The Pitfalls of Radiocarbon Dating

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How Libby's warnings were ignored

Offering in 1952 his new radiocarbon method for calculating the age of organic material (the time interval since the plant or the animal died), W. F. Libby clearly saw the limitations of the method and the conditions under which his theoretical figures would be valid:

A. Of the three reservoirs of radiocarbon on earth--the atmosphere, the biosphere, and the hydrosphere, the richest is the last--the oceans with the seas. The correctness of the method depends greatly on the condition that in the last 40 or 50 thousand years the quantity of water in the hydrosphere (and carbon diluted in it) has not substantially changed.

B. The method depends also on the condition that during the same period of time the influx of cosmic rays or energy particles coming from the stars and the sun has not suffered substantial variations.

To check on the method before applying it on various historical and paleontological material, Libby chose material of Egyptian archaeology, under the assumption that no other historical material from over 2,000 years ago is so secure as to its absolute dating. When objects of the Old Kingdom and Middle Kingdom of Egypt yielded carbon dates that appeared roughly comparable with the historical dates, Libby made his method known.

With initial large margin of error and anything that did not square with expectation, judged as "contaminated," the method appeared to work and was hailed as completely reliable--just as the atomic clock is reliable--and this nobody doubted.

But as the method was refined, it started to show rather regular anomalies. First, it was noticed that, when radiocarbon dated, wood grown in the 20th century appears more ancient than wood grown in the 19th century. Suess explained the phenomenon by the fact that the increased industrial use of fossil carbon in coal and in oil changed the ratio between the dead carbon C12 and the C14 (radiocarbon) in the atmosphere and therefore also in the biosphere. In centuries to come a body of a man or animal who lived and died in the 20th century would appear paradoxically of greater age since death than the body of a man or animal of the 19th century, and if the process of industrial use of fossil, therefore dead, carbon continues to increase, as it is expected will be the case, the paradox will continue into the forthcoming centuries.

As years passed and more tests were made (soon by laboratories counted in scores), a rather consistent deviation between radiocarbon age and historical age started to receive the attention of researchers. The radiocarbon dates diverge from the historical dates by several hundred years (often 500 to 700); and,

interestingly, in the Egyptian samples more so than in samples from most other ancient civilizations. This led Libby to write in 1963: "The data [in the Table] are separated into two groups-Egyptian and non-Egyptian. This separation was made because the whole Egyptian chronology is interlocking and subject to possible systematic errors . . ." Also, "Egyptian historical dates beyond 4000 years ago may be somewhat too old, perhaps centuries too old at 5000 years ago. . ." *(Science, 140,* 278).

The combined efforts of several researchers led them to believe that one of the conditions stipulated by Libby for a flawless functioning of his method was not historically sustained; it is claimed that the influx of cosmic rays varied with time. Yet, since this influx comes from many sources, the sun being only one of them, sunspot activity could be related to the variation only in a very limited degree. Therefore the claim was made that the magnetosphere around the earth, discovered in 1958, suffered occasional weakening, thus allowing more cosmic rays to pass it and to hit the nitrogen atoms in the upper atmosphere, changing them to radiocarbon. It was further claimed that the magnetic field of the earth might have reversed its polarity in the last 40 thousand years, a phenomenon known to have happened in geological epochs. If such reversals were not instantaneous but required thousands of years, the atmosphere during that time would not be shielded from cosmic rays and substantially more of them would reach it. However, the scientific literature of the last few decades did not contain any reference to a reversal observed on human artifacts like pottery though a paper by Manley in 1949 *(Science News,* Penguin Publication) told of the work of G. Folghereiter done at the turn of the century on Attic and Etruscan pottery: he found that the polarity was reversed in the eighth century before the present era.

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. However, three or four rings formed in one year is not uncommon, especially if the tree grows on a slope with the ground several times in a year turning wet and dry because of rapid outflow of water (Glueck *et al., Botanical Review, 7,* 649-713; and 21, 245-365). And certainly the building of tree "ladders," or carrying on the count from one tree to another may cause erroneous conclusions. One and the same year may be dry in South California and wet in the northern part of the state.

Now let us review in the light of research in cosmic catastrophism the correctives that, in our view, need to be introduced into the method. We must also evaluate the basic reliance on Egyptian chronology that, as we shall see, needs to be discontinued.

Speaking of my research as far as it affects the radiocarbon dating method, I would like to separate the finds concerning natural events *(Worlds in Collision, Earth in Upheaval)* from finds concerning the true chronology of Egypt and of the ancient world in general *(Ages in Chaos).*

Libby's discoveries, published in 1952, gave immediate support and even vindication to three independent conclusions of my research into natural events of the past. In *Worlds in Collision* I claimed that the time since the last glaciation needs to be drastically shortened: the figure considered valid in 1950, the year *Worlds in Collision* was published, was still Lyell's of 100 years earlier, namely 35 thousand years. Libby found (and I quote Frederick Johnson, who participated in his volume, *Radiocarbon Dating)* that "the advance of the ice occurred about 11,000 years ago . . . previously this maximum advance had been assumed to date from about 25,000 years ago," actually 35,000 if one looks up the literature of the time. A few years later Rubin and Suess of the Geological Survey of the U. S. A. found that, as I also claimed,

another advance of ice took place only 3,500 years ago.

The second confirmation came concerning the age of the petroleum. In 1950 in the *American Journal of Science (the* present publisher of *Radiocarbon)* a review was published by its editor, Yale geologist Longwell, with a rejection of my entire theory on the basis that oil is never found in Recent formations, being itself many millions of years old. A similar criticism appeared in the article by astronomer Edmondson, who cited the Indiana University geologist, J. B. Patton. One of the early radiocarbon datings of petroleum and petroleum-bearing formation on and off-shore in the Gulf area was by P. V. Smith of Esso Research Laboratory. The "surprising" fact was that oil was found there in Recent sediment and must have been deposited *during* the last 9,200 years." (Emphasis added.)

Actually I asked Libby whether he would see to it that petroleum should be subjected to tests and it was he who drew my attention to the work done by Smith.

A third confirmation also concerned one of the important conclusions of *Worlds in Collision.* To the above-mentioned article by Longwell a Mexicologist also contributed. The Mexicologist, Professor George Kubler of Yale, stressed that certain traditions contained in Mesoamerican heritage were referred by me to events of the pre-Christian era. Kubler insisted that this heritage could not date from the 8th to 4th pre-Christian centuries, but rather was generated in the 4th to 8th century of the Christian era. But in December, 1956, the National Geographical Society in conjunction with the Smithsonian Institution made it known that excavations at LaVenta proved by radiocarbon that the classical period of the Meso-American civilizations (Olmec, Toltec, Maya, etc.) needs to be pushed back by a full thousand years and ascribed not to the 4th to 8th centuries of the Christian era but to the 8th to 4th centuries before that era.

With these three confirmations (time the Ice Age ended, time petroleum was deposited, time of the classical period of the Meso-American civilizations), my *Worlds in Collision* received very substantial confirmations.

But I could not and should not satisfy myself with this support without repaying by demonstrating where the difficulties and pitfalls of the method are hidden.

In the cataclysmic events reconstructed in *Worlds in Collision* and also those that preceded the fall of the Middle Kingdom in Egypt, various effects could not but vitiate the radiocarbon performance, some of these effects tending to make organic life appear older than its actual age, and others making it appear more recent.

Bursts of cosmic rays and of electrical discharges on an interplanetary scale would make organic life surviving the catastrophes much richer in radiocarbon and therefore, when carbon dated, that organic matter would appear much closer to our time than actually true. But if the invasion of the terrestrial atmosphere by "dead" (non-radioactive) carbon from volcanic eruptions, from meteoric dust, from burning oil and coal and centuries-old forests, predominated the picture, then the changed balance of radioactive and of radio-inert carbon would make everything in the decades following the event appear much older. Thus, it is the competition of these factors that would decide the issue in each separate case. My own impression is that in the catastrophes of the eighth century and beginning of the seventh, the second phenomenon was by far more dominant. For the events of the middle of the fifteenth century before the

present era, both phenomena were very expressed, but the burning petroleum added to the exhaust of all volcanoes burning simultaneously, added also to the ash of the proto-planet in near-collision must have outweighed the greatly increased advent of cosmic rays (which resulted also from interplanetary discharges). But in the catastrophe of the Deluge, which I ascribe to Saturn exploding as a nova, the cosmic rays must have been very abundant to cause massive mutations among all species of life, and correspondingly, these cosmic rays must have also changed the radiocarbon clock and certainly made ensuing life, subjected today to radiocarbon tests, appear much more recent than historically true. I am not in a position to point to the century or even millennium when the Universal Deluge took place, but it must have happened between five and ten thousand years ago, probably closer to the second figure.

The Deluge also increased the water basin or hydrosphere on earth, and if we can believe some indications, the Atlantic Ocean (called the Sea of Cronus by the ancients) originated in part during the Deluge. It is quite possible that the volume of water was more than doubled on earth in this one cataclysm.

Thus both conditions stipulated by Libby (that is, constant rate of influx of cosmic rays, and constant quantity of water in the hydrosphere) have been violated, but following the uniformitarian doctrine these violations have been discarded from consideration. We are left with a method in which the researchers have failed to take heed of the warnings expressed by its inventor.

The sustained effort of radiocarbon researchers to find support in Egyptian chronology, and their reliance on that chronology, is fundamentally a mistake. As I tried to show in *Ages in Chaos,* the Egyptian chronology is basically wrong. I drew the attention of Libby to this fact in my letter of October 7, 1953, and I sent him a copy of *Ages in Chaos*; his answer was that he is not at all learned in ancient history; thus he continued to rely on what is unreliable. He cannot be blamed for it because in historical circles the conventional chronology is still the accepted dating in absolute and in comparative sense--the latter meaning that Mycenaean or Minoan civilizations that have no absolute chronology of their own, by relations with the Egyptian past can be dated accordingly; but this means that if the Egyptian datings are wrong, the Minoan and Mycenaean are wrong, too.

Here I shall give a few figures to visualize the extent of the errors in the Egyptian chronology: The end of the Middle Kingdom of Egypt, -1780 in accepted chronology, actually took place ca. -1450--a difference of over 200 years. The following Hyksos period endured, not 100 years, but over 400 years in close agreement with the old Egyptian (Manetho) and Hebrew *(Ages in Chaos*,, I Ch. 2) sources. The beginning of the 18th Dynasty (New Kingdom) falls not in -1580 but in ca. -1050--over 500 years difference. Thutmose III belongs to the second part of the tenth century, not to the first part of the fifteenth. Akhnaton belongs not in the first half of the fourteenth but in the middle of the ninth century. Thus, as I showed in detail in Vol. I of *Ages in Chaos,* there exists an error of ca. 540 years through the entire period covered by the 18th Dynasty.

Even more important is that the dynasty of Seti the Great and Ramses II, termed the Nineteenth Dynasty, did not follow the Eighteenth; the Libyan (Dynasties 22nd to 23rd) and the Ethiopian (Dynasties 24th to 25th) periods intervened. The Libyan Dynasty of Sosenks and Osorkons reigned for 100 years only, instead of over 200; the Ethiopian Dynasty, however, is the only one that in the conventionally written history of Egypt, maintains its proper place. During the Nineteenth Dynasty the error of the accepted Egyptian chronology reached the high figure of over 700 years; and together with it the time of the contemporaneous rulers of the so-called Hittite Empire is equally misplaced by over 700 years.(*) Finally

the Twentieth Dynasty--that of Ramses III and his adversaries--*Peoples of the Sea*--needs to be brought closer to our time by a full 800 years and placed just a few decades before Alexander of Macedon. The Twenty-first Dynasty began under the Persian kings, continued contemporaneous with the Twentieth--its rulers reigned in the Libyan Desert oases--and lasted until the second Ptolemy. (I take this opportunity to give these figures because, instead of a second volume of *Ages in Chaos* that should have followed closely the first that appeared in 1952, the entire work will consist of five presently planned volumes.)

*In this connection, the figure for the "Hittite" fortress, Alishar III, 800 years later than the conventional chronology has it *(Radiocarbon Dating,* 1952), is very nearly true.

Now if the historical basis of radiocarbon studies fails so completely, many conclusions drawn and much data left unpublished require reconsideration. From some correspondence that originated at the Metropolitan Museum of Art, I have concluded that when Libby first asked for specimens, he received not only those dating from the Old and Middle Kingdoms, but also from the New Kingdom--but nothing ever was published of those early tries on New Kingdom specimens. A similar situation concerns more recently tested short-living organic material from the tomb of Tutankhamen.

After many efforts (from 1952 to 1963) to have the New Kingdom of Egypt tested in a systematic way I succeeded in having three little pieces of wood from the tomb of Tutankhamen handed over by the Laboratory Director of the Cairo Museum to Mrs. Ilse Fuhr of Munich, who was directed by me to send them to Dr. Elizabeth Ralph of the University of Pennsylvania Laboratory. Two of the pieces were from the comparatively short-lived thorn plant, *Spina Christi*, and one from the long-living Cedar of Lebanon. The three small pieces were processed together, since a test requires ca. 30 grams (1 ounce) of material. The result was -1120 ± 52 (or following Libby's half life of C14, -1030 ± 50). Now the accepted chronology has Tutankhamen dying in -1350; my reconstruction has him entombed in ca. -830. According to Dr. Iskander Hanna of the Cairo Museum, the wood was from 30 to 50 years dried before being used for funerary equipment. The Lebanon Cedar would not have been cut as sapling-the tree reaches thousands of years of age. The sample could have been from inner rings of a trunk. Dr. E. Ralph confirmed to me on March 5, 1964, that tree rings, when carbon dated, show the date of their formation, not of the year the tree was felled. I wrote to her on March 2, 1964, suggesting that if short-living material (like seeds, papyrus, linen or cotton) should be subjected to tests from the tomb of Tutankhamen, most probably the result will show "ca. -840."

In spring, 1971, or seven years later, the British Museum processed palm kernels and mat reed from the tomb of Tutankhamen. The result, according to Dr. Edwards, Curator of the Egyptian Department of the British Museum, was -899 and -846 respectively. These results *were never* published.

These cases make me appeal that all tests, irrespective of how much the results disagree with the accepted chronological data, should be made public. I believe also that the curiosity of the British Museum Laboratory officials should have induced them to ask for additional material from the Tutankhamen tomb instead of discontinuing the quest on the assumption that tested material was contaminated. The tomb of Tutankhamen had not been opened since soon after the entombment. It is dry--water did not percolate through its roof or walls.

Another way of dulling the sharp disagreements between the accepted chronology and the results of the

tests is described by my librarian assistant, Israel Isaacson *(see elsewhere in this issue. Ed.).* In the case described nothing was purposely hidden but two different approaches were applied.

In one and the same year the University of Pennsylvania Laboratory tested wood from a royal tomb in Gordion, capital of the short-lived Phrygian Kingdom in Asia Minor, and from the palace of Nestor in Pylos, in S.W. Greece. In Gordion the result was -1100; in Pylos -1200. However, according to the accepted chronology, the difference should have been nearly 500 years--1200 for Pylos of the end of Mycenaean age was well acceptable, but -1100 for Gordion was not--the date should have been closer to -700. Dr. Ralph came up with the solution for Gordion. The beams from the tomb were squared and the inner rings could easily be four to five hundred years old when the tree was felled. But in Pylos, the description of the tested wood indicates that these were also squared beams--yet the corrective was not applied--this because -1200 was the anticipated figure. However, as I try to show in detail in the planned *The Dark Age of Greece*, a separate volume of *Ages in Chaos* series, there were never five centuries of Dark Age between the Mycenaean Age and the historical (Ionic) Age of Greece. The Pylos beams are -800, the Gordion beams date from -700.

Now the question arises, how can the radiocarbon method be used for deciding between the conventional and the revised chronologies. Many a reader of Volume I of *Ages in Chaos*, and a few readers to whom I made available the sequel volumes in typescript would agree that the reconstruction is built with such profusion of contemporaneities and linked episodes that the credence given to the conventional history to serve as a control over carbon datings should be now transferred to the reconstruction and let it control, not be controlled by, carbon tests. Yet, for less convinced audiences, the method can serve in two manners. For the period before -500, only comparative tests can serve profitably for the solution of the chronological problems: King Saul was a contemporary of kings Kamose and Amose--and lived not 540 years after them; similarly, King Solomon was a contemporary of Queen Hatshepsut, and Thutmose III of Rehoboam of Judea and Jeroboam of the Ten Tribes; and Amenhotep II of King Asa; Amenhotep III of Omri and Ahab; Akhnaton also of Ahab of Samaria and Jehoshaphat of Jerusalem, and of Shalmaneser III of Assyria. Therefore if we can compare material from two areas contemporaneous in my reconstruction but separated by 540 years in the conventionally written history, we may receive the carbon answer as to which of the two time tables is correct and which is wrong. The ivory of the Shalmaneser III fort near Nimrud and the ivory of Tutankhamen's tomb must yield very close dates.

For the period separated by 200 years from the last cosmic upheaval involving our planet (-687), say for after -500, we may apply the tests without any need to compare contemporaneous samples. Thus the 20th and 21st Dynasties, which in conventional histories occupy the 12th to the middle of the 10th century but in my reconstruction from -400 to -340 (20th) and ca. 450 to -280 (21st), are perfect choices for carbon tests.

Now we see that not only were the warning signals that Libby offered with his method disregarded, but also an unearned reliance on the accepted version of ancient history has caused much stumbling in the dark, more and more tests of diminished value, and a maze of findings, with many undisclosed results of tests, wrong deductions and much exasperation that mark the first 20 years of application of Libby's most imaginative method.