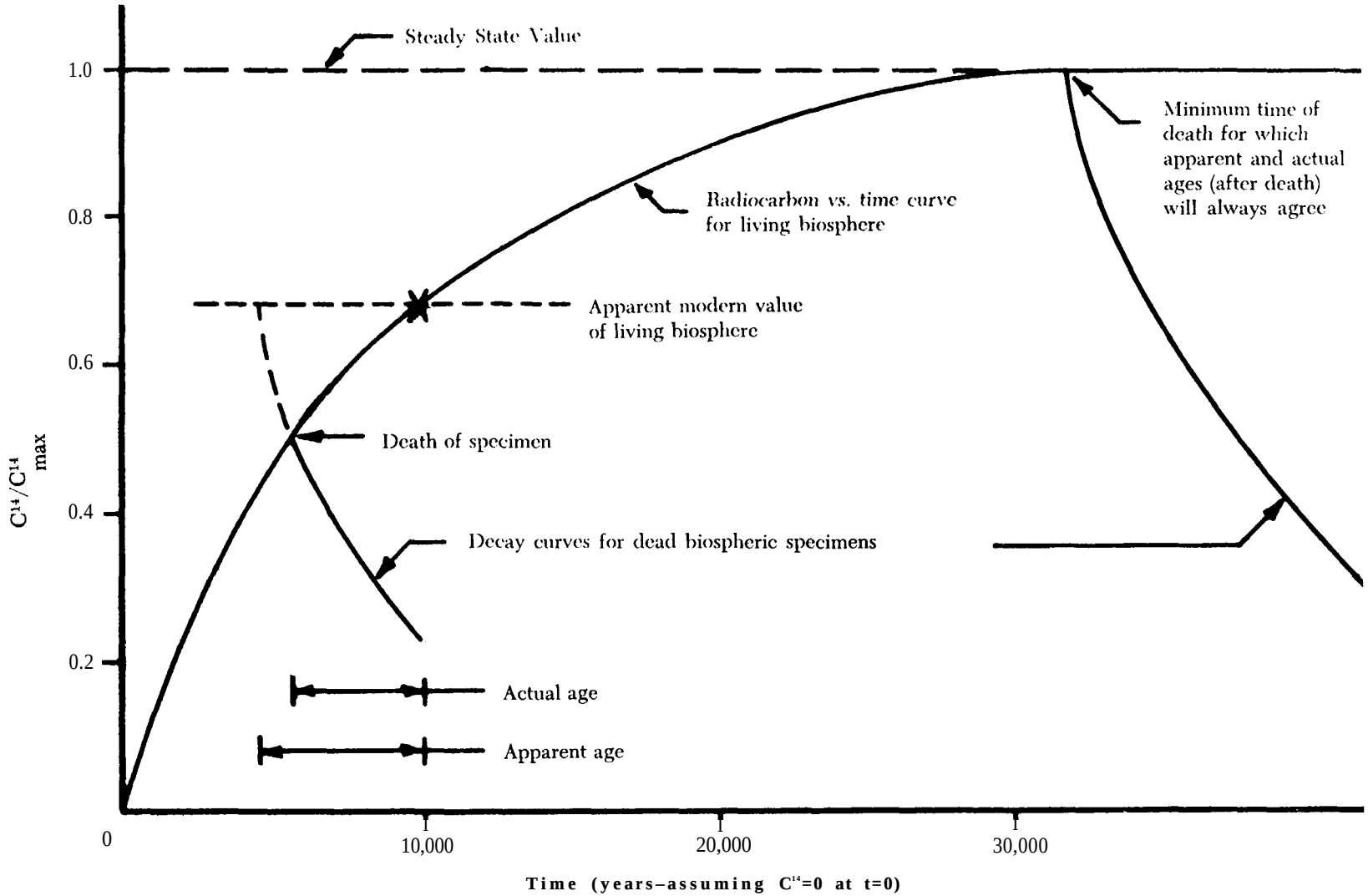

Figure 1. Radiocarbon in Biosphere-Living and Dead. This figure illustrates quantitatively the application of the non-equilibrium model by showing (1) buildup of radiocarbon in the earth as a whole, and (2) the nature of the discrepancy between the equilibrium and the non-equilibrium model as regards radiocarbon dating of biospheric specimens.

206 is an even-even-even isotope, whereas Pb-207 is odd-even-odd.

The observed "modern" relative abundance Pb-206/Pb-207 is about 1.2 which is normal considering the proximity of these isotopes to the magic number 126 (Pb-208, an even, even, even isotope has 126 nucleons all alike, other magic numbers being 2, 8, 20, 50, and 82). However, if the earth were really 4.5 billion years old, the ratio Pb-206/Pb-207 at the beginning would have been only 0.45, a value which would seemingly violate these natural abundance rules. While interesting, this is, of course, not a crucial argument against the conventional claim for great antiquity.

2. Differences in isotope concentrations applied in reading these time clocks are often much less than isotope variations from one mineral to another in the nonradioactive elements with no radioactive sources—of which twelve having atomic weights less than that of zinc, were found to show average variations of 6.6%. This is a value which would mean a billion years or so discrepancy in the long time clocks of geochronometry, i.e., those of the U-Th-Pb, potassium-40/argon-40 and rubidium-87/strontium-87 systems.

3. A statistical analysis of the extensive available data for common leads[8] from identical geological formations made by applying the conventional theory of radiological dating revealed that common leads really have in them *no time index* that can be sorted out and differentiated from observed random variations like those needed to account for variations from one sample to another in nonradioactive and nonradiogenic elements. This was very surprising to one led to think that the common leads could be accurately dated by the lead ratio method.

Lead-204, incidently, is used as the index in dating common leads because it has no radioactive source. The assumption is made that the ratios Pb-204/Pb-206/Pb-207/Pb-208 are 1.0/18.5/15.7/38.0, or thereabouts, in common leads that have never been contaminated with radiogenic lead from U-Th decay. Any difference from this or some other set of lead-isotope assumed to represent uncontaminated lead is supposed to represent the radioactive decay contribution to the common lead before mineralization in the present occurrence. From this one computes the time before mineralization by the lead ratios.

4. The most serious difficulty is the impossibility of defining initial conditions and isotope concentrations needed in all calculations of time with the radioactive time clocks. One can really never know these necessary concentrations so that the science of radiological dating has become merely a *science of guessing.* The best guess is supposed to be that based on lead isotope ratios, all other methods such as the helium and the lead-alpha methods having thus fallen into disrepute.

5. There are interesting and revealing systematic differences in the four most important clocks of the U-Th-Pb system employing these ratios. Let us take t_1, t_2, t_3, and t_4 as the times found from the lead ratio method Pb-206/Pb-207, the U-235/Pb-207, the U-238/Pb-206 and the Th/Pb-208 methods, respectively.

The interesting situation is that the ratios $t_1/t_2/t_3/t_4$ average 1.35/1.18/1.12/1.0! Why this systematic difference between these closely related time clock? The answer when completely appreciated may well prove to be fatal to the U-Th-Pb time clocks. It is definitely not due to diffusion, radon leakage or any of the usual explanations. Chemical and physical analyses are not at fault either; analytical methods are next to perfect in the U-Th-Pb system.

While it cannot affect $t_1/t_2/t_3$, uranium accretion via micrometeorites could easily upset dating by this method, because accretion products are concentrated at the surface where scientists take their samples rather than uniformly throughout the rocks of the crust. A slight surface contaminant of this nature could well be serious when differentiation is considered.

Leaching of uranium from rocks and runoff in river waters into the oceans, actually at rates comparable to the overall decay in the entire crust, can also cause serious discrepancies. While almost as much uranium is disappearing in this way from the surface sediments as is decaying in the entire crust of the earth, particularly revealing is the dilemma that the oceans have in them only a few thousand years of such uranium accumulation. How old are the oceans after all?

6. As mentioned, the *most significant* consideration in explaining the systematic discrepancies in the U-Th-Pb time clocks, which if correct, would obviously all tell the same time, pertains to the neutron-gamma or (n, γ) reactions. That they are very important seems (circumstantially) obvious when one considers the fact discussed at length elsewhere that the nitrogen-14/nitrogen-15 ratio is only about 65% as great in nitrogen found in compounds like nitrates occurring in radioactive minerals as in the atmosphere.

The N^{14} (n, γ) N^{15} reaction is seemingly the obvious answer, and one that has been given by others for this observation. But if radiation in a radioactive deposit can knock down the N-14/N-15 ratio this much, surely the (n, γ) reactions must also be important in the U-Th-Pb system!

Reasons have been given[10], furthermore, that fast neutron "pile" factors should be involved in

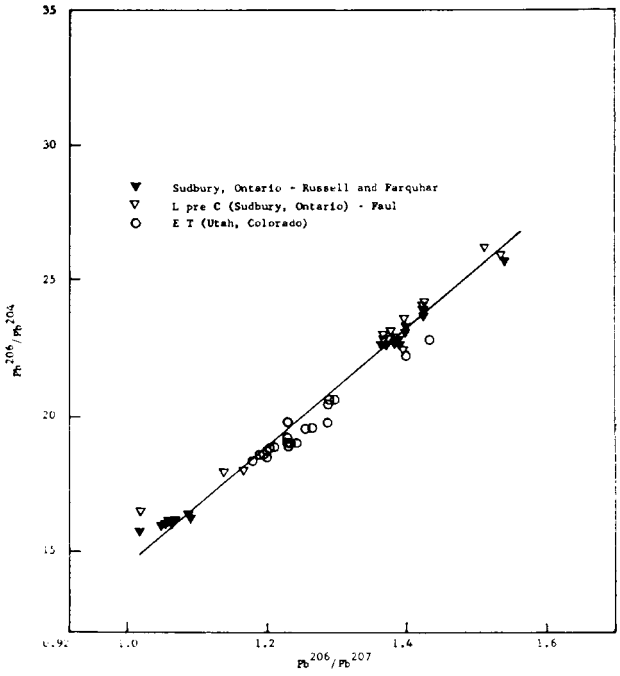

Figure 2. Does the Lead-Ratio method really work? This figure illustrates that common leads may not provide a reliable time clock. Note, for example, that the "preferred" lead ratio method fails to distinguish between Pre-Cambrian (assigned ages of greater than 500 million years) and Early Tertiary (assigned an age of less than 60 million years). (L pre C = Pre-Cambrian, E.T. = Early Tertiary

large U-Th ore bodies. While fast neutron concentrations are no doubt small compared with those possible in man-made fast neutron piles, they need to be only around a millionth as great to upset completely the U-Th-Pb time clocks! Not only would fast neutrons (and slow neutrons also) tend to speed up the apparent decay rates of the radioactive species, but would also convert some Pb-206 to Pb-207 and some Pb-207 to Pb-208. Both of these types of reactions would tend to "age" unrealistically the U-Th-Pb minerals depending on the relative importance of radioactive decay and the (n, γ) reactions.

There are a number of apparently crucial examples where it would appear that the (n, γ) reactions far outweigh the conventional U-decay and Th-decay reactions. Furthermore, the situation appears to be very general! These include cases where both Pb-204 and Th are absent or negligible, but where Pb-208 is present. By approximately quantitative age corrections based on the observed Pb-208 concentrations, and the assumption that they came from the (n, γ) reactions, it appears that one *effectively wipes out all of geologic time.* The following are two striking examples:

(a) The uranium ore at Shinkolobwe, Katanga, contains no Pb-204 (thus no common lead) and no Th-232, but it contains 0.08% Pb-208. The observed ratio Pb-206/Pb-207 is 94.2/5.72 = 16.5 from which the ore has been assigned the age 640 million years. The questions are: where did the Pb-208 come from, and what does it mean concerning age?

If we assume that it came from the Pb^{207} (n, γ) Pb^{208} reaction and that Pb-207 was also reinforced by the Pb^{206} (n, γ) Pb^{207} reaction (the correction†, based also on the assumption that the neutron cross-sections of the leads are all about the same), we arrive at the striking result that this ore is really "modern"! That is, the ratio x = Pb-206/Pb-207 is 21.7 for the leads currently being generated by U-decay. But the correction in x in this case is given by x = (94.2 + 1.3)/(5.72 – 1.3 + 0.08) based on the actual composition of the leads and the assumption that the 0.08% Pb-208 came from Pb-207. Thus instead of the value 16.5, the ratio x would have been 21.2 without the (n, γ) reactions.

(b) The uranium ore at Martin Lake, Canada, also contains no Pb-204 and only 0.02% as much Th as U. But it has in it an average of 0.53% Pb-208. The x-ratio in this case is 90.4/9.1 = 9.93 and the ore has accordingly been assigned an age of 1640 million years. But what about the lead-208?

The (n, γ) correction† in this example is given by the ratio x = (90.4+ 5.2) (9.1 + 0.52 – 5.2) = 21.7. Strange, is it not, that this would agree precisely with the ratio of leads being generated today by U? This is, of course, somewhat fortuitous because the leads do not have precisely the same neutron cross-section, and there are some variations in the dozens or so samples of the ore from which the average values here used were obtained.

The important point is that the (n, γ) mechanism of the systematic discrepancies not only explains these discrepancies but, at the same time, erases all readable ages read from the "long-time clocks". Figure 2 illustrates that common leads may not provide a reliable time clock. Note, for example, that the "preferred" lead ratio method fails to distinguish between Pre-

†To correct the x (= Pb-206/Pb-207) ratio for the influence of (n, γ) reactions so it will be useful in the lead-ratio radioactive time clock in cases where Th and Pb-204 are both negligible as in the Shinkolobwe and Martin Lake examples, the Pb-208 must be accounted as Pb-207 since it came from the reaction Pb-207 (n, γ) Pb-208. Likewise, at equal cross sections for Pb-206 and Pb-207 an amount of Pb-207 equal to x • Pb-208 must be accounted as Pb-206 since it came from the Pb-206 (n, γ) Pb-207 reaction. Therefore, the corrected x-ratio is:

$$x\ (\text{corrected}) = \frac{\text{Pb-206} + x \cdot \text{Pb-208}}{\text{Pb-207} - x \cdot \text{Pb-208} + \text{Pb-208}}$$

This is the basis for the data given in these two examples.

Cambrian (assigned ages of greater than 500 million years) and Early Tertiary (assigned an age of less than 60 million years)! (Pre-Cambrian = L pre C, Early Tertiary = E.T.)

The Potassium Argon or K-40/A-40 method of radioactive dating may likewise be seriously questioned at least for the following significant reasons:

(1) There is altogether too much argon-40 in the earth for an appreciable part of it to have been generated by potassium-40 decay even if one grants for the sake of argument that the earth is several billion years old.

(2) The K-40/A-40 method is based on uncertain half life and branching ratio data (Ca-40 about 88% to 92% and A-40 about 8 to 12% of K-40 decay.) Even by tacitly assuming the minimum branching ratio of 0.08 this method gives "ages" averaging greater than those of the lead ratio method which in turn yields the oldest ages read from the U-Th-Pb "time clocks. "

(3) Like the situation in the U-Th-Pb system, physical chemical analyses of (present) concentrations of the necessary elements and isotopes of the K-40 "clock" are excellent, but sampling is irreproducible and initial concentrations (also quite necessary in applying dating formulae) can be known only by guesswork, however scientific. For instance, what is the justification for applying highly precise analytical methods in an environment where contamination (by precisely the same isotope being analyzed) is greater by a factor of more than a hundred than the radioactivity-generated product one wants to determine?

The Rubidium-Strontium, or Rb-87/Sr-87 "time clock" is another one where pure guesswork is required to *establish* the actual concentrations of the isotopes of this "time clock" at the beginning of a particular mineral.

Sr-87 occurs in the crust at an abundance at least ten times greater than could be generated from the available rubidium-87 in five billion years.

On the other hand, Rb-87 occurs in the same rocks at 50 ppm and with a half-life of 60 billion years. Therefore, even if one were to agree for the sake of argument that the earth is five billion years old, radiogenic Sr-87 would be only about 5% of all Sr-87 present in the rocks.

Again how can one possibly use this method under such an overall contamination? An indirect answer in this case may have been found already in the empiricism that has developed out of extended efforts to apply the method, i.e., in trying to devise scientific guesses for the necessary initial concentrations of Rb-87 and Sr-87.

The ratio Sr-87/Sr-86 ranges between 0.7 and 0.9 in all samples, "old" or "young", but the value needed for internal consistency with other dating methods turns out to be 0.708 ± 0.001. This was the guess decided upon by some authorities to arrive at how much Sr-87 was present in a particular mineral at its beginning.

This guess eventually became popular in dating rocks by this method; it circumvented more difficult procedures designed to answer the really unanswerable question regarding the isotope concentrations at the beginning of a mineral that one needs to know in order to apply any radioactive time clocks. On the other hand, it was shown that unless all rocks are really the same age within about 45 million years, this guess would be inconsistent with observed total abundance data, i.e., it would require exceptions to the rule to be as prominent as the rule.

Radiocarbon Dating of a Global Sea Level Cycle

Uplifts in Canada and Fennoscandia following (the sudden) loss (from the continent into the sea) of the Wisconsin ice caps were correlated. and evidence for this catastrophic disappearance of the ice caps has been presented in the ice cap model of continental drift as outlined in PEM. Eardley[11] noticed in 1964 the global sea level changes predicted three years earlier[12] by the ice cap model; however, he considered them to be caused not by ice caps, but by a slowing of the rate of rotation of the earth over the past 100 million years.

It was pointed out in PEM (pp 138-9) and by Flatte[13] that this would be impossible simply because the relaxation of an unbalance in the crust of the earth is much too rapid (only about 4000 years for a 60% adjustment). In other words, the oceans and continents would adjust at precisely the same rate to a uniform slowing of only about two percent in 100 billion years. Hence no differential shoreline changes would occur by this mechanism.

Eardley regarded the shoreline data described in the U.S. Navy Hydrographic Charts studied by him to be independent of the ice cap effects on the basis that the maps used by Gutenberg[14] and others (from which they concluded that "sea level has risen around the world in amounts ranging from 10 to 20 cm in the past century") showed no latitude effects. However, ice sheet build up and decay occurring over a period of only a few thousand years would simply have to produce latitude effects in land mass adjustments of the character described by him.

There is little doubt that polar land masses were depressed (roughly the amounts noticed by Eardley) by the Wisconsin ice caps. These depressions were under a total load corresponding to about 20 million square miles of ice several miles deep on the two poles. This not only depressed the original continent in polar regions, but also elevated the crust in equatorial and low

latitude regions as required by mass (or volume) conservation. Following sudden loss of this ice into the seas, the land mass adjustments reversed themselves causing a rise at the poles and submergence at low latitudes.

Shoreline regressions in Canada were studied by Farrand and Gajda[15]. Two recent "back to back" publications by Emery and Garrison[16] and Redfield[17] describe the corresponding (reverse) situation for the seashores in low latitudes along the Atlantic, Gulf and Pacific Coasts. In addition an article by Emery *et al.*[18] described the nature of samples used in radiocarbon dating of these conditions. Taken together these studies of (radiocarbon-dated) uplifts and submergences confirm the type of global shoreline reactions predicted in the ice cap model.

Shoreline Predictions Confirmed

They show first (by their coincidence in time) that the high and low latitude shoreline adjustments are really part of the same global adjustment to an isostatic unbalance over the whole crust.

Second, they show that the adjustment cycle changed from equator to pole as predicted by a model in which the crust was suddenly thrown out of balance by unloading at previously heavily loaded poles.

Third, they show the required exponential decay in time of this unbalance and the fact that there remains even yet an appreciable unbalance. The latter point is especially significant when one also realizes that any such unbalance would be more than 75 percent adjusted in 20,000 years and only about two-thirds of it has adjusted so far.

As for Canada a remarkable plot of "isobases of the marine limit" by Farrand and Gajda[19] shows that the shorelines once extended to the very apex of the North American continent. This means that the farthest advance of the shorelines corresponded to the arc with a center in the islands off Northwest Greenland, passing through the southwest edges of the Great Lakes, i.e., the region which divides the flow of water from south and southwestward (into the Mississippi, Ohio, Missouri Rivers), and northeastward into Hudson Bay and The St. Lawrence River.

These shorelines have since receded in high (northern) latitudes quite regularly and over thousands of miles to their present positions. The greatest advance of the shorelines over the continent was described by a semi-circle called by Farrand and Gajda the "limit of warping-Whittlesey zero" which not only passes through the southwest Great Lakes region but also the Northwest Territories and part of New England. The high latitude shoreline regression is associated with uplifting land masses amounting to more than 1500 feet in some places.

While these uplifts were going on in Northeastern Canada, data presented by Emery and Garrison[20], and by Redfield[21] (also based on conventional - equilibrium - radiocarbon dating) reveal just the reverse situation at low latitudes. Emery and Garrison, in fact, recognized the connection between the high latitude and low latitude vertical landmass adjustments.

Like the uplifts in Canada, those at low latitudes are still in progress at ever-decreasing rates. For example, the down-warping is now at a rate of about 0.025 inches per year in Long Island. They both began at much faster rates, but are slowing in the rate of adjustment as the unbalance gradually disappears showing again the effects of the catastrophic, sudden denudation at the beginning of the adjustment cycle.

Global Extent of Adjustments

The global extent of these land mass adjustments is shown by the fact that the same conditions were found in Argentina, Nigeria, Mexico and California as those found along the Atlantic coast of the U.S.A. Also significant are the facts that the rates and total depths of adjustment were smallest at lowest latitudes, increased northward to a maximum, decreased still northward and changed sign at the "Whittlesey zero", growing to large opposite magnitudes on northward.

A discrepancy of a few thousand years seems to exist for the time of beginning of the adjustment. That is, the data of Emery and Garrison seem to show evidence for an artificial aging associated with the fact that their curves extrapolate (without the help of very young specimens taken from near present shorelines) to finite ages at zero depth. This may be the result of (C-12 and C-14) ion exchange which may have unrealistically aged specimens used in the analysis associated with exposure to initial highly saline conditions (See p. 4 of PEM).

A striking fact noted in the data is that the dates of samples taken at the very edge of the Atlantic shelf are not greatly different, if at all, from those at the beginning of the uplifts in Canada. This correlation also supports the theory that these dates are also those to be assigned to the Atlantic rift itself and to continental drift. Appropriate allowances of course, should be made for the unbalance of radiocarbon and the possible unrealistic aging by ion exchange.

When the ice sheets of the Wisconsin were building up (according to the ice cap model of continental drift) the primordial continent ("Pangaea") at high latitudes (both north and south) was subsiding regularly under the ever-increasing polar ice loads. The total load eventually exceeded the strength of the continent and suddenly ruptured it from pole to pole. Im-

mediately after this catastrophic continental rupture, the shorelines were in the positions, approximately, described by Eardley, corresponding to maximum unbalance.

Since then they have readjusted at a maximum rate at first, but at ever-decreasing rates as the global isostatic anomaly lessened exponentially. This situation may be observed in all (radiocarbon-calibrated) depth vs. time results for these readjustments. The proximity in time of continental drift thus seems to be shown by the time scale placed on the related shoreline adjustments accompanying this catastrophic event.

Radiocarbon and Biblical Dates

But, in fact all of this occurred only about 4500 years ago (after the Flood in the "days of Peleg"), not even 10,000 to 15,000 years ago, much less, the 100 million years ago suggested by the slowing rotation model. After all, it is a matter of Bible history, is it not? (See Gen. 10:25 understanding "earth" as used there to refer to the usage in Gen. 1:10. Genesis 10:25 surely cannot refer to Genesis 10:32 as many have supposed.)

While radiocarbon may (when the facts become thoroughly appreciated) be forcing scientists ever closer to the Biblical account, one may still be disturbed by the fact that even the non-equilibrium model of radiocarbon does not bring the scientific and Biblical "records" into coincidence. Instead there remains even in the non-equilibrium model a discrepancy of 50% or more. This may be due to ion exchange, according to the following explanation:

(a) The Noachian Deluge should have raised the pH of the oceans appreciably when the hot, ultrabasic, emulsified materials of the upper mantle were churned into the waters flowing into the great rift.

(b) The dolomites found abundantly at and toward the bottom of the sediments seem to require basic, high temperature deposition based on what has been learned about conditions for their deposition.

(c) In this regard an increase of pH of only two units (from 7.0 to 9.0) would be all that would be needed to account for the solution of all the "precipitates" at once in the waters of the Flood.

(d) In this connection Libby gave for the volubility of carbon (in the form of HCO_3^- and CO_3^{-2}) in contact with the limestones, dolomites, etc., the value $S = A(1 — 0.74)$ showing that carbon would become soluble in proportion to (OH-). Subsequent neutralization of the basic solution by cooling and settling of the basic emulsion would then reprecipitate the carbonates rapidly and in a manner that would have trapped debris rich in fossils in the frozen carbonate rocks.

(e) Particularly interesting in this regard were the observations[22] that mollusks living in warm, basic waters high in carbonates had sufficiently reduced radiocarbon content to make them appear as though they had been dead 1000 to 2300 years! A similar condition may he noted for "Danger Cave" on the west banks of Great Salt Lake. This cave could not have been occupied as long as the 10,000 to 15,000 years ago indicated by the radiocarbon dating of artifacts found in it because it was most likely under the waters of Lake Bonneville until only 1500 to no more than 2000 years ago!

(f) Other radiocarbon dates of samples taken from the highly saline environment around the Great Salt Lake likewise show unrealistic radiocarbon aging caused by C-12 and C-14 exchange.

Radiocarbon Dating of Ancient Civilizations

Two quotations typify the situation quite well.

> Between five and six thousand years ago, in a few favored areas of the world, man firmly mastered the formulas that released him from an immeasurably long past of savagery, barbarism, and nomadism. . . For the first time in his history on earth he became aware of his humanity. He became civilized.[23]

> Perhaps the most important turning point in human history occurred thousands of years before anyone could record it. This was the point in time when, after two million years of vagabond hunting, man settled in villages and began domesticating animals and cultivating crops. Within a short one thousand years or so, the seed of civilization was planted, setting off a vastly accelerated pace of cultural and technological development that enabled man to progress from mud huts to moon shots.[24]

These quotations illustrate that not only archaeologists, but earth scientists generally seem bent on (1) establishing evidence for a supposed evolution of man not merely from savagery to civilization but from "earlier forms" of life, and (2) dating anything they find at maximum possible ages. Both of these ideas must eventually prove futile because man and beast really began their existence on the earth as civilized man and "after their kind", respectively only about six millennia ago.

On the other hand man has degenerated enough times, and in enough places of the world, to permit archaeologists to find real evidence for the savagery to civilization (or its reverse) transition. Real discoveries of this sort thus do not substantiate "evolution". (Editors Note: Readers will find extensive support for the idea of degeneration of man in articles in the *Creation Research Society Annual, 1968.)*

The equilibrium radiocarbon model is popular among archaeologists, not only because it is a sophisticated modern scientific tool and practically all they have to work with, but also because it gives results often far enough removed from Biblical chronology to make them feel comfortable.

Bylinsky,[25] for instance, claimed that radiocarbon has established a date of 6750 B.C. for the deepest layers of "Jarmo", an ancient village considered to represent an early stage in the transition from savagery to civilization, and that a cave called Shanidar close to Jarmo, where "sheep bones (were found) near charcoal . . . in an ideal state for dating with carbon-14" was dated at 9000 B.C.

Bylinsky quoted others to the effect that a cave found in Iran was "occupied about 35,000 B.C. until recent times" and "a farming village . . . founded about 8500 B. C."

Absurd Claim of Accuracy

Also illustrative of a passion for overdating is a further statement by Bylinsky, "A variety of new scientific techniques is helping to expand the scope and meaning of the remote history of man. *First and foremost is radiocarbon* . . . which reaches about seventy thousand years into the past. . ."[26] (Emphasis added) While expressing a majority viewpoint, it is distressing that anyone would claim such accuracy for radiocarbon dating. The claim that radiocarbon is useful in dating specimens as old as 70,000 years is absurd.

Such accuracy is not even possible under the most precise laboratory conditions to say nothing of the uncontrollable and contaminated environment of nature. It would mean, for example, the ability to measure C-14 concentrations (against background radiation) to a precision of one part in 10,000 of the radiocarbon found in the living biosphere.

The usual, still greatly exaggerated, claim is that the upper limit of radiocarbon dating is about 40,000 years. Since the half life of C-14 is 5760 years, this corresponds to about seven half-life periods ($0.5^7 < 0.01$). Furthermore, the C-14 concentration would be only three percent as great at 70,000 years as at 40,000 years after death. Even 40,000 years for the resolution in radiocarbon dating would require extremely careful laboratory control quite unrealistic in the natural environment.

Moreover, such claims of accuracy ignore the possibility of even the slightest unbalance of C-14 in the earth as a whole to say nothing of the 30% observed unbalance.

In spite of feverish tendencies to expand antiquity and provide evidence of "evolution" by unrealistic claims of transitions from savagery to civilization, the assigned dates of well authenticated civilizations (Sumerian, Babylonian, and Egyptian) unearthed and described by archaeologists can, with ever growing factual information, be stretched only a millennium or so.

But the Ark landed roughly 4500 years ago on Mt. Ararat in the mountains northeast of Mesopotamia where the Sumerian and Babylonian civilizations flourished. Both these civilizations must have developed *after* Noah's Flood, sometime between the second and third millennia B. C., although archaeologists assign ages for them between three and four millennia B.C.

The difference of a little more than a thousand years is close incidentally to the correction increment obtained by applying the nonequilibrium model in recalculating radiocarbon-dated specimens about 4000 years old. Considering the magnitude and nature of Noah's Flood (in which the "earth was clean dissolved"–a mechanical not chemical dissolution (per John Woodward), one realizes that the Flood probably completely erased evidence of all antediluvian civilizations such as to leave practically nothing readable in the "history written in the rocks."

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