Accounts of subsequent flooding suffered additionally from intermingling subjective interpretations of upheavals that varied according to their geographical location. Only in God's Word do we have a coherent account of what actually happened during the first catastrophe when the world was certainly "overflowed with water."

Following the confusion of tongues at the Tower of Babel, the Old Testament deals primarily with the Jewish Nation. An account of world events (subsequent catastrophes), other than their effect on the Jews, must come from elsewhere.

Yet it is instructive that when there is purity of one element in a group of flood legends, there is correlation with other Biblical facets of the story. As we have seen, more often than would be expected to occur naturally by chance, there is a correlation between a favored family with (1) survival by boat, (2) a forewarning, (3) one flood only, and (4) preservation of other seeds of life. Such correlations are instructive and they certainly support the authority of the Scriptural Flood record.

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RADIO CARBON DATING*

A. J. 'MONTY' WHITE**

Introduction

It is popularly supposed that science has unequivocably established that men have been on earth for a million years or more. Such a view cannot be readily harmonized with the origin and early history of man as recorded in the first few chapters of the book of Genesis. Accordingly, it is advisable to examine the methods by which supposedly accurate dates have been obtained.

One method used to estimate the age of materials of biological origin is radio carbon or carbon-14 dating. This method, which is claimed to be able to date materials up to 50,000 years old, has obtained widespread use in archeology and geology. It was developed in the mid 1940's at the University of Chicago by Professor Willard F. Libby, who was subsequently awarded the Nobel prize for Chemistry in 1960 for this work.

In this article, the principles upon which carbon-14 dating is based will be explained, the assumptions inherent in this method of dating will be considered, and the extent to which this method has been checked against historically dated materials will be viewed.

The basic theory[1] behind carbon-14 dating is as follows. In the upper atmosphere, nitrogen is transmuted into a rare form of carbon, known as carbon-14. This is due to the bombardment of atmospheric nitrogen by atomic particles called neutrons, which occur in cosmic rays. "Ordinary" carbon is carbon-12, which has 6 protons and 6 neutrons in its atomic nucleus. Carbon-14 is, however, a different "kind" (or isotope) of carbon with 8 neutrons and 6 protons in its nucleus. The formation of carbon-14 from nitrogen can be represented by the following equation:

$$N^{14} + n^{1} \rightarrow C^{14}_{6} + H^{1}_{1}$$

i.e. NITROGEN + NEUTRON gives CARBON-14 + PROTON

Unlike carbon-12, carbon-14 is radioactive and it disintegrates to given nitrogen with the emission of an electron:

$$C^{14}_{6} \rightarrow N^{14}_{7} + e^{0}_{-1}$$

i.e. CARBON-14 gives NITROGEN + ELECTRON

This disintegration process is relatively slow. Carbon-14 is said to have a half-life of about 5,600 years. This means that starting with 1 gram of carbon-14, after 5,600 years one half of it (i.e. ½ gram) will have disintegrated into

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nitrogen and ½ gram will be left. After a further 5,600 years, half of this ½ gram (i.e. ¼ gram) will have disintegrated and only ¼ gram of carbon-14 will be left. After another equally long period only ⅛ gram of carbon-14 will be left, and so on.

Since the newly formed carbon-14 in the atmosphere has the same chemical properties as ordinary carbon, it can combine with the oxygen in the air to form carbon dioxide. This diffuses and it is thought to be distributed evenly in the atmosphere and the oceans. The amount of carbon-14 in the carbon dioxide of our present atmosphere is very low. There is, on average, only ONE carbon atom with the atomic weight of 14 for every 10^{12} (i.e. 1,000,000,000,000) with the atomic weight of 12. This ratio. $1:10^{12}$ has been determined because as the carbon-14 disintegrates, it emits an electron which is detected using very sensitive equipment.

The carbon dioxide, with its radioactive carbon-14 component, is assimilated by plants during photosynthesis, and finally also by animals, which live on plants. Hence at any given time, the ratio between active and non-active carbon in **all** living organisms is the same as that in the air. (This has been shown to be true in our present environment[1]).

Now when an organism dies, it is unable to take up further carbon-14 and that which is already present diminishes due to radioactive decay. Because the activity (i.e. the measurement of the electron emission) of the carbon-14 in a sample decreases at what is assumed to be a constant rate, it is possible by measuring the present activity of the sample to determine the time elpsed since death. Providing that **all** the assumptions inherent in the method are valid, the technique may be applied to samples which are between 500 and 50,000 years old.

Examination of Assumptions

This method is, no doubt, very ingenious and powerful providing that ALL the following assumptions[2, 3] are valid:

1. That the amount of cosmic radiation, and hence the amount of neutron bombardment in the upper atmosphere has been essentially constant over the last 50,000 years.
2. That the concentration of carbon-14 in the carbon dioxide of the atmosphere has been constant over the last 50,000 years.
3. That the carbon dioxide content of the ocean and atmosphere has been constant over the same period of time.
4. That dead organic matter is not later altered with respect to its carbon content by any biological or any other activity.
5. That the huge reservoir of oceanic carbon has not changed in size during the same period of time.
6. That the rate of decay of carbon-14 is a constant and does not vary with time.
7. Finally, that the rate of formation and the rate of decay of carbon-14 have been in equilibrium during the last 50,000 years.

These seven assumptions, **all** of which must be valid if radio carbon dating is to be accurate, must be critically examined from a scientific viewpoint:

Assumptions 1 - 3: These assumptions are contrary to the arguments advanced as causes of the ice-ages, the last of which is thought to have begun about 100,000 years ago[4] and finished about 11,000 years ago.[5] Of the several theories[6] which have been advanced to account for the onset of the ice-ages, the ones most favored by the geologists are (a) variation in the sun's radiation and (b) an increase in the amount of carbon dioxide present in the atmosphere. (**Note:** The ice-ages are a theory rather than a proven fact!)

Now if reason (a) is correct, then assumption 1 is not true and hence assumption 2 is also invalid, for the ratio of carbon-14 to ordinary carbon depends on how many neutrons bombard the upper atmosphere. This, in turn, depends on the amount or intensiity of cosmic radiation. If, on the other hand, reason (b) is correct, then assumption 3 is untrue because the carbon dioxide content of the atmosphere and subsequently the oceans would have changed considerably over the last 50,000 years.

There is also the problem of contamination of atmospheric carbon dioxide by the burning of fossil fuels (i.e. oil and coal) containing no active carbon and which dilute the active carbon dioxide in the atmosphere. During the past century (i.e. since 1870) a considerable proportion (about 3 per cent[7]) of inactive carbon dioxide has been added to the carbon cycle. This means that in carbon-14 dating, the standard used, i.e. the present carbon-14 content of carbon dioxide, on which radio-carbon age calculations are based, is incorrect. This standard, however, could be modified so as to make it correct for the time immediately before the Industrial Revolution.

It has, however, also been found "that the activity of radio carbon in the atmosphere was going up and down before the Industrial Revolution."[8] Moreover, to complicate matters even further the radio carbon content has been steadily increasing since 1954 with the advent of atomic devices which have released neutrons into the atmosphere.[1] These neutrons combine with atmospheric nitrogen to produce carbon-14. The position is so bad that the scientists who work on radio carbon datings disagree with one another as to the position and magnitude of these so called "short term" fluctuations of the carbon-14 content in our present atmosphere.[9] Each group of workers has its own particular standard

on which it bases the age of a particular sample and so each group will give a different age for the same sample!

Assumption 4: This assumption is very important. C. B. Hunt[10] lays special emphasis on the danger of contamination of the sample by external sources of carbon, especially in damp locations. At a conference on radio carbon dating held in 1956 the following remarks[11] were made concerning this assumption:

> The most significant problem is that of biological alteration of materials in the soil. This effect grows more serious with greater age. To produce an error of 50 per cent, in the age of a 10,000 year old specimen would require the replacement of more than 25 per cent, of the carbon atoms. For a 40,000 year old sample, the figure is only 5 percent, while an error of 5,000 years can be produced by about 1 per cent, of modern materials.

C. B. Hunt[10] has proclaimed, "We do not know which dates are in error, or by what amounts, or why."

Assumption 5: Scientists are in no position to assert or deny that the huge reservoir of oceanic carbon has not changed in size during the last 50,000 years, for there is no method for determining this at present.

Assumptions 6 and 7: There is no way of making sure that the rate of decay of carbon-14 has not varied in the last 50,000 years. Who can positively assert that the rate of decay of carbon-14 measured today is the same as it was 50,000 years ago? Concerning the final assumption, Libby has shown[1] that the rate of formation and the rate of decay of carbon-14 were in equilibrium in the late 1940s, but this does not constitute proof that this has been so during the last 50,000 years.

In spite of these highly questionable assumptions it is usually maintained that radio carbon dating has been verified beyond any shadow of doubt by numerous correlations with samples of known age determined by such methods as dendrochronology or other archeological dating methods. THIS IS NOT SO! Professor Libby has said,[1]

> The first shock Dr. Arnold and I had was when our advisors informed us that history extended back only to 5,000 years. We had thought initially that we would be able to get samples all along the curve back to 30,000 years, put the points in, and then our work would be finished. You read statements in books that such and such a society or archaeological site is 20,000 years old. We learned rather abruptly that these numbers, these ancient ages, are not known accurately; in fact, it is at about the time of the First Dynasty in Egypt that the first historical date of any real certainty has been established.

It is pretty obvious that any **genuine** correlation between definitely verified historical dates and the age found by the radio carbon method of dating can be limited only to the last 5,000 years or so, the period covered by Biblical history!

Radio Carbon Dating and the Flood

From these arguments, it can be seen that carbon-14 dating applied to the last 50,000 years is highly suspect because of the invalid and often questionable assumptions which have to be made. There is, however, fairly good agreement between radio carbon dates for the last 4-5,000 years and historically verified chronology,[1] although there are numerous discrepancies and there is a very large margin of error the further back in time that comparisons are made. Carbon-14 dating is therefore quite useful back to 4-5,000 years ago, but it cannot be applied to prehistoric periods when there is no way of calibrating the method.

Moreover, the assumptions inherent in the method are unlikely to be valid for periods distant in prehistory, because of the universal catacylsmic Flood as described in the book of Genesis, and because of the different terrestrial and atmospheric conditions which prevailed before the Flood as described in the first few chapters of the Bible.

Before the Flood, the ratio of radio carbon to ordinary carbon in carbon dioxide would have been much lower than at present due to the different environment which then existed. There was a global semi-tropical climate with vast amounts of plant life all over the world. Furthermore the atmosphere was protected from cosmic radiation by a water canopy which surrounded the earth (Genesis 1 vvs 6-8). Hence the formation of carbon-14 would have been inhibited.

Since the proportion of carbon-14 in the carbon dioxide was smaller at this time, all living organisms assimilating this carbon dioxide would have contained very little or no active carbon. Hence a radio carbon dating of their remains could quite easily put their apparent age as 50,000 years or older (based on today's ratio of carbon-14 in carbon dioxide), when their true age is only 6,000 years.

After the flood, the disappearance of the water vapor canopy would have resulted in an increase in the carbon-14 content of the atmosphere. It would have still taken many centuries to reach the equilibrium condition between the rate of formation and the rate of decay of carbon-14, which was observed by Libby.[1] Hence organisms living in the early centuries after the flood would still have little active carbon in them, and so a radio carbon dating on their remains would still put their age too high. Eventually,

however, the present day equilibrium was reached and radio carbon dating became applicable even though the errors are great.

The Biblical teaching concerning the Genesis Flood thus implies that many of the radio carbon dates given for samples older than about 5,000 years, are much too high. It may be objected, however, that there is little scientific evidence for a universal flood, or for a water vapor canopy previous to the Flood. This is not so. The following quotes show that the hypothesis of a water vapor canopy is involved in the most reasonable explanations of the present high concentration of the Helium-3 isotope in our present atmosphere:

> In addition to the formation of Carbon-14 from nitrogen in the atmosphere by cosmic-ray neutrons, these neutrons also react with deuterium (heavy hydrogen, the hydrogen isotope in heavy water), which would undoubtedly have been present in substantial amounts in such a canopy, to form tritium, a still heavier isotope of hydrogen. Tritium is unstable and decays rapidly by beta decay to an isotope of helium. He 3. But it turns out that there is too much He 3 in the atmosphere to be accounted for by this process operating at present rates during geologic time. (References 3 p. 375)

An authority on cosmic radiation, Korff has suggested[12] two factors which would account for these observations:

> One of these is that the intensity of cosmic radiation, and hence the rate of production of neutrons might have been higher at some time in the geologic past . . . The second possibility invoking action in the past assumes that a time when the earth was warmer the atmosphere contained much more water vapour.

Conclusion

In conclusion, some of the assumptions inherent in radio carbon dating are invalid and others are highly questionable. In spite of this, there is fairly good agreement between radio carbon dates for the last 4-5,000 years and historically verified chronology, although there are numerous discrepancies and there is often a large margin of error. Ages of 6,000 years old or more obtained by this method are incorrect. The Flood and the Biblical account of the conditions existing prior to this event, not only adequately explain all the anomalies of radio carbon dating, but also explain the high concentration of Helium-3 in our atmosphere.

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