A CRITICAL EXAMINATION OF RADIOACTIVE DATING OF ROCKS

SIDNEY P. CLEMENTSON*

Application of radioactive dating methods to sedimentary rocks is here considered. The basic assumption that radioactive disintegration starts when the minerals enter the host rocks is shown to be unsubstantiated. Recent research on young rocks discloses that disintegration in them is already at an advanced stage. The conclusion reached is that the theoretical ages calculated from isotope ratios are not the ages of the rocks, or of the earth but are simply ratios of the minerals themselves which originated in the crust of the earth.

The method employed to obtain the ages of sedimentary rocks using samples containing radioactive materials, is widely known. It rests entirely upon the basic assumption that when radioactive material enters the rock it consists solely of parent element, and the object is to arrive at a theoretical date when the daughter elements in the sample would be considered to have been all parent element. This date is believed to give the age of the rock.

Calculations are made from mass ratios of parent and daughter elements. When due allowances are made for known variable factors, such calculations are accurate enough to arrive at a theoretical starting point of the disintegration. But the basic assumption that this starting point corresponds to the time when the radioactive materials entered the host rock is of course fundamental, for if this is not true, then the theoretical age will bear no relationship to the age of the rock.

Facts to Be Considered

In order to establish the truth or falsity of this assumption the following facts should be considered:

Radioactive materials come originally from the crust of the earth, and with the flow of magma, sedimentary strata may be overlaid or intruded with igneous rock containing radioactive materials. No significance can be placed upon values from materials not associated with igneous rock as these must have been displaced at least once and possibly many times.

The basic assumption is built on the theory that while the radioactive material is in the earth prior to eruption, it is in a molten state. In this condition, daughter elements are constantly separated from parent elements by convection. It is also assumed that when magma flows, the parent element is separate and clean, ready to be used as a natural chronometer in regard to the rocks in which it is found. This should be carefully considered in relation to what is known about the earths crust and in light of the evidence of the rocks themselves.

Below the granite basement of the crust of the earth there is the mantle. The crust is solid and temperatures increase with depth. At levels of the mantle, the temperatures are considered to be so high that if it were not for the high pressure, the mantle material would be in a liquid state; "as it is, seismic evidence indicates that the mantle is solid throughout."[1]

While the mantle has been called solid, views have been expressed, that due to vast differences of temperature and pressure, there are slow but massive movements of the mantle over continental areas. This is indicative of the kind of forces necessary to move mantle material. That the slight differences in specific gravity of parent and daughter elements could cause convection currents is highly unlikely.

It is more likely that the daughter elements, born within the depths of the earth have been held in "close custody," and when a fissure occurs in the crust, and the surrounding pressure drops, the local rock with its minerals, becomes liquid and issues forth-parent and daughter elements together. If this conclusion is correct, then the isotope ratios will in no wise indicate the age of the host rock.

This subject should be considered also in relation to concentrations of radioactive materials at various levels of the crust. The result of tests "forces us to suppose that radioactive elements are for some reason confined solely to the comparatively thin outer layer of the crust,"[2] and that it is usually assumed that "the concentration decreases by half for each kilometer in depth."[3] On this basis we arrive at the conclusion that at a level which magma may flow, the concentration of radioactive material may be small.

If the upper layers of the crust through which the magma may flow have considerable concentrations of radioactive material, in view of the temperature of the magma, we would expect the surrounding rocks to be fused and the magma to carry with it upper subsurface rocks, together with any radioactive elements contained in them.

Specific Problematic Issues

These considerations give rise to the following questions. Does the evidence of the rocks confirm that in magma, parent element emerges alone, without daughter elements; or, does it in

*Sidney P. Clementson is a consulting engineer. He resides at 15 Marshalls Rd., Sutton, Surrey, England.

fact establish the reverse, that it is accompanied by daughter elements? Does the evidence of the rocks imply that radioactive elements laid by magma are usually from one level; or, does it rather show almost invariably that the elements in the lava stream are joined and enriched by upper subsurface elements?

The effect of enrichment can be understood in relation to the normal process of decay of a radioactive series. Assuming a given point in time with a known mass of parent element, for any predetermined period the relative mass of all the isotopes in the series can be calculated. For each length of time, the series of ratios is constant.

When in a sample the ratios of the isotopes are all found to be in accord with such a series, the isotopes are said to be in equilibrium, and it is accepted that they have developed together without disturbance. Should it be found, however, that the ratios of any of the isotopes are not in accord with a series, then the isotopes are not in equilibrium, and it is known that there has been disturbance resulting in some enrichment or fractionation of the elements.

In the use of the old lead uranium calculations any enrichment of the isotopes was not apparent for it is only when the ratios are all known that discrepancies appear. If the elements are in disequilibrium, enrichment to any extent might have taken place, and the age calculated would bear no relationship to the age of the rocks.

How many published ages of sedimentary rocks may come within this category is not known. If it were possible for research workers to make the isotope values available, there is no reason to suppose that any of the dates would stand, because (as it will be shown) there is evidence of disequilibrium and enrichment in all cases of recent research on young rocks.

Of even greater significance than the question of enrichment is the other matter raised, i.e. does disintegration commence when the minerals enter the host rock? It will be realized that if the disintegration elements are carried over into the host rock, then whether in equilibrium or not, the ratios will be in no way related to the host rock. There is one certain way of determining the truth of this matter, and this is by considering analysis of rock samples of known ages.

Research Results Analyzed

Research in the U.S.S.R. has been carried out on some 18 samples from 12 volcanoes containing radioactive materials in the U^{238} series, and the isotopes in the chain are said to be in disequilibrium. It is stated that "since the age of the rocks is small, the daughter elements U^{234} and Io^{230} must have entered the mineral bodies at the time of their genesis instead of being formed on the decay of the parent material."[4] (See Tables 1-3)

Figures are not given for some of the isotopes in the series nor for lead, and the reference to disequilibrium appears to be based largely on the U^{234}/U^{238} and the Io/U^{238} ratios. The U^{234}/U^{238} and Io/U^{238} ratios should be negligible quantities because of the relatively short half-lives for U^{234} and Io. But those ratios given are in fact appreciable. In a number of cases the U^{234}/U^{238} value is about 1.0, given in activity units. In mass units this represents approximately .000037, a ratio which would apply to an age of many millions of years. (See Table 2).

Here it will be seen that the authors are viewing the question of equilibrium from the aspect of ratios assuming the commencement of disintegration when the minerals enter the rocks. But as these rocks are young, they cannot account for the high intermediate ratios. This is of course a plain admission that these ratios are not consistent with the known age of the rock.

Research in the U.S.A. on ten samples from Faial Azores, Tristan da Cunha and Vesuvius supports this view. Here the question of the equilibrium of the isotopes is viewed frankly as based on an origin in the mantle before the flow of magma into the host rocks. It is said:

> If a region of the mantle has remained a closed system for a sufficient length of time, the isotopes in the Uranium decay series will be in secular equilibrium. During the melting process which produces a magma, the condition of secular equilibrium will be upset by any chemical fractionations which take place involving the members of the decay chain. If co-existing phases are in isotopic equilibrium when a magma is formed from a region in secular equilibrium prior to melting, we may use any observed radioactive disequilibrium in the resultant igneous rock to study chemical fractionations.[5]

It is clear from this that any attempt here to calculate an age of the rock from isotope ratios, would result in a completely false answer. Since all radioactive materials that become involved in sedimentary rock, must similarly flow with magma, the answer in all cases would be equally false.

In this research, figures are given for lead in addition to the other isotopes and consequently it is possible to calculate a theoretical age from this. From the data given, the Pb^{206}/U^{238} ratios in mass units can be obtained. The minimum value is 0.84 which represents an age of over 5,000 million years. **This, it should be noted, is a calculated age for rocks which are known to be quite young.** (See Tables 2 and 3)

TABLE 1

Equilibrium Tables-Uranium 238 Series

YEARS	U238	U234	I230	R226	R222	R210	Pb206
100	0.9999999	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
200	0.9999999	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
400	0.9999999	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
800	0.9999998	0.0000001	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
1,600	0.9999997	0.0000002	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
3,200	0.9999995	0.0000004	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
6,400	0.9999990	0.0000009	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
12,800	0.9999980	0.0000018	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
25,600	0.9999960	0.0000036	0.0000001	0.0000000	0.0000000	0.0000000	0.0000000
51,200	0.9999921	0.0000070	0.0000006	0.0000000	0.0000000	0.0000000	0.0000001
102,400	0.9999842	0.0000127	0.0000021	0.0000000	0.0000000	0.0000000	0.0000008
204,800	0.9999685	0.0000211	0.0000059	0.0000001	0.0000000	0.0000000	0.0000043
409,600	0.9999370	0.0000302	0.0000120	0.0000002	0.0000000	0.0000000	0.0000203
819,200	0.9998741	0.0000359	0.0000169	0.0000003	0.0000000	0.0000000	0.0000726
1,638,400	0.9997482	0.0000372	0.0000181	0.0000003	0.0000000	0.0000000	0.0001960
3,276,800	0.9994965	0.0000372	0.0000181	0.0000003	0.0000000	0.0000000	0.0004476
6,553,600	0.9989934	0.0000372	0.0000181	0.0000003	0.0000000	0.0000000	0.0009507
13,107,200	0.9979878	0.0000372	0.0000181	0.0000003	0.0000000	0.0000000	0.0019564
26,214,400	0.9959797	0.0000371	0.0000181	0.0000003	0.0000000	0.0000000	0.0039646
52,428,800	0.9919757	0.0000369	0.0000180	0.0000003	0.0000000	0.0000000	0.0079688
104,857,600	0.9840158	0.0000366	0.0000179	0.0000003	0.0000000	0.0000000	0.0159292
209,715,200	0.9682871	0.0000360	0.0000176	0.0000003	0.0000000	0.0000000	0.0316587
419,430,400	0.9375800	0.0000349	0.0000170	0.0000003	0.0000000	0.0000000	0.0623676
838,860,800	0.8790563	0.0000327	0.0000160	0.0000003	0.0000000	0.0000000	0.1208945
1,670,000,000	0.7727400	0.0000288	0.0000140	0.0000002	0.0000000	0.0000000	0.2272168
3,350,000,000	0.5971271	0.0000222	0.0000108	0.0000002	0.0000000	0.0000000	0.4028394

Table 1. This table contains a rundown of the Uranium 238 series on the computer. These data are useful in calculation of the equilibrim ratios—see Table 2. If a certain crystal were all U-238 at time zero (formation of the crystal), each line in Table 1 indicates the fraction of each nuclide of the U-238 decay series that would be present after the given interval of time had elapsed.

TABLE 2

Equilibrium Ratios

YEARS	U^{234}/U^{238}	Pb^{206}/U^{238}	Pb^{208}/Th^{232}
100,000	.000013	.00000	.00000
410,000	.000030	.000020	.00002
1,690,000	.000037	.000200	.00008
6,550,000	.000037	.001000	.00032
26,200,000	.000037	.004000	.00130
52,400,000	.000037	.008000	.00260
104,900,000	.000037	.016000	.00520
210,000,000	.000037	.033000	.01040
420,000,000	.000037	.066000	.02070
840,000,000	.000037	.138000	.04100
1,680,000,000	.000037	.294000	.08300
3,360,000,000	.000037	.675000	.16600
6,710,000,000	.000037	1.805000	.33000

Table 2. Data such as those illustrated in Table 1 are here presented as ratios between the various nuclides in the U-238 decay series.

TABLE 3
Research Figures

U.S.S.R.		U.S.A.					
Sample	U^{234}/U^{238}	Sample	Pb^{206}/Pb^{204}	Pb^{207}/Pb^{204}	U^{238}/Pb^{204}	Pb^{208}/Pb^{204}	Th^{232}/U^{238}
1	1.12	TR230	18.50	15.78	17.87	39.42	4.26
2	1.11	TR232	18.63	15.75	17.7	39.52	4.23
3	1.17	TR516	18.74	15.74	20.50	39.62	3.84
4	1.04	TR518	18.46	15.85	15.91	39.48	4.44
5	1.00	TR627	18.67	15.78	22.18	39.68	4.33
6	.91	VES	19.14	15.78	12.6	39.48	3.02
7	.49	MAF I	19.36	15.81	14.19	39.59	3.57
8	.45	MAF II	19.36	15.84	16.50	39.53	3.94
9	1.07	MAF III	19.41	15.87	15.31	39.72	3.59
10	1.0	MAF IV	19.36	15.84	13.21	39.67	4.04
11	1.35						
12	1.0						
13	1.36						
14	.97						

U^{234}/U^{238} ratio from sample 5 above calculated:
Ratio in activity units = 1.0 multiply activity units by half lives to obtain mass units.

$$1.0 \times \frac{2.5 \times 10^5}{4.5 \times 10^9} = .000054$$ (See Tables 1 and 2)

This is higher than maximum equilibrium value at .000037 for approx. 100 million years.

Pb^{206}/U^{238} ratio from sample TR627 above calculated: $\frac{Pb^{206}}{Pb^{204}} \times \frac{Pb^{204}}{U^{238}} = 18.67 \times \frac{1}{22.18}$

$\frac{18.67}{22.18} = .84$. (See equilibrium tables, Table 1 and Table 2)

Theoretical age over **5,000 million years.** Minimum of all samples.

Pb^{207}/Pb^{206} ratio from sample MAF I above calculated: $\frac{Pb^{207}/Pb^{204}}{Pb^{206}/Pb^{204}}$

$15.81/19.36 = 0.81$

Theoretical age over **3,000 million years.**

Pb^{208}/Th^{232} ratio from sample TR230 above calculated:

$$= \frac{Pb^{208}}{Pb^{204}} \times \frac{Pb^{204}}{U^{238}} \times \frac{U^{238}}{Th^{232}}$$

$$= \frac{39.42}{17.87} \times 4.26 = 0.52$$ (See Table 2)

Using approx. Thorium age formula age $= 2.01 \times 10^{10} \times (Pb^{208}/Th^{232})$
$= 2.01 \times 10^{10} \times .52 =$ **10,500 million years.**

Table 3. Data are presented here from References 4 and 5. These calculations show that the radioactive materials in the U-238 series are in disequilibrium. Since these are known to be recent volcanic deposits, it is quite evident that samples may be contaminated with daughter elements from the very start and that the "ages" calculated from such ratios are open to serious question. Thus from these recent volcanic deposits one might variously calculate "ages" of anywhere from 100 million to 10,500 million years!

Values of Pb^{207} are also given and this provides the facility to obtain a theoretical concordant age, by the use of $Pb^{207}/^{206}$ ratios. These are expected to be something like 0.05 for young rock, but to reach unity for rocks 3,000 million years old (See Table 3). In this case the values in the samples are all above 0.8, which confirms the conclusion: the ratios of the minerals are not those developed from the parent in the rock, but are the ratios of the minerals in the mantle of the earth.

Concordant Ages Misleading

Derivation of concordant ages is usually thought to be a confirmation of the reliability of the ages obtained for the host rock. But as it has been shown that the ratios are carried over from the mantle, it will be understood that instead of confirming the ages of the rocks, concordant ages provide a powerful confirmation that ratios are carried over from the mantle. Where samples are taken from common sources, the ratios of all the isotopes will of course give

concordant theoretical ages.

A further theoretical age can be obtained for these young rocks with the thorium ratio, i.e., Pb^{208}/Th^{232} (See Table 3). This gives an age of a mere 10,500 million years!

The same facts are derived from attempts to date rocks by the potassium-argon method. Research in this field has been carried out in Hawaii on volcanic rocks, and a number of comments are made about what are called "old age anomalies" caused by "excess argon." It is reported that many of the samples from the Hawaiian Islands contain excess radiogenic argon, and that the ages for rocks containing them "are apparent only, and not derived from potassium *in situ*. Radiogenic argon was incorporated either during primary crystal growth, or during secondary crystallization."[6]

G. H. Curtis writing on the same problem says:

> On theoretical grounds one might expect to find many more cases of the presence of noticeable amounts of Ar^{40} in igneous rocks than so far have been detected. Magmas formed at depths of 50 to 100 kilometers are under sufficient confining pressures to keep significant quantities of old radiogenic argon in solution. ? ? Argon that has been formed from K^{40} decay deep within the earth. Crystals growing in this environment should incorporate some of this argon into their lattices even though argon is inert.[7]

In the case of previously calculated ages, where the real ages were unknown, though presumed to be old, these anomalies apparently were not noticed. But in the case of rocks which were known to be young, it was very obvious that the ages calculated had no relationship to the true ages.

An article by P. M. Hurley[8] is important as it is still used as an argument favoring great ages for earth deposits. The paper deals with dating by radioactivity in the usual manner but the whole conception of time clocks is based upon the assumption that the parent radioactive element enters the sample rocks alone—that it is not accompanied by any of the decay elements acquired in the mantle.

Recent research upon young rocks of known ages challenges this assumption. Isotopic ratios indicated that even "young" volcanic deposits are at an advanced stage of decay, giving theoretical "ages" of thousands of millions of years (Table 3). This refutes the basic assumption of Hurley and means that the dates are not just marginally wrong, but wrong *en toto.*

Conclusion

The conclusion which can be drawn from these facts, which applies equally to dating of all mineral bearing rocks, is that calculated ages give no indication whatever of the age of the host rocks. In cases where calculated ages are millions of years, the rocks could be quite young.

Furthermore, these ages have no relationship to the age of the earth, because of course, the various ages computed have varied so widely. Consequently ratios of parent and daughter elements are merely ratios, and their use as a base for projecting "ages" of the rocks, or of the earth itself, is highly questionable and fraught with many assumptions that cannot be checked.

This conclusion would fit the concept of a young earth and a recent creation as deduced from the Bible.*

*EDITOR'S NOTE: The reader will find that a whole series of articles dealing with flaws in radioactive dating assumptions has been published in previous issues of *Creation Research Society Quarterlies.* D. O. Acrey dealt with basic inconsistencies and unknowns in various radioactive methods [1(3):7-9, Jan. 1965]. Problems in radiocarbon C^{14} dating have been analyzed by several authors: Harry V. Wiant, Jr. [2(4):31, Jan. 1966], Robert Wood [2(4):24-27, Jan. 1966], Harold Armstrong [2(4):28-30, Jan. 1966], R. H. Brown [5(2):65-68, Sept. 1968], and two articles by Robert L. Whitelaw [7(1):56-71, 83, June 1970 and 5(2):78-831. In these last two articles, Robert Whitelaw establishes that radiocarbon studies actually confirm a Bible-based chronology rather than negating it. Melvin A. Cook has shown that the rate of formation of C^{14} is significantly greater than the rate of its decay—a disequilibrium which argues for a recent creation and a collapsed time-scale [5(2):69-77, Sept. 1968 and 7(1):53-56, June 1970]. Gross uncertainties and problems with the potassium-argon dating methods have been demonstrated by Robert L. Whitelaw [5(2):78-83, Sept. 1968, and 6(1):71-73, June 1969]. Diligent study on the part of these and other creationists had produced much ammunition against the evolutionary time-scale which so many people believe to be factual or unassailable. Thus the present paper by Sidney P. Clementson becomes an important treatise demonstrating that radioactive "dates" bear no relationship to the ages of rocks which are known to be quite young. Readers will find that back volumes of C. R. S. *Quarterlies* may be purchased from the Membership Secretary—Prof. Wilbert Rusch, Sr., 2717 Cranbrook Rd., Ann Arbor, Michigan 48104.

References

[1]Mason, Brian. 1958. Principles of geochemistry. Wiley & Sons, Ltd., New York, p. 33.

[2]Gamow, George. 1959. Biography of the earth. Macmillan & Co., Ltd., London. p. 112.

[3]*Ibid.*, p. 114.

[4]Cherdyntsev, V. V., G. I. Kislitsina and V. L. Zverev. 1967. Isotopic composition of uranium and thorium in rocks and products of active volcanicism. Geological Institute. Academy of Sciences. U.S.S.R. Earth Science Section, 172:178.

[5]Oversby, V. M. and P. W. Gast. 1968. Lead isotope compositions and uranium decay series disequilibrium recent volcanic rocks. Earth and Planetary Science Letters (5). North Holland Publishing Co., Amsterdam, p. 199.

[6]Funkhouser, J. G., I. L. Barnes, and J. J. Naughton. 1966. Problems of dating volcanic rocks by the potassium-argon method. Bull. Volcan., 29:709.

[7]Curtis, G. H. 1966. The problem of contamination in obtaining accurate dates of young geologic rocks. Springer Verlag, Berlin, p. 155.

[8]Hurley, P. M. 1949. Radioactivity and time, *Scientific American,* August.