

FALLACIES OF RADIOMETRIC DATING

The Scriptural record states that God made a perfect creation in six days followed by a seventh day of rest.¹ Decay and death, catastrophe and destruction can also be placed into a biblical framework,² a framework that teaches the creation has been tainted by sin, but that one day God will miraculously purge the creation of all sin.

Not only does biblical history mesh with world history -- after all, biblical history is *real* history -- but the opposite of biblical history, the evolutionary version, *disagrees* with the world as we see it. For example, the creation does not display spontaneous upward change as evolution requires, but instead there is downward change toward degradation which permeates all of nature.³

Further, many physical processes show that the earth, the solar system, and the universe are quite young -- thousands of years old, not millions or billions.⁴ **There is a severe lack of terrestrial or cosmic processes giving an appearance of validating the eons needed for evolution to appear plausible.**

Because no one sees evolution happening in real time, its advocates acknowledge that it must be incredibly slow and must require lots of time. In contrast to biblical history,⁵ evolutionary philosophy invokes about 5 billion years for earth history, about 10 billion years for the solar system, and about 20 billion years for the universe. But with a shortage of physical processes to validate these evolutionary eons, how is it that the vast evolutionary time scales continue to be accepted? The answer is *radiometric dating*.

RADIOMETRIC DATING: EVIDENCE FOR OLD AGES?

In the minds of many people, radiometric dating proves the earth and the universe are billions of years old. From the perspective of evolutionary philosophy, radiometric dating is virtually the *only* satisfactory chronometer for dating the earth, solar system and universe. **Ironically, evolution ignores, or explains away, the many physical processes that do successfully date the creation -- because none of these processes allows enough time for naturalistic development.**

Decades before the French scientist Henri Becquerel discovered radioactivity in 1896,⁶ popularizers of evolution had been teaching that the earth and universe are very ancient. Radioactive decay is the very basis of radiometric dating, and radiometric methods are supposed to be the reason evolution "knows" there have been billions of years of time. **Yet the evolutionary geologist Charles Lyell had popularized the idea of a very old earth in the 1830s, long before radioactivity was ever discovered, let alone used for radiometric dating.**⁷ Long before 1896, other evolutionists also wrote papers and articles claiming an old age for the earth.⁸ **Evolutionists thought they knew the earth is old long before radiometric dating.**

The first radiometric dating of rocks was not attempted until 1906,⁹ yet evolutionists believed the earth to be old decades before then. **Clearly, the belief in an old earth is actually independent of any proof from radiometric dating.** Evolutionary philosophy taught an incredibly old earth even before Marie Curie discovered what turned out to be the first

radioactive element in 1887. So it is a fallacy to think that radiometric results somehow "proved" the earth to be old.

Instead, the evolutionary time scale reflects only the consensus of the most vocal and articulate personalities, not scientific fact. Geologist Harold L. Levin referred to the outgrowth of the time scale from this kind of consensus when he wrote, "Clearly, the time scale was not conceived as a coherent whole but rather evolved ..."¹⁰ **That is, the time scale was shaped over several decades of emerging consensus.** This happened before radiometric dating appeared on the scene.¹¹

RADIOMETRIC BASICS

The basic idea of radiometric dating is simple. All matter is made of incredibly small particles called atoms. Atoms have a core called the nucleus circled by electrons. In the nucleus are even smaller particles called protons and neutrons. There are 92 basic kinds of atoms occurring naturally, so there are 92 different "elements"-- substances made of these atoms. **Different atoms vary in how many protons and neutrons are in the nucleus.**

For reasons unknown, some kinds of atoms are unstable. Their nuclei occasionally come "unglued." The protons and neutrons in the nucleus fly apart and the nucleus actually *explodes*. Like tiny bullets, the fragments of the nucleus spew outward at extremely high speeds. The tiny explosion also releases energy.

The nuclear fragmentation, with all the outlying fragments, is called radioactivity. An atom having an unstable nucleus is said to be *radioactive*. A radioactive atom is like a tiny bomb. At any time it is liable to blow up, spewing nuclear "shrapnel" all around. The pieces of nuclear "shrapnel" -- the nuclear fragments -- expelled in the break-up of an atomic nucleus are called radioactive *emissions*.

Marie Curie and her successors found that we can measure how long it takes for half the atoms of any given type to break up or "decay."¹² This interval of time is called the "half life." Rocks, minerals and all other things contain small amounts of radioactive atoms. Atoms of one kind of element can bond with atoms of another to form a "compound." Almost all radioactive atoms are therefore bonded into compounds with other atoms that are not radioactive. This means that ordinary substances -- the compounds and mixtures of compounds in substances we encounter every day -- have small amounts of radioactive atoms in them as part of their normal composition.

Radioactive atoms are in the food we eat and even our own bodies. Every second our bodies are bombarded with fragments from radioactive atoms disintegrating all around us -- some of them within ourselves.¹³ **This natural radioactivity around and within us is called "background radiation."** We cannot escape background radiation, even by sealing ourselves off from the world, because the air, water and food we need for life is naturally slightly radioactive.

But what about a rock below ground, protected from the world above it? Or a long-dead person -- a mummy -- sealed in an ancient tomb? These things would be receiving no radioactive atoms -- in air, water or food -- from the outside, so the radioactive atoms originally in them would slowly decay, disintegrating into fragments that are not radioactive.

Eventually, if the thing were old enough, we would be unable to measure any radioactive fragments ("emissions") coming from them. There would be little or no radioactivity left. And therein lies the basis for radiometric dating.

If we could be sure that our sample -- our rock or long-dead mummy -- had been sealed off from the world since it was newly formed or newly dead, then its remaining level of radioactivity might tell us its age. At least this idea would work if we could compare the present level of radioactivity with the original level of radioactivity when the sample was new. Measuring the present radioactivity is not a major problem. Labs around the world routinely carry out such measurements. *But how can we know the original level of radioactivity?*

Scientists often assume that if a sample has little radioactivity it must be old. According to this reasoning, the radioactive atoms have had lots of time to decay, so not much radioactivity remains. If the sample has relatively high radioactivity, this means radioactive atoms have not had so much time to decay, and the sample must be younger. In other words, if the difference between original ("primordial") radioactivity and the present level of radioactivity is large, the sample must be old. If the primordial and present levels differ only a little, the sample must be younger.

CONVENTIONAL AGES OF ROCKS AND MUMMIES

Conventional chronology assigns widely varying ages to different parts of the creation. The earth with all of its rocks and minerals is supposed to be billions of years old -- the solar system and universe are supposed to be even older -- while most living things have existed for "only" millions of years. Human culture and civilization, with all of man's artifacts, have been around for only tens of thousands of years.¹⁴ **Since rocks and minerals have ages up to billions of years, radioactive elements with half-lives stretching over billions of years are supposed to be necessary for dating them.**

Three long-lived radioactive elements often used for dating rocks and minerals are uranium, potassium, rubidium.¹⁵ **These elements are favored because they are found in the minerals and compounds of virtually all rocks.** The reason this is so is that these elements form compounds that are quite soluble in water, so they have been dispersed worldwide by rivers, ocean currents and floods. But as we will see, the solubility of these compounds makes them useless for radiometric dating. **The very ubiquity making these elements attractive for dating actually sabotages their validity.**

On the other hand, once-living things -- mummies, preserved remains, or anything made from plants and animals -- cloth, paper, tools of wood or bone -- are supposed to be datable with radioactive carbon. All living things past and present contain carbon, a very small percentage of which is radioactive. Radioactive carbon decays much faster than the elements used for dating rocks. It has a half-life of only a few thousand years.¹⁶

In the conventional view, it is useless to date rocks with radioactive carbon, because dating rocks supposedly involves much longer ages, and any radioactive carbon originally in them would have disappeared by now. **However, creationists have found radioactive carbon in supposedly very ancient rocks**

and minerals, showing they must really be quite young.

Likewise, there is a conventional refusal to date coal or fossils (such as dinosaur remains) with radioactive carbon, because these are supposed to be millions of years old, again too long for any radioactive carbon to remain. But creationists have also found radioactive carbon in these.¹⁷

From the perspective of evolutionary philosophy, there are really three kinds of age assessment, each with its own approach to dating. First, any rock that can be dated radiometrically is supposedly billions of years old (occasionally only millions) and must be dated only by its content of some long-lived element (often uranium, potassium or strontium). Then there are once-living remains that are supposed to be datable by their radioactive carbon content. Finally, as will be discussed below, there are fossil-bearing sedimentary rocks *which cannot be dated radiometrically*. **Creationists have felt free to use radioactive carbon dating on all these and have confirmed them all to be young.**

FALLACIOUS ASSUMPTIONS

Since there is this evidence from radioactive carbon dating showing that rocks, fossils, and once-living remains are all "young," how can evolution maintain the claim that radiometric techniques prove old age? **Evolutionists use three scientifically inaccurate assumptions to establish large evolutionary ages.**¹⁸

Assumption #1 is that we can know how much radioactivity a sample had when it was new. For rocks this is when they were newly formed, and for once-living things, when they were newly dead. If assumption #1 is false, we cannot know the original (primordial) level of radioactivity.

Though we can measure the level of radioactivity in the sample today, this does not help us, because **we have no basis for comparing today's measured level with the level of radioactivity in the sample when it was new.** Assumption #1 is fallacious because to know the original state of the sample, one must know the age of the sample. *But the age is what is being sought.* Thus radiometric techniques cannot independently prove or determine the age. **There must be a preconception of age for radiometric dating to appear successful.**

Historical documents or other information *external* to a sample may help us arrive at a preconceived but accurate age for a sample, and radiometric techniques can confirm this preconception. But the preconceived age comes from information *outside* the sample. The sample has nothing within itself telling its age, and **radiometric techniques cannot give us new information. They only confirm the age we suspected.**

This is the key to understanding how evolution can get billions of years from rock dating procedures. **Believing that the real age of the rocks is billions of years, evolution has a preconceived age that is then used to compute the supposed level of radioactivity when the rock was new.**

Since this alleged primordial level is set billions of years ago it is very much higher than today's level of

radioactivity. Billions of years would be needed for the rock's radioactivity to drop so far. This means that the rock must be billions of years old.¹⁹

Preconceiving an age of billions of years to "prove" the same age is circular reasoning, but this is all that radiometric techniques can ever do. This is why it is crucial to rely on real historical data, not on evolutionary presuppositions, to have a reliable assessment of age. The Bible is the most reliable source of historical information extending back to earliest antiquity. **But for rocks, the only "source" of billion-year-ages is evolutionary thought.**

Assumption #2 is that the sample (rock, mummy, etc.) has been completely undisturbed since it was new. If this assumption were true, then the amount of radioactivity remaining in the sample would tell us something about its age -- older samples would have less radioactivity, and younger samples would have more. **But if the sample has been disturbed, then this assumption is false, and the remaining radioactivity tells us nothing about its age.**

By saying that the sample has never been disturbed, the second assumption is claiming the sample has been sealed off from the rest of the universe. No geological process, no weather phenomenon, nor anything else could have taken radioactive atoms from the sample. This assumption may be true for some carefully preserved once-living remains, but for rocks this assumption does not stand.

An industrial technique called "zone refining" is used to purify molten materials such as silicon crystals used to make computer chips. In this process a rod of silicon or other material to be purified is passed over a heating coil that melts a segment of it. It is heated up to white heat. As the rod moves, impurities stay in the molten zone and are thereby carried to the end of the rod.

This process also happens geologically as molten magmas cool to form igneous rock. **Natural "zone refining" can move compounds containing radioactive elements out of the rock.** This can decrease the amount of radioactive elements in a way having nothing to do with radioactive decay. On the other hand, radioactive elements may be moved *into* the rock. **Either way, the radioactive content of the rock changes in a way unrelated to radioactive decay.**²⁰

Exposure of rocks to rain water and ground water also removes radioactive elements. This exposure dissolves compounds with radioactive elements out of the rock. A sample exposed to water can thus appear old as if the elements had been lost by radioactive decay. The very elements -- uranium, potassium and rubidium -- often monitored in radiometric rock dating all form compounds that dissolve easily in water.²¹

Further, nowhere on earth are rocks known to have been perfectly free of contact with water. The Soviets found water permeating even rocks at the bottom of extremely deep test wells.²² Assumption #2 is clearly false for rocks. **A rock appearing old could actually be quite young, as in the following example.**

Igneous rocks form as lava from volcanic eruptions cools and solidifies, and living things can be buried and fossilized in such eruptions. One such fossil found in Kenya is the human skull dubbed KNM ER-1470. Though human, it has been dated by radiometric techniques at 2.8 million years -- older than the

apes supposedly evolving into man. The KNM-ER skull was not dated directly, but by the igneous rock encasing it. **The lava's low radioactive content was taken to signify old age, but the lava had been exposed to rain and groundwater for centuries.**

*Assumption #3 is that the rate of radioactive decay has never changed.*²³ Without assumption #3 we cannot know how long it took for the radioactivity to drop from the higher ancient level to the lower modern level. Yet temperature, pressure, chemical concentrations, and other factors can alter radioactive decay rates.²⁴

Evidence in the form of "radiohalos" also suggests that assumption #3 is not true. Radiohalos are microscopic spheres of discoloration which surround radioactive mineral grains in rock. They must be viewed under a microscope to be seen. The mineral grains responsible for radiohalos contain atoms of radioactive elements such as uranium.

As uranium atoms decay, they explode and spew nuclear debris into the surrounding rock. This "nuclear shrapnel" discolors the rock, but rock is quite dense and the "shrapnel" doesn't penetrate a great distance. Hence the spheres or halos of discoloration remain microscopically small.

Each visible halo requires that as many as 5 billion uranium atoms have decayed. In a young earth, this many decays could have occurred only if nuclear decay rates had been higher in the past.²⁵ A young earth must be assumed to reach this conclusion, so radiohalos cannot be said to prove higher past decay rates, but neither do radiohalos show that past nuclear decay rates were constant as some have claimed.²⁶

THE ROCKS RADIOACTIVITY CANNOT DATE

All that has been said so far about the difficulties of radiometric rock dating actually applies only to igneous rocks, the kind formed in volcanic eruptions as magma or lava cools. Most fossils are found in *sedimentary* rocks. Sedimentary rock is formed from hardened sediments deposited by moving water. *Most fossils are in sedimentary rocks.* **The problems for radiometrically dating sedimentary rocks surpass even the difficulty of dating igneous rocks.**

Major sedimentary deposits occur around the world. Examples include the deposits of the Grand Canyon, and the Navajo Sandstone in Zion National Park, Utah. **Sedimentary rocks account for about 75% of all rocks at the surface,²⁷ but evolutionists never date sedimentary rocks radiometrically,** though radiometric dating is supposedly the way to prove the rocks to be old. Why is this?

Evolutionists acknowledge that the water involved in forming sedimentary rocks dissolves radioactive compounds out of the rocks. This changes the radioactivity in a way having nothing to do with radioactive decay. **In other words, even evolution agrees that sedimentary rocks have been disturbed since their formation, so we cannot hope to know the original level of radioactivity in these rocks.** *Incredibly, the very rocks of most interest to evolutionary philosophy -- sedimentary rocks with all of their fossils, the evolutionary "book of life" -- are not dated radiometrically.*²⁸

Ironically, if sedimentary rocks were dated the same way as igneous rocks -- by their uranium, potassium or rubidium content -- they would appear quite old, because the water they contact in formation dissolves out radioactive compounds and lowers their radioactivity. Yet evolution rejects the idea that sedimentary rocks can be dated like igneous rocks. So how *does* evolution deal with sedimentary rocks and the fossils they contain?

Evolution arrives at ages for such rocks solely by looking at the fossils in them. This is not an independent dating procedure. **The fossils themselves are assigned huge evolutionary ages, so the dating of sedimentary rocks is circular.**²⁹ Over the years evolutionists have simply agreed by consensus how old various fossils should be.

CARBON-14 DATING AND HISTORY

Radioactive carbon (carbon-14 or C-14) is a form of the element carbon. All living tissues have carbon. Carbon enters into living things by way of the *carbon cycle*. In the carbon cycle plants absorb carbon dioxide from the air, then animals and people eat the plants. A small percentage of all carbon is radioactive carbon-14. Carbon-14 forms naturally, and it enters the carbon cycle along with ordinary carbon (carbon-12).³⁰

When carbon-14 is incorporated into an organism, it decays because it is radioactive. After the organism dies, the carbon-14 continues to decay, but is no longer replenished by intake of food and air. Generally, the older the specimen, the lower the carbon-14 content. As mentioned previously, rocks and fossils sometimes have traces of organic, carbonaceous materials, and creationists have successfully carbon-dated some of these and confirmed that they are quite young.

For example, some of the oldest living things are the bristlecone pines of California.³¹ Tree ring studies (counting tree rings) show that bristlecone pines are at most 5000 years old, and probably somewhat less -- 4500 years or so.

Carbon-14 dates that are not based on evolutionary preconceptions, but on historical data, also indicate the same age limit for living things. Dr. Robert Whitelaw, a creationist, showed that *corrected* carbon-14 dates indicate a world-wide Flood around 3000 BC, close to the timing of the Flood in Biblical chronology.³²

How does one obtain these "corrected" carbon-14 dates? The key is relying on actual measurements of carbon-14 in the environment spanning the last several decades. These measurements can be used mathematically to estimate carbon-14 levels in the environment in the distant past. These levels were low.³³ This is different from the evolutionary approach which sets past carbon-14 levels *artificially high*, making it appear that today's lower carbon-14 levels represent a large drop due to supposedly great age.

Whitelaw's study, however, did not prove there was a global Flood 5000 years ago, however, for as mentioned, radiometric dates merely confirm preconceived dates -- in this case, dates consistent with biblical chronology. **The importance of Whitelaw's result was to show that carbon-14 dating yields no proof of old age, and the same conclusion holds for other creationist carbon-14 dates for rocks and fossils that are "young."**

Carbon-14 dating of relics of known historical age likewise can do no more than confirm the accepted age. The Shroud of Turin was known to date from about 1300 AD based on its fiber and weave,³⁴ and C-14 dating indeed confirmed that the Shroud is about 700 years old.³⁵ **But the Shroud's physical characteristics already gave this date.**

The Old Stone Fort, an ancient Indian burial and ceremonial site near Manchester, Tennessee, was known from its archeological context to date from about 270 AD. C-14 dates ranged from about 30 to 430 AD, with an average of about 250 AD, indistinguishable from the date that history had indicated.³⁶ In fact the developer of the radiocarbon dating method, Willard F. Libby, wrote that "radiocarbon dating as such may not be needed to establish historical fact"³⁷

THE UNCERTAINTIES OF CARBON-14 DATING

Conventional C-14 dating invokes assumption #1 discussed above, that scientists can know the C-14 level in the sample when new. Libby expressed his belief in the truth of assumption #1 by claiming, "organic matter, while it is alive, is in equilibrium with the cosmic radiation,"³⁸ but in fact this is often not the case. **Various physical phenomena (e.g., adsorption processes and ion exchange) may limit the passage of C-14 into the structure of a living organism, giving a low C-14 level which appears old.**

For example, a freshly slaughtered seal was carbon dated at 1,300 years.³⁹ Shells of living mollusks were dated as old as 2300 years.⁴⁰ Since the same processes limiting C-14 transport into living specimens also occurred in specimens now dead, it is possible that C-14 ages may be routinely over estimated.

Further, the effect of these processes varies from specimen to specimen depending on local environmental conditions and other factors. This produces a variability in the C-14 dates assigned to contemporaneous samples, so that **samples which should show the same age have a scatter of C-14 dates.**

This means that C-14 dating lacks certainty: "[The] radiocarbon method is still not capable of yielding accurate and reliable results. There are gross discrepancies, the chronology is uneven and relative, and the accepted dates are actually selected dates."⁴¹ Another investigator lamented, "[T]his whole blessed thing is nothing but 13th century alchemy and it all depends upon which funny paper you read"⁴²

The public has an unwarranted confidence in C-14 dates because, "Results are frequently combined or eliminated to produce a more 'archaeologically acceptable' story. Standard statistical tests can be used for combining radiocarbon results only in circumstances where it can be legitimately thought that the samples represent the same event in *radiocarbon* time and where the results are statistically consistent. However, the same standard techniques are too frequently used in ignorance to combine the results of determinations of dissimilar events or materials (e.g., heartwood charcoal and animal bone). Such combinations give an unjustified air of precision to a date, and they disguise real uncertainty."⁴³

In other words, "A series of samples is first examined statistically for aberrant measurements (outliers), which are removed before the measurements are statistically averaged."⁴⁴

Conventional C-14 dating also invokes assumption #2 discussed earlier, that the sample has been undisturbed since it was new. **But in fact the C-14 content of samples is routinely altered by contamination unrelated to radioactive decay.** For example, petroleum products are expected to be "entirely free of radiocarbon,"⁴⁵ so that samples contaminated with petroleum combustion products would be deficient in C-14 and appear old. This explains why wood from a growing tree near an airport was dated at 10,000 years.⁴⁶

Rather than assumption #2 being reliable for C-14 dating, the truth is that, "The unsolved problem, instead, seems to lie in the difficulty of securing samples completely free from either older or younger adherent carbon. At least to the present, no kind or degree of chemical cleaning can guarantee one-age carbon, typical only of the time of the site from which it was excavated."⁴⁷

How severe is this difficulty? According to Ogden, "It may come as a shock to some, but fewer than 50 percent of the radiocarbon dates from geological and archaeological samples in northeastern North America have been adopted as 'acceptable' by investigators."⁴⁸ This subjective type of data selection was used to "date" a core from the Chukchi Sea off the coast of Alaska according to the following rationale:

"Six radiocarbon ages have been determined for organic carbon throughout the core. These ages, which range from $4,390 \pm 210$ to $15,500 \pm 800$ years B.P., are so disarranged that no consecutive dates are juxtaposed, and the oldest age determination is from the 2.88 to 3.40-meter interval. [The oldest date in the deposit, which should have been at the bottom of the core, was toward the top.] This disarrangement of radiocarbon ages suggests that the delta sediments are to some degree composed of recycled sediment. [Rather than questioning the reliability of the C-14 dates, the investigators hypothesized a geologic recycling that would avoid calling the C-14 dates into question. *Then the data selection began.*]

"By disregarding the $15,500 \pm 800$ -year age as being inconsistent with the other radiocarbon ages, and by assuming that contamination had made the remaining dates too old by about the same amount that the radiocarbon age ($4,390 \pm 210$ years B.P.) near the top of the core exceeds usual surface sediment dates, [J. S.] Creager and [D. A.] McManus conclude that the delta was formed about 12,000 years ago."⁴⁹

Of this type of data treatment, Ginenthal commented: "Since it is accepted, without reservation, that the Ice Age ended about 10,000 to 12,000 years ago, the disarranged radiocarbon dates found in the sediment were rearranged to support this assumption. These same dates could also have been rearranged based on other assumptions."⁵⁰

For example, the youngest core samples were about 4000 years old, comparable with the biblical Flood date.⁵¹ **The "older" core samples nearer the surface evidently were contaminated by C-14-deficient pre-Flood sediment due to early post-Flood surface re-working.**

In another C-14 dating survey to determine the age of an uplifted shoreline, **most of the results were discarded because they did not agree with the expected date:** "We know of several hundred radiocarbon dates from the area and time range being considered here, but only 27 have been used in our chronology. All but wood dates have been rejected because of unresolvable contamination problems, and only wood dates that seem to be from stratigraphically significant materials have been used. **Other dates could be used to construct other chronologies.**"⁵² As mentioned earlier, contamination certainly occurs, but **in this case, contamination was the excuse for "selecting out" the dates disagreeing with the preconceived age.**

The most disturbing aspect of this case is that it is not exceptional: "[W]hat immediately stands out is the circular nature of many [rejection criteria]. ... In other words, if one subset is in accord with one's preconceived 'historical chronology' use it; but ignore the sub-set that does not conform ... Many [analyses] are circular in that they presume the validity of the very chronology they are being used to refine."⁵³

In 1989, the British Science and Engineering Research Council conducted C-14 dating tests at 38 radiocarbon testing laboratories. Each laboratory received wood, peat, and carbonate samples of known age, but none of the labs knew the expected age of the samples to be analyzed. **Only seven labs out of the 38 found a sample age resembling the real age,⁵⁴ an agreement of less than 20%.**

CARBON-14: EVIDENCE FOR A YOUNG EARTH

In addition to these difficulties, assumption #3, that the rate of nuclear decay has been constant, does not hold for C-14 dating. Carbon-14 is presently forming in the atmosphere as well as decaying, so conventional C-14 methodology states assumption #3 by saying, *C-14 forms and decays at equal rates.* This statement is called the *steady state assumption.*⁵⁵ Libby and his successors concluded that the C-14 formation rate has been virtually constant for many millennia, thus insuring an unchanging level of C-14 in the atmosphere now, and in turn a constant decay rate.⁵⁶

The reality is that the magnetic field of the earth has been decaying over time,⁵⁷ and during the Flood the earth's atmosphere changed profoundly, becoming less protective,⁵⁸ and the oceans experienced turbulent mixing on a scale never since repeated. A weaker magnetic field and the lack of pre-Flood atmospheric protection would allow more cosmic rays to penetrate the atmosphere,⁵⁹ so that **C-14 formation rates have been higher since the Flood than before.**

As mentioned, petroleum and other materials from the pre-Flood world contain little C-14, showing that the pre-Flood earth provided better protection from cosmic rays than today's earth. Since the Flood, the level of C-14 in the atmosphere has been rising, but eventually the C-14 decay rate will equal the formation rate and the abundance of C-14 in the atmosphere will level out. **Libby realized that this process would require about 30,000 years.⁶⁰ Thus the atmosphere must be younger than 30,000 years.** But the true age is even less.

The present C-14 decay rate is at most only 78% of the formation rate, which caps the atmosphere's age at about 12,500 years.⁶¹ If the atmosphere were older than this, there would be more C-14 in the environment than is observed, and the decay rate would be higher.⁶² The *abundance* of atmospheric C-14 – as opposed to C-14 *dating* – conclusively shows that the earth's atmosphere is young. **Therefore life on earth is recent, and by implication the earth itself is young.**

Realizing that assumption #3 is false allows a downward correction to be made to conventional C-14 dates.⁶⁴ The greater the conventional age, the greater the correction. **All apparently old C-14 dates would fit into a biblical chronology.**

C-14 DATES RELY ON OTHER CHRONOLOGIES

In an attempt to minimize the uncertainties of C-14 dating, carbon-14 dates are correlated with tree-ring dates,⁶⁵ but tree-ring dates are also correlated with C-14 dates.⁶⁶ Different groups of specialists carry out the two sets of correlation activities -- physicists monitor the C-14 correlations, and tree-ring specialists (dendrochronologists) superintend the tree-ring correlations.⁶⁷ **Each group of specialists believes that the other group has a definite grasp of firm dates, and rarely if ever in the conventional literature are the two groups brought together to reveal their unintentional but mutual ignorance.**

This difficulty becomes extreme beyond about 3000 BC, prior to which there are essentially no extant written records, since the Flood occurred then and destroyed virtually all historical documents.⁶⁸ In other words, **all presumed dates before about 3000 BC are really meaningless and are products of consensus in which each group of specialists has given credence to the other's claims.**

Aside from the biblical record, even dates after c. 3000 BC up to about 1000 BC are uncertain in most cases by several decades if not several centuries. One of the earliest claimed dates with a smaller error range is the timing of the total solar eclipse visible over ancient Assyria in 763 BC.⁶⁹

Astronomers can retrodict the occurrence of an eclipse at that time, and clay tablets unearthed by archeologists mention the eclipse as having been visible then. Thus modern astronomy fixes this date as one of the most ancient outside the Bible that can be known with fair certainty.

As mentioned, C-14 and other radiometric methods really do no more than confirming a presumed date factored into the radiometric analysis. The only truly reliable source of dates is historical documents. The Bible is the only such reliable document for dates before 763 BC. Conventional chronologies such as the Egyptian chronology are beset with uncertainties.

Nevertheless, many other ancient chronologies are based on the presumed Egyptian chronology.⁷⁰ The conventional Egyptian chronology was originally tied to the so-called "Sothic cycle."

The Sothic cycle has been shown to be an unreliable basis for dating, but its legacy of an excessively long Egyptian chronology has lived on. Further, numerous Egyptian pharaohs conventionally taken to have reigned separately in fact appear to have been co-regents, such as father and son reigning at the same time.⁷¹ The Egyptian chronology was developed in the 1800s

from faulty time tables worked out for the presumed evolution of culture in the Old World, especially Europe. The faulty Sothic cycle was fit to these older concepts, and now as mentioned, many other conventional cultural chronologies are fit to the faulty Egyptian chronology.

This has led to a number of vexing "pseudo-problems" -- problems that exist only because the underlying chronological assumptions are faulty. For example, Greek chronology appears to be short, but is force-fit to the longer Egyptian time scale.⁷² This has resulted in the concept of a Greek "dark age," an empty gap from the twelfth century to the eight century BC (c. 1150-750 BC) that is absent from any historical record, and which is therefore a major historical puzzle.⁷³

When Libby established the C-14 method in the 1940s, he correlated it with the Egyptian chronology and other chronologies tied to the Egyptian.⁷⁴ Thus C-14 dates from the beginning were based on a faulty time-line.

CONCLUSIONS

Evolutionary philosophy had invoked huge ages decades before radioactivity was ever discovered, let alone used to date rocks. The long ages of radiometric dating are based on *scientifically* invalid assumptions.

Radiometric methods cannot independently date anything. A result is only as good (or bad) as the preconceived age fed into the procedure. When *corrected* with *historical* data, radiometric methods yield young ages. But it is actually the historical data providing the dates; the radiometric procedures are dependent on this external input.

Most rocks (sedimentary fossil-bearing rocks) cannot be dated radiometrically. Evolutionists acknowledge this. Evolutionary philosophy *assigns* huge "ages" to fossils (and the rocks containing them) based on the assumed *stage of evolution* they represent. This is "reasoning in a circle." This circle of reasoning has become very intricate and complex, with evolutionists the world over *by consensus* agreeing to a uniform system of evolutionary "dates." Majority consensus is thus confused with truth.

Radiometric dating is sufficiently complex to confuse the average layperson into feeling that he can never understand chronology. Chronology is thus abandoned to evolutionary philosophy, yet evolutionism has never truly used radiometric methods to reach conclusions about age.

There is in fact a complex web of circular reasoning in which various chronologies interlock in a dependent fashion. The carbon-14 chronology, dating by tree-rings, and conventional Egyptian chronology all interlock in this way, for example. The specialist who doubts his own chronology can look for reinforcement of the long-age concept in the other chronological systems interlocking with his own.⁷⁵

Every Christian is a priest before God and is personally responsible for his own beliefs. Just as Christians look not to a priesthood for personal salvation, neither should Christians look to a secular *scientific "priesthood"* as the source of truth.⁷⁶ **The Christian needs to place his chronological confidence in the historical record preserved in the Bible.**

Notes. Bolding in quotations is added.

- 1 J. Henry, "A Critique of Progressive Creationism in the Writings of Hugh Ross," *Creation Research Society Quarterly*, Vol. 43, June 2006a, pp. 17-20.
- 2 J. Henry, "Did Death Occur Before the Fall?: A Further Critique of the Progressive Creationism of Hugh Ross," *Creation Research Society Quarterly*, Vol. 43, December 2006b, pp. 161-165.
- 3 J. Henry, "Using Care in Defining Evolution as Mere Change in Astronomy and Biology," *Creation Research Society Quarterly*, Vol. 40, September 2003a, pp. 124-127.
- 4 J. Henry, "Evidence from Beyond the Earth for a Young Earth," <creationconcepts.org>, 2005.
- 5 The creation has an age of several millennia (J. Henry, "What Is the Age of the Universe?," <creationconcepts.org>, 2001a). For a general discussion of biblical chronology, see Edwin R. Thiele, *The Mysterious Numbers of the Hebrew Kings*, Zondervan, pp. 67-72; E.R. Thiele, *Chronology of the Hebrew Kings*, Zondervan, 1977, pp. 28-30; and Eugene H. Merrill, *An Historical Survey of the Old Testament*, Craig Press, 1972, pp. 96-98.
- 6 Ivan G. Draganic, Zorica D. Draganic, and Jean-Pierre Adloff, *Radiation and Radioactivity on Earth and Beyond*, CRC Press, 1993, p. 4.
- 7 J. Henry, "An Old Age for the Earth Is the Heart of Evolution," *Creation Research Society Quarterly*, Vol. 40, December 2003b, pp. 169-170.
- 8 J. Henry, "Radiometric Dating Realities," <creationconcepts.org>, 2001b. Twenty-three years before the discovery of radioactivity, one geology text pointed out that the earth's crust was some 100 million years old (J.W. Dawson, *The Story of the Earth and Man*, Harper, 1873, p. 14). **If the crust were this old, the earth itself must have begun evolving eons earlier.**
Well before the discovery of radioactivity, geological items on the earth were also considered to be much older than the biblical chronology would allow. For example,
"In 1878 Dr. Earl Flint was in Central America collecting antiquities for the Peabody Museum of Harvard University. During his travels he learned that quarrymen near Managua, Nicaragua, had been uncovering fossilized human footprints in a mudstone layer ... Between 1884 and 1889 Flint argued in the *American Antiquarian* that the footprints dated to at least 50,000 years and possibly as far back as 200,000 years, a dating which would have placed their owners in the Tertiary period" (Alan L. Bryan, "New Light on Ancient Nicaraguan Footprints," *Archaeology*, Vol. 26, 1973, p. 146).
- 9 Draganic et al., p. 22.
- 10 H. Levin, *Contemporary Physical Geology*, Saunders College Publishing, 1986, p. 187.
- 11 "I wonder how many of us realize that the time scale was frozen in essentially its present form by 1840" (Edmund M. Speiker, "Mountain-Building and the Nature of the Geologic Time-Scale," *Bulletin of the American Association of Petroleum Geologists*, Volume 40, August 1956, p. 1803).
"By the years 1830-1833, when the three volumes of Charles Lyell's great classic *Principles of Geology* were published, the system of sequential or relative dating was well established" (George Gaylord Simpson, *Fossils and the History of Life*, Scientific American Library, 1983, p. 58).
"The basic time scale has remained unchanged since 1879 . . ." (Stephen Rowland, "A New Shirt for Carl," *Science* 83, Vol. 4 no. 5, May 1983, p. 80).
In fact, the early radiometric methods were calibrated around the old Lyellian geological dates. In other words, **the Lyellian dates were used to establish the radiometric procedures supposedly proving them** (J. Henry, 2003b, p. 169).
- 12 Draganic et al., pp. 5-15.
- 13 *ibid.*, pp. 213-214. About 15 radioactive carbon atoms disintegrate each minute per gram of carbon in nature (Draganic et al., p. 60; W.F. Libby, "Radiocarbon Dating," *Science*, Vol. 133, March 3, 1961, p. 622). The human body is 18.5% carbon by mass (Peter H. Raven and George B. Johnson, *Biology*, Times Mirror/ Mosby, 1989, p. 30), so each day nearly 300 million radioactive carbon atoms disintegrate inside the body of a 150 pound person. **This is more than 3000 disintegrations per second.**
- 14 The oldest rocks on earth are considered conventionally to be about 3.8 billion years old (Draganic et al., p. 184). Once-living materials are considered to be datable to a maximum of about 40 thousand to 100 thousand years (*ibid.*, p. 61), about one one-hundred thousandth of the age of the oldest rocks. **In contrast to this conventional chronology, all the creation is actually the same age.** The Creator brought the universe and its parts into existence in *one week* as mentioned above.
- 15 Uranium-238 with a half-life of 4.47 billion years decays through a series of 14 steps to lead-206; the reaction is $^{238}\text{U} = ^{206}\text{Pb} + 8^4\text{He} + 6e^-$
Potassium-40 with a half-life of 1.25 billion years changes directly to calcium-40 by the reaction $^{40}\text{K} + e^- = ^{40}\text{Ar}$
Rubidium-87 with a half-life of 48.8 billion years decays directly to strontium-87 by the reaction $^{87}\text{Rb} = ^{87}\text{Sr} + e^-$
There are other outcomes of these reactions not presented here, and other long-lived elements are also used in radiometric dating (Don deYoung, "Radioisotope Dating Review," in Larry Vardiman, Andrew A. Snelling, and Eugene F. Chaffin (editors), *Radioisotopes and the Age of the Earth: A Young-Earth Creationist Perspective*, Institute for Creation Research and Creation Research Society, 2000, pp. 29-39).
- 16 The half-life of radioactive carbon is taken to be 5730 years (Draganic et al., pp. 59-60; W.F. Libby, "The Radiocarbon Dating Method," *Pensee*, Vol. 3 no. 2, Spring-Summer 1973; in Ian Tresman (editor), *Catastrophism!: Man, Myth and Mayhem in Ancient History and the Sciences*, CD-ROM version 1.41, Knowledge Computing, 33 Reginald Street, Derby DE23 8FR, UK, May 2004).
- 17 Ken Ham, Andrew Snelling, and Carl Wieland, *The Answers Book*, Master Books, 1991, pp. 73-75; Robert Garbe, Hugh Miller, John Whitmore, George Detwiler, Doug Wilder, Frank Vosler, John Ditmars, and D. Davis, "Direct Dating of Cretaceous-Jurassic Fossils," in William Overn (editor), *Proceedings of the 1992 Twin-Cities Creation Science Conference*, Minneapolis, July 29-August 1, 1992, pp. 9-10.
- 18 John D. Morris, "Prologue," in Vardiman et al., p. v. Morris lists the three assumptions in the opposite order from the discussion in this paper.
- 19 The use of complicating concepts such as "isochrons" does not change this conclusion (Russell Arndts and William Overn, *Radiometric Dating: Isochrons and the Mixing Model*, Bible Science Association, 1983, pp. 1-33). An "isochron line ... can be straight, but have nothing to do with sample age. ... [Isochron] lines even may have a downward slope, implying a negative sample age. Such mixing lines are called fictitious or pseudoisochrons" (de Young, p. 42).
- 20 de Young, pp. 44-45; John R. Baumgardner, "Distribution of Radioactive Isotopes in the Earth," in Vardiman et al., pp. 54-59; Melvin A. Cook, *Prehistory and Earth Models*, Max Parrish, 1966, pp. 31-32.
- 21 "[As] much as 90 percent of the total radioactive elements of some granites could be removed by leaching ... with weak acid. ... [C]ommonly as much as 40 percent of the uranium in most fresh-appearing igneous rocks is readily leachable" (M.R. Klepper and D.G. Wyant, *Notes on the Geology of Uranium*, Bulletin No. 1046-F, U.S. Geological Survey, 1957, p. 93). See also H.S. Slusher, *Critique of Radiometric Dating*, Institute for Creation Research, 1981, p. 31.
- 22 "[The Soviets] found open fractures with fluids flowing through them at depths down to at least 11.5 kilometers. Many scientists expected that pressure would close all open space below three kilometers" (William J. Cromie, "Windows to the Earth," *Mosaic*, Vol. 12 no. 1, Spring 1981, pp. 29-30).
German scientists drilling a deep hole in their country have found crevices and pores at almost all depths down to 7.5 kilometers, even though theory said they could not exist because of intense pressures. These voids were filled with circulating fluids (Richard A. Kerr, "Looking - Deeply - Into the Earth's Crust in Europe," *Science*, Vol. 261, July 16, 1993, p. 295).
- 23 "The probability of the decay of a radionuclide is independent of the age of the nucleus and is unaffected by heat, pressure, magnetic and electric influences, and, in fact, all external forces. The basis for all radioactive dating methods is this constancy of decay rate" (Draganic et al., p. 59).
- 24 Experimental data show that nuclear decay rates are not constant (J. Henry, "Nuclear 'Decay' Constants Are Not Constant," <creationconcepts.org>, 2003c).
The theory of alpha and beta particle production in nuclear decay also implies that nuclear decay rates are not constant (D. Russell Humphries, "Accelerated

Nuclear Decay: A Viable Hypothesis?," in Vardiman et al., pp. 357-364). Verses such as Deut. 32:22 refer to fire in the earth, possibly caused by higher energy release rates in nuclear decay (ibid., pp. 351-357).

25 ibid., pp. 335-336.

26 ibid., p. 374; J. Henry, "Polonium Radiohalos: Evidence for Special Creation and a Young Earth," <creationconcepts.org>, 2006c.

27 Harold L. Levin, *Contemporary Physical Geology*, Saunders, 1990, p. 131.

28 "The sedimentary rocks that contain the record of life rarely contain radioactive materials suitable for dating" (Colin W. Stearn and Robert L. Carroll, *Paleontology*, Wiley, 1989, p. 16).

"Many sedimentary rocks cannot [be dated], and with few exceptions fossils are found in [them]" (Simpson, p. 68).

"In contrast to igneous rocks, the minerals of sediments can be weathered and leached of radioactive components. ... In addition, the age of a detrital grain in a sedimentary rock does not give an age of the sedimentary rock but only of the parent rock that was eroded much earlier" (Levin, 1986, p. 190).

29 "Geologists are here arguing in a circle. The succession of organisms has been determined by a study of their remains embedded in the rocks, and the relative ages of the rocks are determined by the remains of the organisms that they contain" (R.H. Rastall, "Geology," *Encyclopedia Britannica*, Vol. 10, 1956, p. 168).

"The charge that the construction of the geologic scale involves circularity has a certain amount of validity" (David M. Raup, "Geology and Creationism," *Field Museum Natural History Bulletin*, Vol. 54 no. 3, March 1983, p. 21).

"A circular argument arises: interpret the fossil record in terms of a particular theory of evolution, inspect the interpretation, and note that it confirms the theory" (Tom Kemp, "A Fresh Look at the Fossil Record," *New Scientist*, Vol. 108 no. 1485, December 5, 1985, p. 66).

"Are the authorities maintaining, on the one hand, that Evolution is documented by geology and, on the other hand, that geology is documented by Evolution? Isn't this a circular argument?" (Larry Azar, "Biologists, Help!," *Bioscience*, Vol. 28 no. 11, November 1978, p. 714).

"The intelligent layman has long suspected circular reasoning in the use of rocks to date fossils and fossils to date rocks" (J.E. O'Rourke, "Pragmatism Versus Materialism in Stratigraphy," *American Journal of Science*, Vol. 276, January 1976, p. 47).

Unfortunately, virtually all the experts just cited excuse their circular "dating" with the response, "How else are you going to do it?" In fact, this was exactly the reaction of Dr. Donald Fisher, State Paleontologist of New York, in a 1979 interview with Dr. Luther Sunderland (L.D. Sunderland, "The Geologic Column: Its Basis and Who Constructed It," *Bible-Science Newsletter*, Vol. 24 no. 12, December 1986, p. 6).

30 "[C]osmic rays produce secondary neutrons in their initial collisions with the top of the atmosphere. ... Nitrogen-14, the abundant nitrogen isotope, reacts [with these neutrons] to form carbon-14 with the elimination of a proton. It also reacts about 1 percent of the time to produce tritium (radioactive hydrogen)

..." (Libby, 1961, pp. 621, 622). "This article [was] adapted from [Libby's] Nobel address, delivered in Stockholm, 12 December 1960, where he was awarded the Nobel prize in chemistry" (ibid., p. 621).

31 "... [B]ristlecone pine is the world's oldest known living tree" (C.W. Ferguson, "Bristlecone Pine: Science and Esthetics," *Science*, Vol. 159, February 23, 1968, p. 839).

32 Robert L. Whitelaw, "Time, Life and History in the Light of 15,000 Radiocarbon Dates," *Creation Research Society Quarterly*, Vol. 7, June 1970, p. 56. In Florida, mammoth bones found with other extinct animals and human artifacts were C-14 dated at 2000 years (Jim Hester, "Late Pleistocene Extinction and Radiocarbon Dating," *American Antiquity*, Vol. 26 no. 1, July 1960, pp. 62, 65, 72), a date similar to the biblical timing of Pleistocene life after the Flood.

33 Humphries, p. 373.

34 Lynn Picknett and Clive Prince, *Turin Shroud: In Whose Image?*, HarperCollins, 1994, p. 13.

35 ibid., p. 7-8; Draganic et al., p. 61.

36 Charles H. Faulkner, *The Old Stone Fort: Exploring an Archeological Mystery*, University of Tennessee, 1968, pp. 23-26.

37 Libby, 1961, p. 626. 38 ibid, p. 622.

39 Wakefield Dort, "Mummified Seals of Southern Victoria Land," *Antarctic Journal*, Vol. 6, 1971, p. 211.

40 M. Keith and B. Anderson, "Radiocarbon Dating: Fictitious Results with Mollusk Shells," *Science*, Vol. 141, August 16, 1963, p. 635; Meyer Rubin and Dwight W. Taylor, "Radiocarbon Activity of Shells from Living Clams and Snails", *Science*, Vol. 140, August 16, 1963, p. 637.

41 Robert E. Lee, "Radiocarbon: Ages in Error," *Anthropological Journal of Canada*, Vol. 19 no. 3, 1981, p. 27.

42 R. Stuckenrath, "Radiocarbon: Some Notes From Merlin's Diary," *Annals of the New York Academy of Science*, Vol. 288, 1977, p. 188.

Even under ideal conditions, C-14 dating is not precise: "The method works extremely well if all one wants is an estimate of age. Problems arise as soon as attempts are made to establish dates. The first relates to the inherent error associated with the laboratory measurement of the amount of ¹⁴C in a sample (the activity). This inherent error tends to smudge the age determination so that no routine radiocarbon date can be guaranteed within a century either way. Individual measurements can in fact be much worse than this" (Michael G.L. Baillie, *Tree-Ring Dating and Archaeology*, University of Chicago, 1982, p. 224).

43 S. Bowman and N. Balaam, "Using Radiocarbon," *Antiquity*, Vol. 64, 1990, p. 317.

44 F.A. Hassan and S.W. Robinson: "High-Precision Radiocarbon Chronometry of Ancient Egypt, and Comparisons with Nubia, Palestine and Mesopotamia," *Antiquity*, Vol. 61, 1987, p. 129.

45 Libby, 1961, p. 623. Evolutionists base this expectation on the belief that petroleum products formed millions of years ago, so that all C-14 should have decayed. Creationists expect this because of evidence that pre-Flood C-14 levels were low, so that the petroleum products formed as a by-product of the Flood would be deficient in C-14 compared to modern biomass.

46 Bruno Huber, "Recording Gaseous Exchange Under Field Conditions"; in K.V. Thimann (editor), *The Physiology of Forest Trees*, Ronald Press, 1958, pp. 187-195; p. 194.

47 Charles Ginenthal, "Scientific Dating Methods in Ruins," *The Velikovskian*, Vol. 2 no. 1, 1994; in Tresman.

48 J. Ogden, "The Use and Abuse of Radiocarbon Dating," *Annals of the New York Academy of Science*, Vol. 288, 1977, p. 173.

49 D.S. McCulloch, "Quaternary Geology of the Alaskan Shore of the Chukchi Sea"; in David M. Hopkins (editor), *The Bering Land Bridge*, Stanford University, 1967, pp. 91-120; p. 110.

50 Ginenthal.

51 Additional C-14 dating showed an increased bias toward younger dates of about 4000 years (William N. Irving and C.R. Harington, "Upper Pleistocene Radiocarbon-dated Artefact from the Northern Yukon," *Science*, Vol. 179, January 26, 1973, p. 340). Ginenthal viewed these results as being *too young*, claiming that the cores should be viewed as *even older* than 12,000 years.

52 D.M. Mickelson, L. Clayton, D. Fullerton, and H. Borns, "The Late Wisconsin Glacial Record of the Laurentide Ice Sheet in the United States," in H.E. Wright (editor), *Late-Quaternary Environments of the United States*, Vol. 1, University of Minnesota, 1983, pp. 12-13.

53 Jesse E. Laskin, "Misusing Radiocarbon: A Case Study," *Chronology and Catastrophism Review*, Vol. 14, 1992; in Tresman.

54 Andy Coghlan, "Unexpected Errors Affect Dating Techniques," *New Scientist*, Vol. 123 no. 1684, September 30, 1989, p. 26.

55 Cook (p. 3) described the steady state assumption as follows: "... [A]ccording to the steady state postulate underlying the Libby method of C¹⁴ dating ... the rate of change in time of [C-14 activity] (or dC/dt) is zero. In general

$$dC/dt = k_f - k_d I \quad (1.1)$$

where k_f is the (zero-order) specific rate constant for formation and k_d is the (first-order) specific rate constant for decay. Two of the important basic postulates of the radiocarbon method are thus embodied in the two relations

$$k_f = \text{constant} \quad (1.2)$$

[constant rate of C-14 formation]

$$k_f = k_d I \quad (1.3)$$

[steady-state assumption]."

Some of the algebraic symbols here and below are changed from Cook's symbols. Listing the new

symbol, then Cook's original symbol(s), the changes are: $C = I_0(\text{now}) = C^{14} = \text{C-14 decay rate at any time, counts/g/min}$

$C_{\text{max}} = I_{\text{max}} = I_0 = \text{steady state maximum of C-14 decay rate, counts/g/min;}$

$k_f, k_d = k'_f, k'_d = \text{rate constants of formation (f) or decay (d);}$

$T = t_0 = \text{time for C-14 decay rate to achieve steady state, years;}$

$t = t' = \text{time, years;}$

$\lambda = \text{decay constant, years}^{-1}.$

56 Libby denied that factors liable to affect the C-14 formation rate could have varied in the foreseeable past: "[W]e conclude that the cosmic ray flux, the magnetic field in the vicinity of the earth, and the rate of mixing in the oceans have not varied from the average during the last 4000 or 5000 years" (Libby, 1961, pp. 279-280).

57 Henry, 2005a.

58 J. Henry, "The Pre-Flood World," <creation concepts.org>, 2007a.

59 "[Another] problem [with C-14 dating] relates to the basic assumption, implicit in the method, that the cosmic ray flux has always been a constant, i.e., that the ^{14}C has always been produced at a steady rate" (Baillie, 1982, p. 224).

60 "... [T]he earth's atmosphere may not be in steady state as far as radiocarbon is concerned even though only about 30,000 years are required to establish this steady state as shown by Libby. [But conventional C-14 dating rejects] the apparent *fact* that radiocarbon is not in steady state in the atmosphere ... (Cook, p. xi; see also R.E. Lingenfelter, "Production of Carbon 14 by Cosmic-Ray Neutrons," *Review of Geophysics*, Vol. 1, 1963, pp. 35, 52).

61 "... [T]he actual intensity of [C-14] radiation to the steady state or maximum intensity in the biosphere appears to be less than 0.78. On the conventional assumption that the [production rate of C-14 in the atmosphere] is constant in time, a basic postulate of the radiocarbon dating method, this result leads to an 'age' of 12,500 y or less for the atmosphere" (Cook, p. 1).

62 "... [S]etting C/C_{max} at 0.78 [means] either the atmosphere is for one reason or another in a transient or build up stage as regards C^{14} ... or else something is wrong in one or another of the other basic postulates of the radiocarbon dating method" (Cook, p. 6).

63 "[One way] of revising the radiocarbon dating method ... is simply to adopt a non-equilibrium or non-steady state model based on integration of equation (1.1) to give

$$C = C_{\text{max}}e^{-\lambda(T-t)} = I_{\text{max}}(e^{-\lambda t} - e^{-\lambda T}) \quad (1.5)$$

where ... $I_{\text{max}} = 19.7$ counts/g/min for the steady state or long time [decay rate of C-14] in the biosphere.

... By using the ratio $C/C_{\text{max}} = 0.78$ [now] and the value $\lambda^{-1} = 8330$ y one obtains from equation (1.5) the result $T = 12,500$ y and $I_{\text{max}}e^{-\lambda T} = 4.4$ counts/g/min. Therefore,

$$C = 19.7e^{-\lambda t} - 4.4 \quad (1.6)$$

for the radiation intensity [in counts/g/min] of a sample that has been dead t years" (Cook, p. 6).

64 "[The non-equilibrium model of C-14 dating] reduces the computed age by an amount dependent on the age of the sample by amounts increasing in time from about 20% in 1000 years, 30% in 4000 years and finally telescoping all very long ages to 12,500 years or less. ... [Therefore] *an exact application of Libby's method and data* for the C^{14} method dates the atmosphere at around 10^4 years" (Cook, pp. 8, 10). But the ratio C/C_{max} may be as low as 0.72 (Cook, p. 8). **This places an upper limit on the age of the atmosphere of less than 12,500 years.**

65 C-14 dates are calibrated by tree-ring dates:

"The bristlecone pine chronology has generally been accepted as verifying the validity of radiocarbon dating for greater than 7000 years ...

The bristlecone pine tree ring chronology ... has made possible the determination of the extent of the deviations of the radiocarbon dates ... back to some 7500 years ago ... So we are driven back to the bristlecone pine method to extend the [C-14] chronology backward to glacial times about 11,000 years ago" (W.F. Libby, "Dating by Radiocarbon," *Accounts of Chemical Research*, Vol. 5 no. 9, September 1972, pp. 289, 293, 294).

"The assumption that the concentration of radiocarbon in living matter remains constant over all time is a bold one. It appears to be nearly correct; however, deviations of a few percent occur. **These are determined by the measurement of radiocarbon in the wood in trees dated by the number of rings found.** The Bristlecone Pine is the most famous and most useful tree yet discovered" (Libby, 1973).

"[The bristlecone pine chronology] constitutes the first independent time control of such length for radiocarbon analysis" (prepublication abstract of Ferguson; in Herbert C. Sorensen, "The Ages of Bristlecone Pine," *Pensee*, Vol. 3 no. 2, Spring-Summer 1973; in Tresman).

"To determine the extent of correction necessary to render the radiocarbon method reliable, **dendrochronologists devised a plan to control the radiocarbon dates** by building a chronology of tree rings of the white bristlecone pine, the longest living tree. The method caught the fancy of the radiocarbon researchers" (Immanuel Velikovsky, "The Pitfalls of Radiocarbon Dating," *Pensee*, Vol. 3 no. 2, Spring-Summer 1973; in Tresman.).

"The bristlecone pine chronology ... has been used as the standard for calibration of the radiocarbon timescale" (J.R. Pilcher, J. Hillam, M.G.L. Baillie, and G.W. Pearson, "A Long Sub-Fossil Oak Ring Chronology From the North of Ireland," *New Phytologist*, Vol. 79, 1977, p. 713).

"The primary importance of [the bristlecone pine] chronology undoubtedly lay in its **contribution to the calibration of the radiocarbon time scale**" (Baillie, 1982, p. 37).

"One effect of the tying down of the Belfast early medieval [tree-ring] chronology and the subsequent dating of a number of English [tree-ring] chronologies has been **the specification of a number of radiocarbon samples in real time**" (Baillie, 1982, p. 228).

"Tree-ring based calibrations are routinely applied to C-14 dates falling within the time span of the calibration curves or tables" (Jesse E. Lasken, "Should the European Oak Dendrochronologies Be Re-examined?," *Chronology and Catastrophism Review*, Vol. 13, 1991; in Tresman.).

"[The C-14] method has been checked by comparison with ... certain old trees whose age is well established by other techniques" (Draganic et al., p. 60.)

66 Tree-ring dates are calibrated by C-14 dates:

"The first major work on tree-ring dating was done in America on the sequoia and bristlecone pine trees, but other studies have now been done in Northern Ireland, Britain and Germany. ...

"The strength of a date determined from tree rings is its precision: an exact year can be identified, with no approximation. The difficulty is that no one tree records the whole of history, so a master chronology must be built up by linking pieces of wood from different trees in sequence and then matching samples to be dated against this; this is not easy and it is made harder by the fact that although the growth of the various individual trees responds to a common climatic signal, there are considerable local variations and 'noise' on the signal, which mask the common features. It is rather like trying to assemble a lengthy Morse code message by listening to a lot of short snippets recorded from a variety of radio receivers operating under poor conditions, continually drifting in and out of the background swish. It is part science, part art ...

"The problem is that one mistake can throw the whole exercise [of matching ring sequences from different trees] ... [T]he researchers [first assembling a master tree-ring sequence for Northern Ireland] resorted to radiocarbon dating to give approximate dates to help them make progress and provide some kind of a check ... **but in the process the independence of their dates from radiocarbon dates must have been compromised.** ..." (Alasdair Beal, "A Bit Creaky?: Tree Rings, Radiocarbon and Ancient History," *Chronology and Catastrophism Review*, Vol. 13 no. 3, 1991; in Tresman).

"[T]he bristlecone pine results have been built into the Irish oak and German oak dendrochronologies. Various individual trees making up the various 'floating site chronologies' that were eventually linked to form these chronologies were **originally tentatively dated by use of C-14 measurements**" (Lasken, 1991).

But the bristlecone pine chronology was in turn determined by reference to C-14 dates: "[T]he known occurrence of [bristlecone pine] samples 9,000 years old (**dated by radiocarbon only**) lends hope that in time an absolute chronology may yet be available covering at least 10,000 years" (Baillie, 1982, p. 37). The claim of a 9000 year old sample is also mentioned in Ferguson, p. 842.

"Occasionally, a [wood] sample from **a specimen not yet dated by tree-rings is subjected for radiocarbon analysis**" (Ferguson, p. 845). Ferguson worked with bristlecone pines.

In establishing the Irish oak chronology, "... [A] **large number of radiocarbon determinations were carried out in the Palaeoecology Laboratory to establish relative ages and the age range** of the groups of timbers under investigation ... [O]nce groups of timbers from different sites had been shown to have similar radiocarbon ages, cross-dating was attempted between site chronologies" (Pilcher et al., pp. 713-714).

"Samples from tree-trunks or stumps are taken with a power-saw, normally one section of about 20

cm thickness and one of 2-5 cm thickness. The thin slice is used for tree-ring dating and **the thick one is stored for radiocarbon and stable isotope measurements ...**" (Pilcher et al., p. 714).

Baillie (1982, p. 202) repeated elsewhere that, "Sampling [for the Irish tree-ring sequence] was carried out mostly using a chainsaw. Two slices were taken, wherever possible, from each tree: one slice about 3 or 4 cm thick for dendrochronological study and a reserve slice between 15 and 30 cm thick **as a source of both samples for radiocarbon calibration ...**"

In the Irish oak chronology, the young end of a 2990 year floating sequence, now a part of the so-called "long chronology," was **"based largely on radiocarbon measurements and on the assumption that the overall trend of the C-14 calibration shown by Seuss (1970) is correct"** (Pilcher et al., p. 716). Seuss had worked out a correlation between C-14 dates and bristlecone pine chronology.

"For the BC period [the calibration] has been limited to ... low-precision ¹⁴C measurement associated with an assumed absolute bristlecone pine calibration. ... [R]ecent developments in European dendrochronology and **the high-precision ¹⁴C measurement of a long Irish oak series now make the estimated error on the calendrical fixing of the dendrochronological axis small**, probably < 20 years" (G.W. Pearson, J.R. Pilcher, and M.G.L. Baillie, "High-Precision ¹⁴C Measurements of Irish Oaks to Show the Natural ¹⁴C Variations from 200 BC to 4000 BC," *Radiocarbon*, Vol. 25 no. 2, 1983, pp. 180-181).

German dendrochronologists also relied on Seuss's correlation of bristlecone dates with C-14 dates. **"The ¹⁴C measurements on these samples provided a substantial basis for a preliminary estimation of the absolute ages** of these then-floating Holocene oak tree-ring chronologies. This was accomplished by comparing their ¹⁴C variations with those obtained for absolutely dendro-dated bristlecone pine chronology ..." (T.W. Linick, H.E. Seuss, and B. Becker, "La Jolla Measurements of Radiocarbon in South German Oak Tree-Ring Chronologies," *Radiocarbon*, Vol. 27, 1985, p. 20).

The absolute ages of several other south-central European chronologies, besides the Donau 7/9/12, the Main 5, the Donau 3/10, and the Zug-Sumpf chronologies, were **"determined by calibration with C-14 measurements** of H E Seuss, University of California ... of known age bristlecone pine wood" (Bernd Becker, "Tree-Ring Dating and Radiocarbon Calibration in South-Central Europe," *Radiocarbon*, Vol. 22, 1980, p. 219).

67 Tree-ring dating is beset with difficulties and uncertainties. It is not a reliable basis for chronology for dates older than perhaps a millennium at most. See *Appendix B, Dendrochronological Difficulties*.

68 In the midst of research leading to the radiocarbon dating method, Libby found that history is only 5000 years old. Libby and his colleague J.R. Arnold sought to calibrate the C-14 scale with historical objects of known age. According to the belief that human civilization has been evolving over tens of thousands of years, one would think that there must be historical artifacts spanning this time. But not so, as Libby discovered: "Arnold and I had our first shock when our advisors informed us that history extended back only

for 5000 years. [The Flood destroyed all civilization existing before about 5000 years ago.] We had thought initially that we would be able to get samples all along the curve, back to 30,000 years before the present ... You read statements to the effect that such and such a society or archeological site is 20,000 years old. We learned rather abruptly that these numbers, these ancient ages, are not known accurately; in fact, the earliest historical date that has been established with any real certainty is about the time of the 1st Dynasty in Egypt" (Libby, 1961, p. 624). This startling revelation that civilization is "young," however, was ignored and C-14 "dates" were eventually established to "verify" the expected "old" ages of "prehistoric" objects.

69 Merrill, p. 97.

70 "[M]ost near eastern and Mediterranean early chronologies are based on cross-dating to Egypt and [are not independent]" (Lasken, 1991).

71 See *Appendix A, The Sothic Cycle and Egyptian Chronology*.

72 "The fascinating gold treasures of the Mycenaean tombs, together with Egyptian findings, that were excavated by Heinrich Schliemann stimulated the phantasy of the baffled public. From then on the history of early Greece became completely detached from its own chronology and depended exclusively on the most controversial Egyptian chronology. ..." (Benny Peiser, "Greek History Begins in the Sixth Century B.C.," *Aeon*, Vol. 2 no. 3, 1990; in Tresman).

73 "... Accordingly, the corresponding chronological framework of Greek history today generally accepted maintains at least three crucial breaks: a) the collapse of the Mycenaean age in the thirteenth/twelfth century B.C.; b) **the Dark age of Greece that lasted until the eighth century B.C.** [i.e., the Dark Age spanned c. 1500-750 BC]; c) the actual beginning of Greek 'history' ... detectable from the eighth century B.C. onwards" (Peiser).

The conventional view is that beginning about 1200 BC the "next four centuries, the Greek Dark Ages, were marked by the disappearance of the major characteristics of the relatively advanced Mycenaean civilization ..." (T. Walter Wallbank, Alastair M. Taylor, and Nels M. Bailkey, *Civilization Past and Present*, Scott, Foresman, 1967, p. 40). Decades later, this claim continued:

"The four centuries from around 1150 to 750 B.C.E., the Greek Dark Ages, were marked by drastic depopulation and the disappearance of the major characteristics of Mycenaean civilization ..." (Palmira Brummett, Robert B. Edgar, Neil J. Hackett, George F. Jewsbury, Alastair M. Taylor, Nels M. Bailkey, Clyde J. Lewis, and T. Walter Wallbank (Late), *Civilization Past and Present*, Longman, 2000, p. 57).

74 "The C-14 time scale has been **tied to the conventional Egyptian chronology as well as to tree-ring dates**" (Draganic et al., p. 60).

"Radiocarbon chronologists, testing the accuracy of carbon 14 as a scientific dating technique, have utilised what they consider to be the firmly grounded chronology of pharaonic Egypt as a check" (Ronald D. Long, "A Re-examination of the Sothic Chronology of Egypt," *Orientalia*, Vol. 43 (new

series), 1974, p. 262; see also *Kronos*, Vol. 2 no. 4, Summer 1977; in Tresman).

"... [We] had, in the initial stages, the opportunity to check against samples of known age, **principally Egyptian artifacts** ..." (Libby, 1961, p. 624).

The half-life of C-14 is taken to be 5730 years, **but this value was obtained by consulting the dates of Egyptian artifacts and also tree-ring chronologies**. When Libby first developed the C-14 dating technique, the "accepted value" for the half-life of C-14 was 5568 years (Libby, 1963, p. 278), or "about 5600 years" (Libby, 1961, p. 622). In 1961, however, Libby (p. 625) noted that "[t]he curve of knowns [i.e., ages of mostly ancient Egyptian artifacts, and tree-ring dates] seems to indicate that a slightly longer half-life might be permissible."

On the basis that "the deviation" between C-14 dates and those of the other chronologies was lessened "when the half-life is taken to be 5730 instead of 5568 years," a radiocarbon conference at Cambridge University recommended adopting the current half-life in 1962 (Libby, 1963, p. 278).

75 "Indeed it could be said that force-fitting of the pieces [of evidence] into preconceived pigeon-holed classifications is what is almost a way of life for the Quaternary worker....Tendencies to oversimplify in this way lead to new discoveries being forced into a pigeon-holed classification. Such arbitrary methods tend to perpetuate an illusion of security and precision in an apparently repeated confirmation of the original model. This tendency to confirm discoveries from limited amounts of data has been called *The Reinforcement Syndrome* ..." (D.Q. Bowen, *Quaternary Geology: A Stratigraphic Framework for Multidisciplinary Work*, Pergamon, 1978, pp. 7, 8).

But the dendrochronologists' reliance on C-14 dating is so strong that one wrote, "[R]ejection of radiocarbon dating also means rejection of dendrochronology (tree ring dating), one of the most accurate dating methods yet developed. A tree ring sequence 7,000 years long has been developed from the long-lived bristlecone pine tree of the southwestern United States....More recently, a 6,000-year tree ring sequence developed from Irish Oak trees has been radiocarbon tested and its calibration curve generally agrees with that established from the bristlecone sequence. Both sets of calibrated dates generally support the conventional chronology for ancient Egypt ..." (William H. Stiebing, "Heinsohn's Revised Chronology," *Aeon*, Vol. 2 no. 5, p. 49; in Tresman).

On the other hand, the reliance of Egyptologists on C-14 dates is so strong that it could be written: "The existing corpus of radiocarbon measurements for ancient Egypt is, with a few exceptions, not fully satisfactory. But rigorous application of objective criteria for selecting sets of measurements and a statistical clean-up of the data yield, in most cases, chronometric age estimates congruent with conventional historical estimates and with chronometric determinations for synchronous historical events in Nubia, Palestine and Mesopotamia" (Hassan and Robinson, p. 129).

76 J. Henry, "The Rise of the New Scientific Priesthood," <creationconcepts.org>, 2006.

UNDERSTANDING THE SOTHIC CYCLE

The Sothic cycle was a cycle of time used for time-keeping in ancient Egypt. It is based on observing the heliacal rising of Sirius, the brightest star. A.E. Roy ("The Astronomical Basis of Egyptian Chronology," *SIS Review*, Vol. 6 no. 1-3, 1982; in Tresman) explains further:

"... [The] *heliacal rising* of a star [happens when it] is seen in the early morning light just above the horizon in the eastern hemisphere just before it gets light enough, with the Sun rising, to blot it out.

"This will occur once a year, because it takes the Sun one year to move once around the ecliptic, and so the heliacal rising of a star will take place once a year -- but it will not be the calendar year; it will be the *seasonal year* ... and this is 365.2422 days in length, whereas the calendar year consists of 360 plus the 5 additional days, which is 365 days. ..."

The difference of about a quarter of a day between the calendar year and the seasonal year means that **each year the heliacal rising of a star will be about a quarter of a day later on the calendar than the year before.** After four years, the heliacal rising has moved about one day backward on the calendar. **The movement of the heliacal rising through the entire calendar requires four years times 365, or about 1460 years.** This period is actually 1456 years, since the seasonal year is not quite one-quarter of a day longer than the calendar year, and is called a Great Year.

The brightest star in the sky is Sirius, Sothis to the Egyptians, also called the Dog Star because it is in the constellation Canis Major. **For Sothis, the Great Year of 1456 years is called the *Sothic cycle*.** Sothis was Isis, the Egyptian goddess of agriculture and fertility, "because the heliacal rising of Sirius foretold the inundation of the Nile Valley ... when the equatorial rains began to pour into the White Nile and the snows in Abyssinia began to melt and pour into the Blue Nile" (Roy).

The association of Sirius/Sothis with agricultural fertility implies that the first Sothic cycle began in the spring, known to the Egyptians as the first day of their month Thoth. The inauguration of the first Sothic cycle on the first day of Thoth presumably occurred soon after Egypt was established as a recognizable entity. Therefore, the date of the beginning of the first Sothic cycle would tell when Egyptian civilization began.

The Roman writer Censorius in 239 AD wrote the book *Liber de dei natali*, in which he mentioned that a new Sothic cycle -- taken to be 1460 years -- had begun 100 years earlier, in 139 AD. This meant that the cycle before had begun in 1322 BC. In the fourteenth century, Theon of Alexandria wrote that the interval from the Egyptian ruler Menophres to the end of the Augustan age spanned 1605 years. The Augustan era ended with the beginning of Diocletian's reign in 283/4, and taking away 1605 years from this date yields that date 1322 BC for Menophres reign, the year when a Sothic cycle began according to Censorius.

"Egyptologists identified Menophres as Ramesses III, thus fixing Ramesses' date as 1322 BC. ... The next step was to slot in all the pharaohs from Manetho's king list, which came down to us in two

versions, those of Eusebius and Julius Africanus" (Roy). This procedure placed the earliest pharaohs at very ancient dates, **yielding a long Egyptian chronology spanning several millennia BC.**

FALSE ASSUMPTIONS OF SOTHIC DATING

This long chronology became the basis for C-14 calibration. But there were two assumptions built into this conclusion: (1) that the length of the Sothic cycle as employed by the Egyptians was constant over the millennia of Egyptian history; and (2) that the names in Manetho's king list were of pharaohs ruling sequentially and never as co-regents or as heads of contemporaneous ruling families. **Neither of these assumptions has been proved.** If they are false, the possibility exists that conventional Egyptian chronology is too long.

Without a steady timing by the Sothic cycle over the millennia of ancient Egypt, Sothic cycle dating fails. Thus, "[T]he belief that this cyclical progress of the civil year did obtain and was not interfered with has been a **cornerstone of Egyptian chronology** since it was formulated by Eduard Meyer in 1904" (Richard A. Parker, "Sothic Dates and Calendar 'Adjustment,'" *RdE*, Vol. 9, 1952, p. 102; in Long). In other words, "The defenders of Sothic dating [make] the proposition that the same Egyptian 365 day calendar was used without reform for approximately 3000 years" (Jesse E. Lasken, "Sothic Dating: The Shameless Enterprise," *Chronology and Catastrophism Review*, Vol. 1999 no. 2, February 2000; in Tresman), a "claim central to the Sothic hypothesis" (Leo Depuydt, "On the Consistency of the Wandering Year as Backbone of Egyptian Chronology," *Journal of the American Research Center in Egypt*, Vol. 32, 1995, p. 43).

The Sothic cycle chronology also assumes that the king list of Manetho was a record of sequential rulers. However, "[Manetho's kinglist] was not designed as a sequential review of Egypt's ruling families ... One thing is certain: **there is absolutely no way that Egypt sported the 561 kings at an average of just under 10 years per reign listed by the Julius Africanus version**" (Dale F. Murphie, "It's Time to Get Serious About Manetho," *Chronology and Catastrophism Review*, Vol. 1998 no. 1, September 1998; in Tresman).

With the Manetho king list to being sequential, the date for Ramesses III was similar to earlier dates for his reign. But "how J.C. Pritchard, a Scottish scholar, arrived at the date of -1147 for the commencement of the reign of Ramesses III is unknown. Since his book was published in 1819, nearly three years before Champollion's sensational September 22nd 1822 announcement that he had decoded the Rosetta Stone, it follows that he could not have based the deduction on hieroglyphic texts, none of which could provide a date in that format anyway. ... There was no appeal possible to earlier historical writings, as none of the classical authors mentions Ramesses III, whose name was actually fixed by modern historians ..." (Murphie).

Thus the original rationale for placing Ramesses III at many centuries BC may have been no more than a guess, but the supposed date became the framework on which the Manetho king list was interpreted and the Sothic cycle chronology was built.

No wonder it has been said that, "What is proudly advertised as Egyptian history is merely a

collection of rags and tatters" (Alan Gardiner, *Egypt of the Pharaohs*, Oxford, 1961, p. 53). More than a few historians have abandoned the Manetho king list and the Sothic cycle as guides to chronology. Now Egyptian chronology is taken to be long because C-14 dating supposedly shows it to be so. The irony is that the C-14 chronology was based on an Egyptian chronology ultimately derived from the Sothic cycle and the Manetho king list interpreted according to assumptions now rejected by these historians.

EGYPTIAN DATES: 1000 YEARS TOO OLD

The conventional 4000-year-old starting date for Egyptian civilization is also the starting point of two Sothic cycles of about 1460 years each prior to 1322 BC, i.e., about 4242 BC, assuming the Sothic cycle was truly fixed throughout Egyptian history. "But the claim that this is the 'earliest fixed date' has been discredited. Most scholars [now] either move [the start date for Egypt] forward by one cycle of Sothis to 2781 [sic], or reject the assumption that the [Sothic cycle dates Egyptian civilization]" ("Sothic Cycle," Wikipedia, <en.wikipedia.org/wiki/Sothic_cycle>, December 10, 2006).

Even Libby (1963, p. 278) noted, "... [T]he Egyptian historical dates beyond 4000 years ago may be somewhat too old, perhaps 5 centuries too old at 5000 years ago, with decrease in the error to 0 at 4000 years ago. In this connection it is noteworthy that the earliest astronomical fix is at 4000 years ago ..." (Libby, 1963, p. 278).

Interestingly, "... [O]ne of [Ramesses III's] names was *Nekht-A-Neb*, the name of a prominent personality whom Diodorus fixed plainly in the 4th century BC" (Murphie). The fourth century BC centers on c. 350 BC, **about 1000 years more recent than the conventional date for Ramesses III.** An Egyptian chronology so revised lines up nicely with biblical chronology. Without considering biblical chronology, Cook (p. 3) likewise concluded that, "... [A]ll assigned or 'historical' ages [in Egyptian chronology] may be too great by upwards of 1000 years ..."

APPENDIX B: DENDROCHRONOLOGICAL DIFFICULTIES

MULTIPLE AND MISSING TREE-RINGS

Tree-ring dating is rendered uncertain because trees may not add only one growth ring annually:

"[T]he production of one growth ring per year is not a certain process. **It is possible, under certain conditions, for a tree to miss out a growth-ring or to produce two growth-rings in one season.** The first of these phenomena occurs where there is insufficient xylem growth to form a noticeable ring, normally due to extreme drought. The second is the result of a defoliating agent which arrests the tree's growth early in the year after which there is a secondary out-growth of new foliage. The cause of the defoliation could be drought, late frost or insect attack" (Baillie, 1982, p. 52).

Trees growing in adverse environments may fail to form an observable annual growth ring: "... [T]he bristlecone pine ... seems to survive because of adversity. ... Denied spurts of youthful growth, such trees cautiously add no more than an inch to their

girth in a century. With so little tissue to nourish, they can afford to shut up shop almost entirely during lean years. **In such times they may produce no cones and lay down no rings** except on narrow strips of the stem" (Edmund Schulman, "Bristlecone Pine, Oldest Living Thing," *National Geographic*, Vol. 113 no. 3, March 1958, pp. 356-357).

Baillie (1982, p. 29) concurred: "... [T]rees ... could miss rings in years of extreme hardship."

Missing rings make dating difficult: "[The heart of the oldest known living tree] ... has survived more than 4,600 years; **missing rings makes precise dating difficult**" (Schulman, p. 362). Schulman "first [drew] attention to [bristlecone pines] in 1953" for tree-ring dating (Baillie, 1982, p. 38).

Ferguson (p. 840) likewise wrote: "**In bristlecone pine, problems of cross-dating are caused by so-called 'missing' rings** associated with the extremely slow growth rate of this species on arid sites."

On the other hand, trees may form multiple rings in a year: "It has long been supposed that tree rings are formed annually and so can be used to date trees. ... [T]his is not always so, as **more than one ring may be formed in a year**" (Waldo S. Glock and Sharlene Agerter, "Anomalous Patterns In Tree Rings," *Endeavour*, Vol. 22 no. 1, January 1963, p. 9). Libby (1963, p. 280) endorsed this conclusion by saying, "These authors show that more than one growth ring can form in 1 year ..."

Misinterpreting multiple rings from one year as separate annual rings make tree-ring dates too old: "[S]ome trees add more than one ring per year, and thus a question has been raised about the accuracy of tree-ring dates. This finding indicates that **rings sometimes have been incorrectly correlated with years, too great an age having been assigned from tree rings**" (Libby, 1963, p. 279).

Multiple rings result from extremes in water availability in a season. **Several rings may form annually**, especially when trees are growing on a slope that experiences alternating wet and dry conditions because of rapid drainage of rain water (Waldo S. Glock, "Growth Rings and Climate," *Botanical Review*, Vol. 7, December 1941, pp. 680-684, 690-691).

Likewise, Ferguson (p. 840) wrote: "In certain species of conifers ... **one season's growth may be composed of two or more flushes of growth**, each of which may strongly resemble an annual ring."

Growth ring irregularities mean that dating by tree rings is not an exact science: "The plain fact ... is that dendrochronology is only ever difficult to the dendrochronologist" (Baillie, 1982, p. 261).

RING GROWTH AND THE ENVIRONMENT

Growth ring formation is a function not only of time but of environmental factors unique to each tree:

"Growth is the cumulative result of all factors acting on the tree over time. Some factors, such as tree species, tree genetics and site quality, are fixed and therefore exert a relatively constant influence on the resultant tree growth. **Stress factors, such as climate, insects and disease, [and] tree competition ... can change dramatically with time and contribute to ... radical growth fluctuations.** ... Therefore, even though the tree rings can be measured with considerable accuracy and the data [can be] de-trended [statistically smoothed] to minimize the geometry associated with tree age and stand competition, the effect of climate may be

significant and remains largely unquantifiable" (D.L. McLaughlin, D.E. Corrigan, and W.D. McIlveen, *Etymology of Sugar Maple Decline at Selected Sites in Ontario (1984-1990)*, Phytotoxicology Section, Air Resources Branch, Ontario Ministry of the Environment, 1992, pp. 94, 96).

This is why, "In the 1960s botanists and palaeobotanists in England and Ireland were firmly of the belief that climate and the multiplicity of site factors affecting tree ring growth would make dendrochronology unworkable [in those places]" (Baillie, 1982, p. 22). Baillie himself (1982, p. 17) acknowledged: "... **[T]here could be no guarantee of the response of an oak to any particular aspect of climate.**" Baillie's Irish oak chronology is now taken to be the virtual standard in tree-ring dating.

Yet "... from the very beginning the Irish dendrochronological work was built on the assumption that the bristlecone pine calibrations applied world-wide" (Lasken, 1991), when in fact **the unique environmental factors acting on each tree ensure that no chronological conclusions can be drawn from trees growing in different places.** Attempting to establish tree-ring dates anyway has resulted in chronologies that are too long:

"The method [in establishing the Irish oak sequence] was to choose a site and measure two trees. Their ring patterns were compared visually and by computer correlation. On average each would be about 200 years in length. If these two did not cross-date, they were accepted as two units and a third pattern from the same site could be compared with both. If neither matched, there were three units with which to compare the fourth pattern, and so on. Eventually two ring patterns would be found to cross-match acceptably (sometimes as many as 20 trees were compared before two would match)" (Baillie, 1982, pp. 203-204). But if climate variabilities and local conditions stressed each tree uniquely, **contemporaneous sequences would appear different, the match would be undetected, and the resulting chronology would be too long.**

The attempt to cross-date trees from different places, and even different continents has led to the widely acknowledged problem of -

FALSE-MATCHING RING SEQUENCES

"Several studies, including one on the English oaks from Swan-Carr that were used to bridge the Irish chronology at c. 940 BC, have suggested that **English and Irish oaks exhibit multiple (false) matches on a relatively frequent basis**" (Lasken, 1991). Also see M.A. Munro, "An Improved Algorithm for Crossdating Tree-Ring Series," *Tree-Ring Bulletin*, Vol. 44, 1984, pp. 17-18; T.M.L. Wigley, P.D. Jones, and K.R. Briffa, "Cross-Dating Methods in Dendrochronology," *Journal of Archaeological Science*, Vol. 14, 1987, p. 51.

Amazingly, "... **[V]isual matching is subjective** and the ability of a trained observer to find sufficient similarities, in two long ring patterns, to establish a cross-correlation, is not a measurable quantity" (Michael G.L. Baillie, "A Recently Developed Irish Tree-Ring Chronology," *Tree-Ring Bulletin*, Vol. 33, 1973, p. 20). The reality is that, "[In] constructing the chronology [of cross-matched ring samples] ... the 'art' of dendrochronology becomes apparent. ... [S]ome people are better at pattern recognition than others. ... Simply because two pieces look alike does not mean they fit together"

(Baillie, 1982, p. 23). When an activity becomes this subjective, is it still "science"?

CO-DEPENDENT DENDROCHRONOLOGIES

The Irish oak and other European oak chronologies were calibrated by the bristlecone pine chronology: "During the 1970s [when the Irish and British oak chronologies were established] the only available calibration for the first millennium was **based on American analysis of known age wood samples [i.e., bristlecone pine]**" (Baillie, 1982, p. 195).

Researchers building up the Irish master tree-ring sequence "**also used other tree-ring chronologies (English, German and Californian [i.e., bristlecone pine]) to help as the work proceeded**" (Beal). Also see J.R. Pilcher, M.G.L. Baillie, B. Schmidt, and B. Becker, "A 7,272-Year Tree-Ring Chronology for Western Europe," *Nature*, Vol. 312, 1984, pp. 150, 151; and M.G.L. Baillie, J.R. Pilcher, and G.W. Pearson, "Dendrology at Belfast as a Background to High-Precision Calibration," *Radiocarbon*, Vol. 25, 1983, p. 173.

But the European oak chronologies were also calibrated with bristlecone pine dates. The absolute ages of other south-central European chronologies besides the Donau 7/9/12, the Main 5, the Donau 3/10, and the Zug-Sumpf chronologies were "**determined by calibration with C-14 measurements of ... of known age bristlecone pine wood**" (B. Becker, "Tree-Ring Dating and Radiocarbon Calibration in South-Central Europe," *Radiocarbon*, Vol. 22 no. 2, 1980, pp. 219-226).

In other words, "The C-14 measurements ... provided ... a preliminary estimation of the absolute ages of these then-floating Holocene oak tree-ring chronologies. This was accomplished by **comparing their C-14 variations with those obtained for absolutely dendro-dated bristlecone pine chronology ...**" (T.W. Linick, H.E. Seuss, and B. Becker, "La Jolla Measurements of Radiocarbon in South German Oak Tree-Ring Chronologies," *Radiocarbon*, Vol. 27 no. 1, 1985, pp. 20-32).

But of course the bristlecone pine dates had been C-14 calibrated: "Like their Irish counterparts, **the German dendrochronologists ... relied on Seuss's curves**" of calibration of bristlecone dates with **C-14 dates** (Lasken, 1991).

SUBJECTIVITY OF TREE-RING DATING

Michael Baillie, the person most responsible for establishing the Irish oak chronology, asserted that, "In common with all trees growing in a temperate climate oak develops one growth increment or ring per year. Thus under normal circumstances it leaves, over its lifetime, a record of the number of years it has been growing." But he also acknowledged that it is precisely in "normal circumstances" that rings are "complacent" and do not form distinctive sequences ("signatures") that can be compared with other trees to yield long chronologies (Baillie, 1982, p. 46).

In the end, acceptance of tree-ring dates is based on faith: "... [I]t is hoped that sufficient evidence is provided to allow complete faith in the chronologies described. ... **Faith in the integrity of the reference chronologies is fundamental to the nature of the results produced**" (Baillie, 1982, pp. 24-25).