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You ask for my opinion of Dr. Robert Gentry's work on pleochroic polonium halos. I spent a number of hours reviewing this fascinating work with him some weeks ago. I was impressed with the clarity of the evidence for "anomalous halos"—that is, cases where there are rings indicating the presence of some members of the normal radioactive decay chain without the other members of the family tree that normally are present, that normally do show up in rings of their own, and that have to be there on present views of the radioactive decay chains involved. If the evidence is impressive, the explanation for it is far from clear. I would look in normal geologic process of transfer of materials by heating and cooling; in isomeric nuclear transitions; and in every other standard physical phenomenon before I would even venture to consider cosmological explanations, let alone radicl cosmological explanations. To explore all the avenues that need exploring would take months, not the few hours I was privileged to spend in Dr. Gentry's company. A few days ago I reviewed his work, all too briefly, with Dr. G. Wasserburg of Cal Tech, who is an expert in the radioactive dating of rocks, whose opinion would be much more to the point than mine, especially if he will give it to you in writing.**

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**Professor Wheeler requested that this letter be printed in full. Dr. Wasserburg's views have not been obtained.

References

[1]Gentry, Robert V. 1973. Radioactive halos, *Annual Review of Nuclear Science* 23(5541):347-362.

[2]Struve, Otto 1959. Finding the age of the Earth, *Sky and Telescope* 18(8):433-435.

[3]Gentry, Robert V. 1968. Fossil alpha-recoil analysis of certin variant radioactive halos, *Science* 160(3833):1228-1230.

[4]Gentry, Robert V. 1974. Radiohalos in a radiochronological and cosmological perspective, *Science* 184(4132):62-66.

[5]Fremlin, J. H., and R. V. Centry 1975. Spectacle halos. (Discussion) *Nature* 258(5532):269-270.

[6]Gentry, Robert V., L. D. Hullett, S. S. Cristy, J. F. McLaughlin, J. A. McHugh, and Michael Bayard 1974. Spectacle arrays of ^{210}Po halo radiocentres in biotite, a nuclear geophysical enigma, *Nature* 252(5483):564-566.

[7]Moazed, Cyrus, Richard M. Spector, and Richard F. Ward 1973. Polonium radiohalos: an alternate interpretation, *Science* 180(4092): 1272-1274.

[8]Gentry, Robert V., Warner H. Christie, David H. Smith, S. A. Reynolds, Raymond Walker, S. S. Cristy, and P. A. Gentry 1976. Radiohalos in coalified wood: new evidence relating to the time of uranium introduction and coalification, *Science* 194(4262):315-318.

WHAT WILL THEY SAY IN 10,000 A.D.?

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It is shown herein that evolutionists increase their estimates of the earth's age exponentially. Conclusions are given on the assumption that this trend will continue.

Evolutionists have contended that estimates of the earth's age by creationists are much too small. However, estimates of the age by the evolutionists have varied greatly over the years, as is shown by data, gleaned from the literature, given in Table 1. There is indeed quite a variation. It would be interesting, then, to speculate on what evolutionists will be saying in the future if the present trend continues.

Accordingly, the data from Table 1 were analyzed by least squares, both linearly[10] and exponentially.[11] In what follows, y is the estimated age, and t the time, in years A.D., when the estimate was made.

Linear regression yields the equation

$$y(t) = 33553406.95t - 6.228783058 \times 10^{10} \quad (1)$$

The correlation coefficient is

$$r = 0.898994372 \quad (2)$$

To fit with an exponential $y = ae^{bt}$, the curve $ln(y) = bt + ln(a)$ is fitted to the data $\{t_i, ln(y_i)\}$. It will be recalled that *ln* represents the natural logarithm. The resulting equation is

$$\ln[y(t)] = 3.651117028 \times 10^{-2}\, t - 49.70256740 \quad (3)$$

The correlation coefficient is

$$r = 0.969637219 \quad (4)$$

Obviously, the next question is: Which of Equation 1 and Equation 3 better fits the data. Since the correlation coefficient for Equation 3 is closer to 1.0, it can be concluded that Equation 3 is the better fit.

In fact, if the true correlation is ρ, then

$$z = (n - 3)^{1/2}/2 \times \ln[(1 + r)(1 - \rho)/(1 - r)(1 + \rho)] \quad (5)$$

(n being the sample size) has an approximately normal distribution.[12]

Therefore, with 95% confidence, the conclusion is that in the linear Equation 1 the true correlation is between 0.583 and 0.979. For the exponential Equation 3 it is between 0.858 and 0.994.

Table 1.

Year in which the estimate was made.	Estimated age of the earth in years.
1850	100 million[1]
1850	25 million[2]
1932	1.6 billion[3]
1947	3.35 billion[4]
1949	2.5 billion[5]
1960	2 billion[6]
1974	5 billion[7]
1975	4.5 billion[8]
1976	4.6 billion[9]

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Thus the data strongly favor an exponential rather than a linear fit. To predict, then, what evolutionists will be saying in the future one may use Equation 3 and extrapolate. Extrapolation can lead to large errors; but an evolutionist should be the last person to complain, since he extrapolates from the present to over four billion years ago.

The inevitable conclusion in that in 4,000 A.D. evolutionists will assert that the earth is $6.932.10^{41}$ years old, and in 10,000 A.D. that it is $9.560.10^{136}$ years old.

Or is the conclusion that evolutionists expounding on the age of the earth, like fishermen describing the one that got away, tell a bigger story each time?

References

[1]Hotchkiss, W. O. 1932. The story of a billion years. Willaims and Wilkins, Baltimore, p. 41.

[2]Curtis, Helena 1975. Biology. Second edition. Worth, New York, p. 17.

[3]Hotchkiss, *Op. cit.*, p. 49

[4]Holmes, A. 1947. A revised estimate of the age of the earth; *Nature* 159(4030);127-128.

[5]Ahrens, L. 1949. Measuring geologic time by the strontium method, *Bulletin of the Geological Society of America* 60(2):217-266. See especially p. 258.

[6]The Earth (in) Collier's Encyclopedia, 1960. Collier, New York. Vol. 6, p. 460.

[7]Rhodes, Frank H. T. 1974. Evolution. Golden Press, New York, p. 96.

[8]Curtis, *Op. cit.*, p. 17

[9]Abell, George O. 1976. Realm of the universe. Holt, Rinehart and Winston, New York, p. 153.

[10]For the appropriate formulae see Hoel, Paul G. 1962. Introduction to mathemathical statistics. Wiley, New York, pp. 160-172.

[11]For the appropriate formulae see: Draper, Norman, and Harry Smith 1966. Applied regression analysis. Wiley, New York, pp. 263-264; and Brownlee, K. A. 1965. Statistical theory in science and engineering. Wiley, New York, pp. 344-345.

[12]Freund, J. 1971. Mathematical statistics. Prentice-Hall, Englewood Cliffs, New Jersey, pp. 426-430.

Editor's Note: Dr. Rodabaugh and I have noticed with interest that, according to Equation 3, the age of the earth would have been estimated at about 5,600 years about 1600 A.D. Thus "the beginning" would have been set about 4000 B.C., as a straightforward reading of Genesis would seem to indicate. Now in fact, about that time most learned men, at least in Christendom, would have subscribed to some such estimate of the age; it was around that time that Ussher issued his chronology. But not long afterwards, the age of the earth began to be inflated.

It may be noticed that Equation 3 indicates an exponential increase; and another way of stating such an increase in to say that the thing concerned (here the age claimed for the earth) doubles in a certain time. The time to double can be calculated from Equation 3; and it comes to be about 20 years. It interested me very much that Dr. Gerardus D. Bouw, Ph.D. of Rochester, New York, remarked quite independently, in correspondence, that the age claimed for the earth is doubling about every 20 years.

GALAXY CLUSTERS AND THE MASS ANOMALY

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Various proposals which have been proposed to resolve the so-called "missing mass" or "mass anomaly" in galaxy clusters are reviewed here. Basically, these hypotheses can be broken down into two types of proposals: the missing mass hypotheses and the missing physics ideas. The presence of the mass anomaly has been used, in the past, in support of a young cosmos. The validity of such an approach is reviewed.

Introduction

It seems that no matter how hard secular man attempts to describe and affect his environment without reference to the Creator, there is always a vague, uneasy "something's missing" aspect to that endeavour.

This "missing" factor has manifestations in every humanistic search for truth and can be seen in many forms; from the three existential questions of philosophy—Who am I? What do I? and How be I?—to the missing links of evolutionary biology; from the missing volatiles of Mars[1] to that missing factor in each human life which many scientists deem necessary to complete that life. The Christian reader will recognize this vacuous state as the quest for Christ who is the Way, the Truth and the Life.

In this study one particular "missing" property is singled out for a more detailed look. This property is variously called the "missing mass"—by those who hold that the mass is actually present in some undetected form—or the "mass anomaly"—by those who are not sure whether there really is an undetected source of mass or whether modern physics is really applicable in it present form on such a grand scale.

The mass anomaly is made evident by estimating the total mass of a galaxy or galaxy cluster by two different methods. The first of these involves a straightforward count of the members coupled with a mass estimate for each member. The second method is based on the dynamics of the system. In practice the two mass estimates differ by factors of two or more for galaxies, but 10 to 400 for galaxy clusters.

The Problem on the Galactic Scale

The smallest systems for which this phenomenon is currently recognized is for galaxies; in particular, the Milky Way. This is not because of anything special about galaxies or their sizes so much as that the next smallest system for which comparable dynamic data exist is the solar system. For the Galaxy the two methods of estimating the mass are as follows:

(1) The number of stars per unit volume in the neighborhood of the sun is counted. These are grouped into brightness classes via the mass-luminosity function.[2] Hence, given the luminosity (intrinsic brightness),

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