THE BIBLE, RADIOCARBON DATING AND ANCIENT EGYPT

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In the mid-1960's Egyptologists and radiocarbon chronologists were in an awkward predicament while attempting to reconcile differences between historical and astronomical data by means of C14 determinations. Evidence derived from radiocarbon dating did not match with what experts in the history of the ancient Near East had reasoned was the astronomical basis for Egyptian dynastic history. Specimens sealed to certain years B.C.E. by means of the chronology based on astronomical anchor points, related dates through the radiocarbon method which did not match the accepted dating system. Differences were often in the magnitude of centuries. Archaeological, methodological, and geophysical explanations for the discrepancies were sought. No answers were forthcoming. What was overlooked and should still be employed is an historical and Biblical explanation.

Nevertheless, dendrochronologists and geophysicists did arrive at, what was believed to be, some physical reasons for the discrepancies. Beginning with de Vries, and continuing under Suess, Ferguson, et. al., the claim was made that a recalibration of C14 dates is possible which verifies accepted and "astronomically" founded Pharaonic chronology. On the other hand, it was also asserted that this supported the accuracy of the dating technique. Radiocarbon dates without calibration do not verify and support the ancient history of Egypt as it is taught today.

In Egypt a general calendrical date could be assigned to an object assuming the historians were correct in their reconstruction of history. With the tree-rings of the bristlecone pine (Pinus aristata), however, near absolute calendrical dates corresponding to ancient Egyptian times could be checked by radiocarbon dating. That is, near absolute calendrical dates were utilized with the assumption that the dendrochronologists counted the "annual" rings precisely. Calendrical or true age of the tree rings did not result in the same age as that gained from C14 analysis. Dendrochronologically dated tree rings revealed problems, therefore, which when combined with other investigations demonstrated the fact that some of the foundational assumptions of C14 dating were invalid and needed restating.

From recent research, the following facts have become known: production of C14 by cosmic rays has varied due to a) modulation of the galactic cosmic ray flux, b) changes in exchange rate between the atmosphere and the oceans, c) changes in the earth's magnetic dipole moment, and d) worldwide fluctuations in atmospheric concentration of radiocarbon. In addition, dendrochronologically dated tree-rings from trees of the southern hemisphere do not generate the same true or calendrical age and radiocarbon age relationships as that related by radiocarbon dated tree-rings of bristlecone pine. It is now an admitted possibility that the amount of radioactive C14 available to living organisms may vary with altitude, and that "dead" tree-rings may absorb C14. We are left with precalibration C14 dates for Egypt which, in fact, closely match the correctly correlated Egyptian-Biblical chronology.

Introduction

Egypt is the one location in the ancient western world where the following exist: specimens of sufficient antiquity, free from contamination (in part due to the dry climate), sealed to a particular pharaoh's reign (since the cartouche is often discovered engraved on objects or in a tomb), and where there is a fairly complete literary history. From Menes, the first pharaoh in the late fourth millennium B.C., to Augustus, Caesar at Rome when Christ was born, the land of the Nile has had a continuous line of royal successions. Fortunately, the list of rulers and their reigns were recorded.

This being the case, some Egyptologists have utilized radiocarbon dating in an attempt to verify their chronology. Supposedly, the astronomically founded time-scheme of Egypt is already firmly established. If C14 dating is a legitimate and precise, scientific dating technique, archaeologists should be able to substantiate Egyptian chronology by obtaining dates from radiocarbon analysis. On the other hand, geophysicists feel that they ought to be able to test and prove the tangible exactitude of the C14 method by dating ancient Egyptian materials already sealed to a certain limited time span. These conclusions are based on the assumption that the absolute astronomical dating of Egypt is accurate.

Astronomical Suppositions

At some point in the distant past the approximate coincidence of the Nile with the heliacal rising of the star Sirius marked day 1, month 1 or Thoth 1 of the Egyptian calendar. Ancient Egypt's year consisted of twelve months of thirty days each with an additional five epagomenal days or a 365 day year. Accordingly, the calendar was ¼ day short every year or 1 day in 4 years. Egyptologists assume that throughout Pharaonic time no corrections or changes were made in this system.

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Thus, the error accumulated until only once in 1460 years would Thoth 1 and the heliacal appearance of Sirius (Sothis to the Egyptians) on the horizon occur at the same time. In operation, this Sothic cycle of 1460 years meant that the seasons and months had no significance in relation to each other since they wandered throughout the year. In order to support this hypothesis enormous emphasis has been placed upon seven statements regarding the heliacal risings of Sirius. An analysis of the seven demonstrates, however, that there is no proof for astronomical dating.

Four of the seven citations are crucial to the hypothesis: the Illahun and Ebers Papyri, Elephantine date and Medinet Habu calendar. The other three sources are not of the ancient Middle and New Kingdoms. No Sothic dates derive from the Old Kingdom.

Egyptologists claim that the fragmentary Illahun Papyrus refers to a heliacal rising in a specific year of Pharaoh Sesostris III. Thus, a date is established in Dynasty XII and a means is made available to assign a beginning date for Dynasty I on an "astronomical" base. In truth this is a hoax since no pharaoh is named on the papyrus![1]

The hieratic writing within the cartouche of the Ebers Papyrus is so indistinguishable that scholars have had to rely on guessing for the identification.[2] Many, including Ebers himself, felt that it was Bicheres of Dynasty IV rather than the current choice of most experts today, Amenhotep I of Dynasty XVIII.

Elephantine's Sothic date originated in an unknown year of Thutmose III and is, therefore, of little value for the establishment of an absolute chronology. Whether the Medinet Habu calendar belongs to Ramesses II of Dynasty XIX or Ramesses III of Dynasty XX is not known. The difference of many decades between the two pharaohs makes this source useless.

"Astronomical" dating for Egypt might have weathered all criticism, if C14 dating had not proven it wrong. Unfortunately, radiocarbon chronologists have trusted the "astronomical" dating and were influenced to tamper with the real C14 ages through calibration.

The Controversy

In 1962, W. C. Hayes represented the concensus among Egyptological experts in *The Cambridge Ancient History* by writing, "For Egypt in the dynastic period the results so far obtained from the carbon 14, the radiocarbon method of dating . . . are not sufficiently precise or sufficiently consistent to contribute much of value to our reconstruction of Egyptian history."[3]

Willard F. Libby, founder of radiocarbon dating, after considerable examination of the available evidence in 1963 made this statement: "These plots of the data suggest that the Egyptian historical dates beyond 4,000 years ago may be somewhat too old, perhaps five centuries too old at 5,000 years ago, with decrease in the error to 0 at 4,000 years ago."[4] Other geophysicists also suggested that the problem resided in history.[5]

Colin Renfrew, European prehistorian, has observed the development of this controversy between physics and Egyptology. In 1971, Renfrew was able to write as a matter of past history that, "the discrepancy was to be set at the door of the physicist rather than the Egyptologist. The consequences were dramatic."[6]

The Data

Before an examination of the reasons for discrepancies in the interpretation of the radiocarbon dating results, we should take note of the published dates which denote the problem. Some of the radiocarbon values as published beginning in 1955 are listed in Table I.

Over 150 C14 dates have been published for ancient Egyptian materials. Due to space limitations, Table I contains approximately one-third the total number. Dynasties I, XII and XVIII have been given special attention as they are pivotal to an understanding of Old, Middle and New Kingdom chronology. Publication of *Radiocarbon Supplement,* connected with the *American Journal of Science,* began in 1959. Within the period between 1955, when Libby issued his work on the method, and 1959, there were a few minor dates for Egypt published in *Science.* Dates from the 1960, 1961, 1970 and 1972 (part 1) copies of *Radiocarbon Supplement* are not included in this paper since they do not contain any additional or pertinent information for this discussion.

Of greatest importance is the fact that this series of determinations in Table I corroborates the Bible and corrected Egyptian history. The list absolutely negates the accepted or evolutionary interpretation of Egyptian history (i.e. succeeding non-parallel dynasties) — hence the pronouncement of Prof. Hayes.

A common attitude to be found among archaeologists regarding these data is, as Säve-Söderbergh reported: "If a C14 date supports our theories, we put it in the main text. If it does not entirely contradict them, we put it in a foot-note. And if it is completely 'out of date', we just drop it."[7] Dismissal of Table I by archaeologists is based on the view that refinements in C14 dating and tree ring calibration corrects C14 dates so that history and the method are reconciled.

The Search Begins

In 1958, de Vries discovered variations in the concentration of radiocarbon with relation to

TABLE I

Sample No.	Dynasty	C14 Age: (Before Present)	(B.C.)	Accepted Historical Date (B.C.)	Biblical Date (B.C.)
C-1	III	3699±770	1749	2700	1718
		4234±600	2284		
		3991±500	2049		
	average	3979±350	2020		

Acacia beam from the tomb of Zoser at Sakkara. "Known age" according to Wilson is 4650±75 B.P.

Note: B.P. in all dates given refers to before 1950 A.D.
Historical ages are given in accordance with *The Cambridge Ancient History,* latest revisions.
Biblical dates are from a strict and literal interpretation of Scripture correlated with ancient history. See Herman L. Hoeh's *Compendium of World History.*

The dating of this acacia beam is closer to the Biblical date than the historical date in every case. All the dates show, as they should, that the wooden beam is older than the tomb. An acacia being several hundred years old at the time it was cut down for use in the tomb of Zoser gave a determination of several hundred years before the death of the Pharaoh. Note should be taken of the fact that this was the first published date using the method invented by Libby. If 2700 B.C. was the correct date for the death of Zoser then all the C14 dates should have been at least one hundred years older than 2700. All of the dates are far too low for Egyptian history without the Bible to be correct.

Source: W. F. Libby's determination found in *Radiocarbon Dating,* 1955, 2nd edition, University of Chicago Press, Chicago, U.S.A.

U-4	I	3840±150	1890	2810±100	2000

Charred grains in large vessel in tomb 6 at Ma'sara.

Here is an excellent case where the large discrepancy between C14 dates and accepted history can be seen. Contrast this difference of almost one entire millennium with the close comparison between the C14 age and the Bible.

BM-27	I	4100±150	2150	3008±200	2050

Wood (acacia, probably *A. arabica*) from a brick mastaba at Sakkara. Tomb belonged to Hemaka, a vizier, dating to the reign of Udimu.

Again the difference between the C14 date and history is striking. Since the wood cut to be used in the tomb was perhaps 80 years old the Biblical date coordinates well with C14.

P-214	I	4447±150	2497	3008±200	2050

Acacia wood from the tomb of Hemaka.

This reading is perhaps too high, although it could just be very old wood. It will be noticed that with the passage of years the technique of dating improved and greater accuracy was attained which showed the close similarity between the Bible and C14. The wood should have dated older than the estimated historical date for Hemaka. Instead, the C14 result was five centuries after the death of this official.

P216	IV	4082±102	2132	2708	1726

Cedar log of upper chamber of southern pyramid of Snefru at Dahshur.

Estimated age is 2708 B.C. The cedar log used by Snefru for his pyramid construction was fairly old when it was cut. Again the C14 date is far too young for a log that was supposed to have been old enough to be used in a structure in the 28th century B.C.

P-11	XIII	3710±98	1760	1858	1680

Cedar from outer sarcophagus of Aha-nakht at El Bersheh.

The radiocarbon date should have been older than the assigned date of this XIIIth Dynasty sarcophagus. Instead, the Biblical date for the dynasty fits in well with the C14 date. The wood was about a century old when it was cut.

Source: Data from *Radiocarbon Supplement,* (1959).

A-220	XII	3840±150	1890	1992-1786	1892-1680

Wood from large plank from an El Borshen tomb dating to the Twelfth Dynasty.

Here is a case where the Bible and history were already approximately reconciled. The C14 date for the XIIth Dynasty, therefore, falls within the limits of both systems of chronology.

Lv-93	XXII	2750±210	800	1000-750	750

Wood from the lid of an Egyptian mummiform coffin from Deir el Bahari. The style of the coffin suggests a date between 1000 and 750 B.C.

This is another time when the Bible and history were not in disagreement to begin with. It is important in these cases to realize that all three can be in agreement.

Source: Data from *Radiocarbon Supplement,* (1962).

TABLE I (Continued)

Sample No.	Dynasty	C14 Age: (Before Present)	(B.C.)	Accepted Historical Date (B.C.)	Biblical Date (B.C.)
A-334	II ?	4090±50	2140	*circa* 2690	*circa* 1990

Charcoal from what is believed to be Dynasty II remains.
The wood that was burned and became charcoal must be older than the time to which it is assigned historically. The Biblical date, therefore, is in harmony. The accepted historical age, however, is far too old. That is, when Egyptian history is corrected to conform with events as they occurred and as they are found in the Bible, the dynasties are dated by some five centuries lower than they are presently.

TF-56	III	3990±110	2040	2700	1737

Acacia wood.
The historical date is seven centuries and more too old.
Buhen Old Kingdom Series, Sudan. (done by the lab in Arizona):

A-330	3960±60	2010	2610-2340	1737-1486
A-331	3960±60	2010	2610-2340	1737-1486
A-332	3820±50	1870	2610-2340	1737-1486

All were charcoal samples from copper smelting site at Buhen, Sudan. The site has jar seals with the cartouches of Khafre, Menkaure, Userkaf, Sahure and Niuserre.
Historical dates are in error on the order of six centuries. A tree that started to grow about the year 2000 B.C. and was cut around the beginning of the Old Kingdom produced charcoal C14 dates which fit in well with the Bible. With charcoal we do not know whether old or young rings were the parts burnt off.
Source: *Radiocarbon Supplement,* (1963).

A-434	XII	3560±50	1610	1992-1786	1892-1680

A reinforcing timber built into the north girdle wall about 50 cm. above the present ground level, fortress of Askut.
The Biblical figures are closer than the historical.

A-433	XII	3670±60	1720	1992-1786	1892-1680

A reinforcing timber built into the wall of the Semna I fortress in the Sudan. The timber was 100 cm. above ground level in the west portal of the northern fortress. Estimated age is the time of Sesostris III, *circa* 1872 B.C.
The Biblical age is closer than that of the historical.

R-35	Middle Kingdom	3880±80	1930	2000-1750	2035-1680

Fragment of wooden basket classified as belonging to the Middle Kingdom.
Source: *Radiocarbon Supplement,* (1964).

UCLA-739	I	4265±80	2315	3100-2900	2254-1993

Linen found in mastaba 2050 at Tarkhan by Petrie in 1914 and considered by I.E.S. Edwards to be Dynasty I.

UCLA-900	XII	3640±80	1690	1870	1778

Deckboard from funerary ship of Sesostris III.

P-717	XVIII	3111±59	1161	1500-1370	970-870

Charcoal from Tomb 12. Estimated time is Thutmose III - Amenhotep III.
These data are obvious in their implications. The Bible is correct and C14 dating substantiates scripture. Egyptian history should be corrected in accordance with the Bible and science.

P-718	XVIII	3087±59	1137	1408-1372	870

Charcoal from burial chamber of tomb which is archaeologically dated to the reign of Amenophis III.

P-726	XVIII	2980±50	1030	1343	840

Pieces of *Cedrus libani* and *Zizyphus spina* from coffin of Tutankhamon, Valley of the Kings.

P-720	XVIII	2981±58	1031	1370-1314	840-800

Wood from sacrophagus found in underground chamber of Tomb 37, no. 9, end of Dynasty XVIII.

R-36	XIX	2950±45	1000	1300-1235	832-773

Well-preserved sycamore wood fragment from an anonymous tomb, Thebes, Valley of the Queens. Estimated time of Ramesses II.
Source: *Radiocarbon Supplement,* (1965).

TABLE I (Continued)

Sample No.	Dynasty	C14 Age: (Before Present)	(B.C.)	Accepted Historical Date (B.C.)	Biblical Date (B.C.)
A-569	I	4200±90	2250	3100-2900	2254-1993
Same sample used in UCLA-739.					
A-520	IV	3720±80	1770	2600-2480	1750-1626
Charcoal Pit 1, level 2.					
Source: *Radiocarbon Supplement,* (1966).					
UCLA-1201	I	4290±60	2340	3100-3000	2100-2050
Reed matting remains used as brick course bonding on north side of superstructure of Tomb 3503 (Mer-Neit), Archaic Cemetery, Sakkara. Sealed archaeologically according to Martin of Cambridge University.					
UCLA-1202	I	4235±60	2285	3000	2100
Reed matting from the south side of superstructure of Tomb 3035 belonging to Hemaka at Sakkara's Archaic Cemetery.					
UCLA-1203	I	4140±60	2190	2900	2100
Reed matting found in the inner enclosure wall of the west side of Tomb 3505 at Sakkara.					
UCLA-1212	XII	3500±60	1550	1897-1877	1798-1779
Plant remains of reed matting used as bonding found in pyramid of Sesostris II at El-Lahun.					
Source: *Radiocarbon Supplement,* (1967).					
Birm-20	I	4224±97	2274	3100-2900	2254-1993
		4206±68	2256	(same)	(same)
Same sample was tested in UCLA-739, A-569, NPL-5 and Burleigh. Tarkhan linen discovered by Petrie.					
Note the remarkable similarity between the Bible and both determinations for this Dynasty I material.					
Source: *Radiocarbon Supplement,* (1968).					
BM-203	I	4150±110	2200	3100-2900	2254-1993
Same sample of Tarkhan linen as reviewed in the previous specimen.					
BM-248	I	4160±110	2210	3100-2900	2254-1993
Same as above.					
Note the precision with which the dating of the same sample yields dates which confirm the Bible and Dr. Hoeh.					
BM-231	I	4270±65	2320	2900	2100
Reed used as bonding in Tomb 3505.					
BM-233	III	4000±65	2050	2675	1737
Same as the previous sample, only taken from Tomb 3030 and estimated to be from the early IIIrd Dynasty, *circa* 2675.					
BM-234	III	3790±65	1840	2650	1737
Acacia wood from Tomb 3510.					
BM-236	III	3840±65	1890	2550	1737
Linen from Dynasty III tombs #3508 and #3510.					
BM-237	IV	3720±110	1770	2550	1750
Human collagen from Tomb 3508 and 3510.					
Source: *Radiocarbon Supplement,* (1969).					
UCLA-1413	XI	3770±60	1935	2000-1900	2000-1890
Wood fragment from a bow and thought to be of the XIth Dynasty.					
Source: "Ancient Egyptian Radiocarbon Chronology," *Philosophical Transactions of the Royal Society.* R. Berger, 1970. A, 269, pp. 23-36.					
Tomb of Wadji (Dynasty I, *circa* 3025), three wood samples:					
BM-319	I	4225±70	2275	3025	2100
BM-320	I	4206±80	2256	3025	2100
BM-322	I	4349±70	2399	3025	2100

There is good comparison between the three tests made by the British Museum. It should be apparent to the reader that as the techniques have improved so has the close similarity between Biblical chronology and C14 dating. The wood was several hundred years old before it was cut to

TABLE I (Continued)

Sample No.	Dynasty	C14 Age: (Before Present)	(B.C.)	Accepted Historical Date (B.C.)	Biblical Date (B.C.)
be used in this Dynasty I tomb. For the accepted historical scheme to be valid, the C14 dates would have to have been older than 3025 B.C.					
BM-323	I	4342±70	2392	*circa* 3000	2100
Acacia wood from mastaba of the nobleman, Hemaka (reign of Udimu) at Sakkara.					
BM-324	IV	3974±70	2024	2600	1750
Wood samples from southern pyramid of Snefru at Dahshur.					
BM-325	IV	3852±80	1902	2600	1750
Cypress wood from upper chamber of southern pyramid of Snefru.					
BM-331	VI	3770±85	1820	2350	1614
Pine wood, outermost rings of large beam supporting royal sarcophagus of Teti.					
BM-511	XVIII	2972±60	1022	1450	1030
Pine wood from sarcophagus of tomb 3518, Sakkara. The sample dates from the mid-XVIIIth Dynasty—based on Cypriote-Base ring I juglet.					
BM-512	XVIII	2910±50	960	1450	1030
Dom palms nut shells found in tomb 3518, Sakkara.					
BM-333	XIX	2940±100	990	1290-1224	834-773
Reed used as bonding between mud brick courses from storage magazine in NW corner of Ramasseum, Thebes (funerary temple of Ramesses II).					
BM-336	XIX	2890±100	940	1214-1208	696-690
Reed used as bonding in pyramid-chapel of Tjanefer, third prophet of Amun at Thebes (reign of Seti II).					
BM-340	XXX	2310±80	360	380-363	379-361
Reed matting used as bonding found in Great Temple of Amun, Karnak. Brick stamp bears Nectanebo I's name.					
When history and the Bible agree they are both confirmed by C14 dating.					
Source: *Radiocarbon Supplement*, (1971, #2).					

time and location on the earth.[8] This strikes at one of the supporting pillars of this dating method. The facts became known to de Vries when he dated by radiocarbon method certain tree rings from timbers found in European buildings whose date of construction were absolutely sealed to a particular year. Deviations in the C14 activity in the atmosphere around 1700 A.D. were proven to exist. Searching for the cause of this phenomena, de Vries proposed that the fluctuations in C14 were related to climatic conditions.

Within a short period of time other investigators found the same trend in dating tree rings. In 1960, Willis, Tauber and Münnich stated that their findings resulted in general correspondence with the curve obtained by de Vries for the period of the last 300 years.[9] Their study was made in three European laboratories on sections of California *Sequoia gigantea.*

Further research reinforced the fact that there were variations in the concentration of C14. In 1961, Stuiver expressed the feeling that there was an inverse correlation between C14 activity and the number of sunspots during a particular time. Stuiver and Suess, in 1966, were able to describe part of the problem as follows: ". . . The production rate of C14 by cosmic rays undergoes large variations because of a modulation of the galactic cosmic ray flux by the sun."[10] In addition, Stuiver and Suess noted that there were indications that the dipole moment of the earth had changed over the last 6000 years.

Problems Discovered

In 1965, Suess obtained 150 wood samples, dated by dendrochronology, from Dr. Huber of the Forest-Botany Institute in Munich and Dr. Ferguson of the Arizona Tree-Ring Laboratory. The wood, which included European oak, American fir, Hitchcock and sequoia, covered the centuries after Christ. Research established that the C14 dates did not correspond to the tree-ring ages. Reasons for this were thought to derive from: changes in the atmospheric C14 reservoir, sunspot numbers as they cause changes in cosmic ray intensity, and changes in the C14 oceanic reservoir.[11]

In reference to sunspot numbers, Schove made a study of sunspot cycles from B.C. 649-2000 A.D. He concluded that C14 in atmospheric carbon

dioxide increased when there were periods of low solar activity. When there were large numbers of sunspots the atmospheric C14 decreased.[12] We cannot, however, deduce from this that ancient Egyptian materials were necessarily affected since the study only covered an area back to 649 B.C.

The Suess Curve

Physicists continued to struggle for a reconciliation with historical dating. By 1969, Suess had measured the carbon 14 activity of dendrochronologically dated bristlecone pine tree-rings which had calendrical dates reaching back to the third millennium B.C. He used the data to derive a "Suess calibration curve" which plotted true age against radiocarbon dated dendrochronologically dated bristlecone pine tree-rings. This enabled geophysicists to change dates, which appeared to be too young due to an evolutionary approach in the magnitude of centuries.

Thus, the Egyptian dates were made to seem older than the actual precalibrated determinations. With this development some felt that history and physics were finally reconciled. An examination of Table II will show that this is not true. Calibrated dates based on Suess's curve are still too young to match the evolutionary Egyptian time-scale.

Since the Egyptian material, which Egyptologists claimed to be irrevocably established and dated by "astronomical" calculations, did not render correspondence with the dating of the identical material by C14 dating, researchers sought datable substances found in the natural environment with an age parallel to the antiquity of Egypt. Discrepancies between "set" Egyptian dates and C14 dates meant that, either Egyptian chronology was not properly constructed, or the C14 method was not sufficiently precise for historical purposes.

Discovery and investigation showed that *Pinus aristata* grew in ancient times and that its tree-rings could be counted. Calendar dates or B.C. years were assigned to specific rings after the tree-rings were counted. These wooden rings were then dated through the radiocarbon technique. Suess made a graphic plot of the data: the C14 age of the tree-rings (dated previously by dendrochronology) as opposed to the actual calendar age of the same tree-rings derived from counting the rings. It was then theorized that the curve drawn through the points makes possible the correction of C14 dates. Tree-rings revealed the changing amounts of C14 available for absorption during any particular year.

For recent centuries the quantity of C14 absorbed by a tree-ring rendered a C14 age, after analysis, which corresponded to the true or dendrochronologically dated ring. To illustrate the point further, however, a tree-ring count equivalent to 2000 B.C. would, according to pre-Suess curve theory, relate a C14 age in the vicinity of 2000 B.C. This did not prove to be true. In general, Suess demonstrated that the C14 age of a tree-ring was not the same as the calendar or true age of the identical ring.

The Suess curve makes it quite clear that the amount of C14 in the ecosystems of the earth has not remained static over time. For the most part modern tree-rings have C14 ages which correspond closely to true age.

Deviation between true and C14 ages increases as we retrogress in time. For example, Arizona laboratory bristlecone pine sample 1031 was tree-ring counted and given a date of 4275 B.C. When this same ring portion was dated by radiocarbon the resulting age was 3425± 29 B.C. In this case there is an eight and one-half century difference. Likewise, Arizona bristlecone pine sample 736 was counted and was assigned an age of 3000 B.C. Radiocarbon analysis rendered an age of 2363± 64 B.C. The difference between true or calendar age and the C14 age was 637 years.[13]

Therefore, according to the theory, a C14 date is lower than the actual age. Carbon 14 dates are made to appear to be older than they really are through use of the Suess calibration curve. Geophysicists concluded that the quantitative difference between true age and C14 age of bristlecone pine tree-rings was the same quantitative difference between "astronomical" ages and C14 dates for Egyptian material.

Therefore, just as a tree-ring with a calendar age of 3000 B.C. should have related a C14 date of 3000 B.C. (in accordance with pre-Suess theory), but did not, and rather rendered an age of 2363 B.C., so an Egyptian artifact assigned an age of 2363 B.C. by C14 would now have the same quantitative relationship between true and C14 ages as that related by the *Pinus aristata* tree-rings.

An Egyptian object might have been carbon dated in the area of 2363 B.C. This is radiocarbon years and not true age (if the Suess curve is applicable to Egypt). To find the true age the Suess calibration curve is used which demonstrates (or so the theory proposes) that the calendar age of a C14 date of 2363 B.C. is actually 3000 B.C. The radioactive carbon 14 in the atmosphere in 3000 B.C. was much higher than the amount expected, due to changes in the geomagnetic field, galactic cosmic ray flux, etc. An object which came from the time of 3000 B.C. would C14 date and produce a figure of 2363 B.C.

A C14 date of 2363 B.C. mirrors the amount of C14 available to bristlecone pine tree-rings in 3000 B.C. on the old static C14 atmospheric level theory. Suess calibration is based on the conception that tree-rings, contemporary with an-

cient times, contain the quantity of C14 in the atmosphere for not only California, but also the Near East and around the world.

There must be scientific reasons for the unusually high C14 levels found in the old tree-rings which render low C14 ages. If dipole changes for the geomagnetic field occurred, there would have been variations in the number of cosmic rays which entered the earth's atmosphere. Major alterations in the C14 production would have resulted.

Modulation in the galactic cosmic ray flux is the other major reason offered for this situation of low C14 ages.

Also, radiocarbon chronologists have suggested: the possibility of internal sapwood contamination, *in situ* production of radiocarbon based on bristlecone's nitrogen content over long periods of time and the uncertainty of the actual half life of radiocarbon.[14] Internal sapwood contamination, and *in situ* production of C14 in old rings would have caused high C14 counts in the tree-rings. We must not forget that further studies may prove the need for alteration of the half life.

Calibration

Table II contains the same fifty samples in Table I. In the second table, however, the dates have been arranged by dynasty. The three columns to the right of the sample numbers are: C14 determinations (B.C.) as they were published, accepted historical dates based on an evolutionary and inflated time-scale which is also claimed to be supported by astronomy, and the Suess calibration curve figures derived from the Suess curve chart found in the rear pocket in *Nobel Symposium 12: Radiocarbon Variations and Absolute Chronology,* 1970, edited by Ingrid U. Olsson.

It will be noticed that in some cases the Suess figure covers several hundred years. The reason for this is the nature of the curve itself. A single C14 date when plotted on the curve can appear on multiple calibrated or true dates. As stated by Vogel, "A consequence of the fluctuations in the initial C14 content—the de Vries effect—is that the same radiocarbon date sometimes corresponds to two or three calendar dates."[15]

In addition, this curve is not a curvilinear extension in one basic direction, i.e. A.D. to B.C. At some points the curve bends back on itself much like a geologic overthrust. That is why, progression towards increase in C14 dates does not always mean an increase in true or calibrated dates. Two reasons given by geophysicists for this phenomena are (1) erratic changes in the composition of the atmosphere with regard to C14, and (2) changes in the intensity of cosmic rays.

Scientists gathered in Uppsala, Sweden, for the 12th Nobel Symposium, felt that, in general, the Suess curve dates agreed with history. According to Suess, "there are no single radiocarbon dates that are more accurate than the curves shown in . . . my paper."[16] He continued: "I think the curve in my paper is the most detailed and most accurate one at present available. I am very happy that other laboratories have confirmed the general trend."[17]

Calibration Fails

Calibrated dates for Dynasties I-VI are still too young for the inflated historical time framework and, of course, too old for the Biblical chronology. If calibration is to verify the historical time system, the figures have to be older than the assigned dates. This is not the case.

In many specimens the growth time for wood has not been considered. The one sigma margin for every C14 date applies to both directions. In a few cases adding one sigma places the calibrated date near the close of the period assigned historically. This factor, however, applies equally well in the opposite direction.

Most calibrations for Dynasty XII and XIII are older than the historical date. Biblical placement of Dynasty XII does not differ by more than a century with inflated history. C14 still corroborates Bible chronology (see Table I). Calibrated values for Dynasty XVIII and XIX are too young in five out of six cases. In order for the Suess calibration to have substantiated accepted historical interpretation, the determinations should have been consistently older. The Bible, accepted history, precalibration and calibrated dates all basically agree for the late periods of Dynasty XXII and XXX. Suess calibration does not end the discrepancies.

The Problems of Calibration

We cannot know that *Pinus aristata,* growing in the White Mountains of California, provides data applicable to organisms living millennia ago on a worldwide basis. As Collis noticed, "now that fluctuations have been observed, it is assumed that they are worldwide . . . that dispersal of newly formed C14 in the atmosphere is so rapid that geographical variations do not exist. . . ."[18] We cannot be certain that the curve plotting true age (calendar age) or dendrochronologically counted tree-rings age against C14 dated dendrochronologically dated tree-rings is valid. Dr. Berger, a close associate of Dr. Libby at UCLA, made the following comment:

> Ideally it would be desirable to check Suess's data by measurements carried out with a different species. However, up till now a search for a similar long-lived tree coupled with an environment providing excel-

TABLE II

Sample No.	C14 Date (B.C.)	Historical Date B.C.	Suess Curve Calibration (B.C.)
DYNASTY I:			
UCLA-739	2315±80	3100-2900	3350-2960
A-569	2250±90	*ibid.*	2960
Birm-20	2274±97	*ibid.*	2950
BM-203	2200±110	*ibid.*	2950-2600
BM-248	2210±110	*ibid.*	2950-2600
UCLA-1201	2340±60	3000	2970
P-214	2497±150	3008±200	3390-3220
BM-27	2150±150	*ibid.*	2950-2560
UCLA-1202	2285±60	*ibid.*	2950
BM-231	2320±65	2900	2960
UCLA-1203	2190±60	2900	2950-2610
U-4	1890±150	2810±100	2480-2210
BM-319	2275±70	3025	2950
BM-320	2256±80	3025	2930
BM-322	2399±70	3025	3350-3005
BM-323	2392±70	3000	3350-3005
DYNASTY II:			
BM-233	2050±65	2675	2500
A-334	2140±50	2690	2950-2550
DYNASTY III:			
C-1	2029±350	2690	2500
TF-56	2040±110	2690	2490
BM-234	1840±65	2650	2190
BM-236	1890±65	2550	2480-2210
DYNASTY IV:			
BM-324	2024±70	2600	2490
BM-325	1902±80	2600	2480-2230
BM-237	1770±110	2550	2170
A-520	1770±80	2617-2500	2170
P-216	2132±102	2708	2950-2550
DYNASTY V:			
A-330	2010±60	2610-2340	2490
A-331	2010±60	2610-2340	2490
A-332	1870±50	2610-2340	2370-2190
DYNASTY VI:			
BM-331	1820±85	2350	2180
DYNASTY XI:			
UCLA-1413	1935±60	2100	2480-2390
DYNASTY XII:			
R-35	1930±80	2100-1780	2480-2390
A-220	1890±150	2000-1800	2480-2210
UCLA-1212	1550±60	1897-1877	2030-1760
C-81	1671±180	1831	2120

TABLE II (Continued)

Sample No.	C14 Date (B.C.)	Historical Date B.C.	Suess Curve Calibration (B.C.)
UCLA-900	1690±80	1870	2120
A-434	1610±50	1992-1786	2090
A-433	1720±60	1992-1786	2130
DYNASTY XIII:			
P-11	1760±98	1858	2160
DYNASTY XVIII:			
BM-511	1022±60	1450	1310
BM-512	960±50	1450	1210
P-726	1030±50	1343	1312
P-717	1161±59	1500-1370	1470
P-718	1137±59	1408-1372	1460
P-720	1031±58	1370-1314	1310
DYNASTY XIX:			
R-36	1000±40	1300-1235	1310-1220
BM-333	990±100	1290-1224	1310-1220
BM-336	940±100	1214-1208	1210-1110
DYNASTY XXII:			
Lv-93	800±210	1000-750	940-870
DYNASTY XXX:			
BM-340	360±80	380-363	420

lent preservation conditions for fallen logs has failed to be successful.[19]

Therefore, only one species provides measurements for the period of ancient Egypt. Too much emphasis can be placed on one isolated species peculiar to its own environment.

The Kauri Tree

Fortunately, another species has been analyzed for part of the A.D. period and compared with the *Pinus aristata* results. The important southern hemisphere run was made by Jansen on the New Zealand kauri tree *(Agathis australis)*. "Unfortunately," according to Shawcross, "the New Zealand run reported by Jansen shows serious divergence not only from the calendar scale but also from the results obtained by the northern hemisphere laboratories."[20]

New Zealand radiocarbon chronologists have studied a single kauri tree whose age dates back to *circa* A.D. 1000. The earliest tree-rings relate dates which are, on an average, 100 years older than the Northern Hemisphere results with *Pinus aristata* for the same period. That is, kauri still demonstrate that C14 ages even at A.D. 1000 are younger than true age, but not nearly as young in comparison to the youth rendered by bristlecone. This demolishes the theory on which the Suess curve rests. There are geographical variations of C14 for the same year.

That both kauri and bristlecone C14 ages are younger than true age, but not in the same degree may mean that the rings have not been properly counted. Or, if the count was precise, the geographical determinants in the Southern Hemisphere may have produced a curve different from that developed by Suess for bristlecone. Since this was a recent age study, there is no proof that the count was not exact. The point is that geography affects C14 variations.

If there is this degree of difference only 950 years ago, there is no way of predicting the differences between kauri and bristlecone during the eras of importance with relation to the Egyptian past. This situation does not inspire confidence in the Suess curve. Furthermore, kauri calibration can in no way serve to support bristlecone's calibration for Egypt because the kauri only began to grow in A.D. 1000.

Why does the kauri analysis expose a discrepancy? Proportionally lower C14 quantities in the Southern Hemisphere may be the result of the 40% greater oceanic surface in that hemisphere and the strong winds between 40° S and 50° S latitude. With more ocean surface there is greater exchange between atmospheric carbon

dioxide and the surface bicarbonate. The fact still remains that geographical situations change C14 variations and that these factors must be known for a particular area before a calibration curve is used to "correct" C14 dates. Therefore, any curve which attempts to "correct" Egyptian dates will of necessity have to originate from Egyptian tree-rings.

Why didn't trees living at the same time in the A.D. centuries, but geographically separate, produce the same measure of C14 activity in the atmosphere? Collis observed that:

> The peculiarity of the New Zealand sequence was explained as due to volcanic activity in the area (a factor in the Aegean as well) while . . . Suess suggested . . . perhaps direct solar radiation on the bristlecone pine, thus producing high C14 counts, and even that the "dead" tree rings were absorbing C14 after death. In this last case, perhaps the half-life of C14 can be affected.[21]

Collis made it clear that more knowledge regarding regional effects had to be attained before conclusions were possible. It does not follow that trees in the White Mountains or the kauri grew under the exact same conditions as organisms in ancient Egypt.

A variety of reasons have been offered to describe the problem. Suess suggested, as did Lal, that there is an altitudinal factor involved in absorption of C14. No city in ancient Egypt was at the same altitude as the White Mountains. Berger also recognized that, ". . . bristlecone pine wood exposed at high elevations may suffer *in situ* production of radiocarbon based on its nitrogen content over long periods of time.[22] Now, it is being suggested, that there is absorption of C14 after the "death" of the "annual" tree-ring growth. In addition, Berger stated that the reason the *Pinus aristata* calibration curve does not reconcile with history is the possibility of internal sapwood contamination.

Jansen, on another point, felt, "changes in the movement of the vertical oceanic currents may lead to C14/C12 changes which could . . . affect local areas. . . .[23] Shawcross believes that there are differences in relative proportions of atmospheric radiocarbon in the two hemispheres and that there is a considerable time lag before any equilibrium is achieved.

Other Tree Studies

Japanese trees have been studied and compared with other Northern Hemisphere trees (European and American). Research has revealed a 40 to 80 year difference between their C14 ages on contemporary tree-rings. The Japanese trees, like the kauri, show an age that is older than the C14 bristlecone tree-ring age. It is of interest that trees other than bristlecone render C14 ages that are closer to true age. This proves that the variations are not only latitudinal, but also longitudinal.

In addition, the longitudinal variation is not on the same order. Location in the same hemisphere has a bearing on secular variations. Reasons suggested for these lower concentrations of C14 are (1) dominance of oceanic air masses and (2) greater exchange between atmospheric CO_2 and marine surface bicarbonate. Again, here is proof of the significance of geographical coordinates on C14 variations.

A Neolithic tree-ring sequence from Auvernier, Switzerland, has been compared with *Pinus aristata*. Results were reviewed by Collis, who stated that, ". . . again there seems to be a local factor, either that the bristlecone pine curve is not relevant, or that something causes unusually high readings in California and low in Switzerland."[24] It will be necessary for more low altitude species to be checked before anything like a calibration curve can be reached.

At the Twelfth Nobel Symposium in 1969, Jansen reported that trees from Australia and New Zealand differ considerably from European and North American measurements. Jansen stated that one ". . . explanation is that atmospheric radiocarbon has indeed been distributed in a very inhomogeneous fashion in the past."[25] Lerman, *et. al.*, believe that the difference between the hemispheres may be ". . . based on the latitudinal distribution of the C14 input into the atmosphere and of the exchange with the marine carbon reservoir."[26]

In a quite recent study, Baxter and Walton have shown fluctuations in C14 concentrations and variations in atmospheric mixing.[27] From their evidence, these men deduce a rate of injection of stratospheric C14 into the troposphere which increases during certain periods of solar maximum. In addition, it was found that stratospheric residence time can be significantly shorter, by as much as one year, than subsequent measurements.

Suess made an assumption when he created the curve. In his own words, "the validity of these curves and tables is based on the assumption that wood and other plant material grown at the same time show the same radiocarbon content, independently of their geographic place of origin."[28] **The assumption has been proven false.**

Conclusions

Application of the Suess curve drawn on the basis of radiocarbon dated dendrochronologically dated tree-rings to areas other than the location where the tree-rings grew is based on the false conception that there are no geographical factors influencing the secular variations of C14. All

C14 dates cannot be "corrected" by this curve. There are geographical elements unique to every area as demonstrated by the kauri and Japanese runs.

Unknown is the nature of the physical elements which would produce a curve peculiar to the particular geographical orientation of Egypt. There are no trees in Egypt which began growth in ancient times. Besides this fact, there is Suess's own admission that the curve is quite uncertain and that deviations on the order of 200 years are possible.[29]

Biblical chronology, corrected ancient Egyptian history and C14 dating without calibration agree. Inflated, evolutionary and so-called "astronomically" based Egyptian history does not agree with radiocarbon dating even after it is calibrated on the Suess curve. Egyptian history should be corrected.

Bible chronology before the Flood is not in agreement with C14 dating. Further refinements and qualifications will probably produce even better correlation between the Bible and C14 dating. The number of factors which are now known to influence C14 dating may explain the errors and inflated chronologies for the Palaeo-, Meso-, Neo- and some Chalcolithic archaeological remains before the Flood.

If a large percentage of cosmic radiation was shielded from the earth by a canopy before the Noachian Deluge, then organisms living during the time from Creation to the Flood would have a C14 date much earlier than an actual historical date. Scientists must account for this as well as the lingering effects after the Flood in their computations. Their discoveries indicate that there were catastrophes and a major change in the C14 oceanic reservoir. By admitting the fact that a Flood did occur, physical explanations of scientific data are facilitated.

Acknowledgments

The author would like to acknowledge his debt to Dr. C. Rainer Berger for stimulating discussions regarding this subject. I am grateful to Dr. H. L. Hoeh for his meticulous explanations of ancient chronology and for the invaluable use of his studies on Biblical history. Furthermore, I appreciate the encouragement of Mr. Wayne Ruppersburg.

References

[1]Borchardt, L. 1899. Das zweite papyrusfund von kahun und die zeitlich festlegung des mittleren reiches der ägyptischen geschichte, *Zeitschrift für Ägyptische Sprache und Altertumskunde*, XXXVII, p. 99.

[2]Brugsch, H. 1870. Ein neues sothis-datum, *Zeitschrift für Ägyptische Sprache und Altertumskunde*, VIII, p. 108.

[3]Hayes, W. C., M. B. Rowton, and Frank H. Stubbings. 1962. *Chronology Egypt; Western Asia; Aegean Bronze Age*. Fascicle #4 from Vol. 1, chapter VI, *The Cambridge Ancient History*. Cambridge, At the University Press, p. 22.

[4]Libby, Willard F. 1963. The accuracy of radiocarbon dating, *Antiquity*, XXXVII, p. 216.

[5]Damon, P. E., Austin Long, and D. C. Grey. February 15, 1966. Fluctuations of atmospheric C14 during the last six millennia, *Journal of Geophysical Research*, 71, #4, p. 1059.

[6]Renfrew, Colin. October, 1971. Carbon 14 and the prehistory of Europe, *Scientific American*, 225, #4, p. 67.

[7]Säve-Söderbergh, T. 1970. C14 dating and egyptian chronology, *Nobel Symposium 12 Radiocarbon Variations and Absolute Chronology*, Stockholm, Almquist and Wikwell, p. 35.

[8]de Vries, H. 1958. Variation in concentration of radiocarbon with time and location on earth, *Koninkl. Ned. Akad. Wetenschap Proc. B.*, 61. pp. 94-102.

[9]Willis, E. H., M. Tauber, and K. O. Münnich. 1960. Variations in the atmospheric radiocarbon concentration over the past 1300 years, *American Journal of Science, Radiocarbon Supplement*, 2, p. 3.

[10]Stuiver, M., and H. Suess. 1966. On the relationship between radiocarbon dates and true sample ages, *American Journal of Science, Radiocarbon Supplement*, 8, p. 535.

[11]Suess, H. 1965. Secular variations of the cosmic-ray-produced carbon 14 in the atmosphere and their interpretations, *Journal of Geophysical Research*, 70, #23, pp. 5937-5952.

[12]Schove, D. 1955. The sunspot cycle 649 B.C. to A.D. 2000, *Journal of Geophysical Research*, 60, pp. 127-145.

[13]Damon, P. E., A. Long, and D. C. Grey. 1970. Arizona radiocarbon dates for dendrochronologically dated samples, *Nobel Symposium 12 . . .*, p. 617.

[14]Berger, R. 1971. Ancient Egyptian radiocarbon chronology, *Philosophical Transactions of the Royal Society of London, A*, 269, p. 35.

[15]Vogel, J. 1970. Discussion of historical chronologies, *Nobel Symposium 12 . . .*, p. 125.

[16]Suess, H. 1970. General discussion of the magnitude of the C14/C12 variations, *Nobel Symposium 12 . . .*, p. 327.

[17]*Ibid.*, p. 329.

[18]Collis, J. Sept., 1971. Thoughts on radiocarbon dating, *Antiquity*, XLV, #179, p. 200.

[19]Berger, R. 1971. Ancient Egyptian radiocarbon chronology, *Philosophical Transactions of the Royal Society of London, A*, 269, p. 32.

[20]Shawcross, W. Oct., 1969. Archaeology with a short, isolated time-scale: New Zealand, *World Archaeology*. 1, #2, p. 191.

[21]Collis, J. *Op. cit.*, p. 201.

[22]Berger, R. *Op. cit.*, p. 35.

[23]Jansen, H. March, 1962. Comparison between ring-dates and 14 C dates in a New Zealand kauri tree, *New Zealand Journal of Science*, 5, #1, p. 78.

[24]Collis, J. *Op. cit.*, p. 201.

[25]Jansen, H. 1970. Secular variations in Australia and New Zealand, *Nobel Symposium 12 . . .*. p. 269.

[26]Lerman, J., W. Mook, and J. Vogel. 1970. C14 in tree rings from different localities, *Nobel Symposium 12 . . .*, p. 275.

[27]Baxter, M., and A. Walton. 1971. Fluctuations of atmospheric carbon-14 concentrations during the past century, *Proceedings of the Royal Society of London*, Series A, 321, p. 105-127.

[28]Suess, H. 1970. Bristlecone-pine calibration, *Nobel Symposium 12 . . .*, p. 304.

[29]Suess, H. *Op. cit.*, p. 306.