

Isaac Exchange

RATE Responds to the Isaac Essay Review

Randy Isaac published an essay review on *Radioisotopes and the Age of the Earth, Vol. II* in the June 2007 issue (pp. 143–6). The members of the RATE group who conducted the research and published this work representing the Institute for Creation Research and the Creation Research Society appreciate the thoroughness with which Isaac reviewed our report and his investment of time. However, we disagree with his accusations of deception and lack of integrity in claiming that our data affirm a young earth. Thank you for allowing us to defend ourselves against these charges and briefly respond to some of the more serious technical issues he raised.

Although our research on radioisotopes and the age of the earth is a work in progress, we discovered several major evidences for *accelerated nuclear decay* during the eight-year project, and therefore we felt justified reporting them as we did. Even though a full understanding of the mechanism of accelerated decay is not yet complete, we wanted to encourage others that the apparent conflict between the billions of years of earth history commonly espoused by conventional science and the thousands of years declared by Scripture seems to be resolvable. We were careful to point out not only the evidence that supports our theory of accelerated decay, but to also state explicitly where we still had problems and shortcomings. To accuse the RATE group of deception and lack of integrity for concluding that the earth is young based on our evidence is like requiring Isaac Newton to delay publishing his law of Gravity because he could not explain the mechanism of gravitational attraction. We believe the rate of helium diffusion from zircons, the presence of polonium radiohalos near uranium radiohalos in granite, the discordance of isochron dates among multiple conventional dating methods, and the presence of measurable concentrations of carbon-14 in coal and diamonds as explicated in our book provide strong evidence for a young earth. To weakly assert the significance of this evidence would not only do a great disservice to Christians but also to the advancement of science.

In response to Isaac's specific technical criticisms of the RATE research, we encourage the reader to find the details in our reports and evaluate for themselves if we have presented evidences that are "... not based on any accepted scientific methodology" and "... are not reliable for dating" (p. 145). The methods in our report are widely used for dating of rocks and minerals. Our report carefully applies accepted geochronological practices, discovers new evi-

dence for rapid nuclear decay, points out inconsistencies in conventional interpretations, and calculates alternative, young-earth dates. We address most of the criticisms which he raises in detail either in our book or in published research reports and show that they are invalid. For example, his criticism that our helium diffusion measurements made for zircon crystals in a laboratory vacuum do not apply to high-pressure conditions found underground is refuted in Humphrey's article, *Helium Evidence for A Young World Overcomes Pressure*, www.trueorigin.org/helium02.asp. The bottom line is that external pressure has practically no effect on diffusion rates in crystals when they are hard. Zircons are some of the hardest crystals known. Diffusion rates in our zircons were influenced far less than one percent by removing them from underground pressures to a vacuum chamber.

Isaac made the statement that "*the presence of uranium also seems to provide a reasonable explanation for the source of the polonium and polonium halos with normal decay rates and standard ages of granite*" (p. 144). He apparently does not recognize that below the annealing temperature of 150°C, hydrothermal convective systems can only last for a short time. Laboratory observations show that water below that temperature will flow through the biotite for only a few months, certainly not for millions of years. Uniformitarian rates of decay in a uranium halo fall vastly short of producing the hundreds of millions of water-transported polonium atoms needed to make a fully-developed polonium halo, particularly for polonium-214 and polonium-218 radiohalos. Because of their extremely short half-lives, on the order of days to months, only accelerated decay will work.

In his critique of the chapter, Do Radioisotope Clocks Need Repair? Isaac faults the authors, "... they fail to explain why there are so many cases where there is good concordance of isochrons ..." (p. 144). Again, he says the RATE authors, "... fail to invalidate the vast amount of concordance" (p. 144). Isaac needs to provide documentation from technical literature where *vast amount of concordance* is established. Does he have examples of concordant isochrons between U-Pb, Sm-Sr, Rb-Sr and K-Ar in suites of earth rocks? If he has such documentation of a vast amount of concordance, he could easily trivialize the RATE researcher's statements about discordant isochrons. If Isaac could provide this documentation, he would have one of the strongest arguments in favor of the accuracy of radioisotope ages. Good scholarship and scientific integrity require documentation of such statements.

The RATE group shows large *discordances* in isochron estimates of the age of rocks and minerals to be normative and as large as factors of two or three in some cases, much larger than the 15% Isaac stated in his review. These discordances were far outside the usual statistical confidence limits. We believe such common mismatches show

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large differences in decay rates depending on decay type and atomic weight. These consistent trends may be hints of a mechanism of accelerated decay. The large discrepancies invalidate the usual isochron ages, requiring an extensive overhaul of the conventional analysis to account for variable decay rates.

The basic argument for a young earth from the presence of carbon-14 in coal and diamonds is that they cannot be older than about 50,000 years even using uniformitarian assumptions about the concentration of atmospheric carbon-14. These dates are young compared to the millions or billions of years conventionally assumed. Isaac's criticism of circular reasoning in estimating a biblical age of 5,000 years does not apply to our basic premise. His concerns about contamination were considered in our reported results by subtracting an experimentally-determined standard background from the measurements. *Contamination* becomes unlikely when one considers that roughly the same amount of radiocarbon has been reported in over seventy published measurements of fossil carbon from a wide variety of materials, depths, and sites all over the world. His alternative hypothesis for the presence of carbon-14 due to the interaction of neutrons with nitrogen impurities in diamonds would require a neutron flux four orders of magnitude higher than the largest fluxes observed deep underground, as we pointed out on pages 614–6.

We believe the four primary evidences for accelerated decay stand on their own merit. This does not mean that we have solved all the problems, far from it. The primary concern openly admitted by the RATE group is the disposal of the large amount of heat if the decay processes were multiplied by a factor of one million or so during the Flood. We discussed this frankly and suggested at least one possible solution—cosmological cooling. There are other problems such as the radiation problem and the exact explanation of the mechanism of accelerated decay. Isaac stated that we assumed that “C-14 did not have an accelerated decay constant while heavier nuclei did” (p. 145). What we assumed was that the C-14 decay would not be accelerated as much as heavier elements. This assumption is supported by more recent research which shows that variation in the strength of the nuclear force would not affect the C-14 nucleus as much due to weak or nonexistent pairing forces in light nuclei such as C-14 (Chaffin, paper submitted to the 2008 International Conference on Creationism). We discussed some of these issues and problems in great detail in our book and offered suggestions on several others.

Rather than name calling and putting down quality scientific progress because we have not answered all of the questions, we would encourage Isaac and the ASA to recognize good science when it occurs and join us in advancing research on the problems yet to be overcome.

Since reporting the RATE results, we have been encouraged to hear of work being done in various university and government laboratories on accelerated decay, particularly as applied to the disposal of radioactive waste. It would be a feather in the cap of Christian scientists of all stripes if we were to make a contribution to such an important topic as the age of the earth. We could claim a more accurate understanding of earth's history and contribute to advances in conventional science and its applications. And, most importantly, we could increase confidence in the Word of God. Will you not join us?

The RATE Group

Larry Vardiman, Andrew A. Snelling, Eugene F. Chaffin, Steven A. Austin, D. Russell Humphreys, Donald B. DeYoung, Steven W. Boyd

Isaac Replies

We share with the RATE team the fundamental belief in the doctrine of creation and we unite with them in worshipping God our Creator. We agree that an accurate study of God's book of nature will reveal a story of the creation that is complementary and not contradictory to the inspired book of Scriptures. As an important step toward quality in such a scientific endeavor, we encourage the RATE team to ensure that all work is published in relevant peer-reviewed technical literature prior to being publicly claimed as a scientific result. Henry Morris, Jr., writing in an appendix to the introduction in the RATE Vol. II report, deems it sufficient to obtain reviews from those pre-selected to be committed to a young-earth conclusion.¹

Christian leaders from St. Augustine to contemporary evangelical theologians have maintained that there is no clear teaching of the age of the earth in the Scriptures. Christians who agree on the reliability of the Bible can differ on their estimates of the age of the earth as inferred from the Bible. We should distinguish between the clear *teachings* of Scripture and *inferences* which we may draw from biblical texts.

The interested reader is invited to peruse the technical geochronology literature which addresses the key scientific issues raised by the RATE team. Space permits us to reference only a few examples.

The high sensitivity of noble gas diffusion in solids to many factors, particularly grain size and structural phase, is addressed by McDougall and Harrison.² They attribute a two order of magnitude higher diffusivity in vacuum measurements to early phase breakdown during heating. In a method known as zircon (U-Th)/He thermochronometry, it is possible to determine the rate at which helium is produced in a zircon from alpha-emitting radioactive elements. The time since a zircon cooled to the closure temperature, when helium outdiffusion became

negligible, can be calculated from the measured helium concentration. This averts the need to know the specific diffusivity of helium except to estimate the value of the closure temperature. The results are consistent with standard ages of zircons.³

The RATE team uses a very different diffusion dating method based on the amount of helium that is lost. They assume an initial helium concentration derived from Gentry's estimated retention factors⁴ and calculate how long it would take, if there were no further alpha decay, for the concentration to decrease to the current level. However, the diffusion equations tell us that the helium concentration will only increase and not decrease unless there is an increase in temperature. The RATE team model does not describe physical reality and the results are irrelevant. To assess what they call a uniformitarian model, they assume the zircons are in a steady-state condition. However, age information cannot be extracted directly from a steady-state condition since values are not changing with time. The RATE team inserts 1.5 billion years into their steady-state condition Eq. 16⁵ and the results are physically meaningless. The proper mathematical treatment of helium generation and diffusion in a mineral has been reported in the literature⁶ and the results are consistent with standard ages. Helium diffusion in zircons does not indicate a young earth but provides strong evidence for an old earth.

Studies of radiohalos have not been widely reported in the peer-reviewed literature since Gentry documented them in the 1960s and 1970s. Though there remain unexplained phenomena connected with these halos, there does not appear to be an unsolvable contradiction with accepted ages of granite. Polonium halos have only been found in granite that also contain myrmekite and not in magmatic granite without myrmekite.⁷ Though there is no scientific consensus in the literature about the formation of granite containing myrmekite, unpublished work by Collins indicates the plausibility of explanations for these halos with standard ages.⁸

The isochron methodology and abundant data are reported, for example, by Dalrymple,⁹ who cites more than 250 measurements of terrestrial, lunar, and meteoric rocks with excellent concordance. These data include both isochron and non-isochron techniques and demonstrate consistency among all techniques. The RATE team acknowledges in its report that there is a high degree of concordance in measurements of meteorites.¹⁰ This alone confirms the validity of this dating technique.

The discordances claimed by the RATE team in terrestrial rocks are not unexpected in light of the thermal history and environmental exposure of the selected samples. Each of the radioactive decay systems measures a different point in the thermal history of the rock. Concordance is expected only where those thermal points

coincide. Some systems such as Rb-Sr are more sensitive to environmental exposure than others like U-Pb. Discordant measurements are therefore common while the high degree of concordance documented by Dalrymple offers ample verification to meet the RATE team's criterion.

The carbon-14 levels that Baumgardner claims to find in ancient coal and diamonds show significant variation from sample to sample, suggesting contamination. Virtually all of the previous literature cited by Baumgardner are studies of AMS instrument sensitivity and calibration. More details are discussed in an adjacent letter by Kirk Bertsche. There is no basis for concluding that these radio-carbon signals indicate any age of the samples.

The idea that radioactive decay rates have been significantly different in the past is strongly contradicted by experimental data and theoretical analysis.¹¹ The RATE team has provided no direct evidence for a change in decay rates. They note the evidence for a massive amount of radioactive decay, particularly based on fission track data, and postulate accelerated decay rates to accommodate the idea of a young earth.

The RATE team has honestly acknowledged that even if their technical claims were accurate, there remain unsolved problems that cannot be reconciled with any known scientific process. In his summary at the RATE conference in Denver on Sept. 15, 2007, Don DeYoung noted the need to invoke divine intervention in order to circumvent these problems. However, the oft-stated summary by the RATE team, that their results provide assurance of the biblical interpretation of a young earth, leaves the average listener with the mistaken impression that these problems are nonexistent, trivial, or soon to be resolved. Rather, the RATE team acknowledged overwhelming evidence for hundreds of millions of year's worth of radioactivity¹² and admitted that compressing this activity into a few thousand years would generate more than enough heat to vaporize all granitic rock.¹³ They state that no known thermodynamic process could dissipate such a large amount of heat.¹⁴ Their expressed hope in solving heat dissipation by cooling via enhanced cosmological expansion¹⁵ has not been realized and is not consistent with our knowledge of the expanding universe.¹⁶ Thus, the RATE team has provided solid evidence that, scientifically, the earth cannot be thousands but must be billions of years old.

Notes

- ¹L. Vardiman et al., *Radioisotopes and the Age of the Earth 2* (Institute for Creation Research, 2005), 24.
- ²I. McDougall and T. M. Harrison, *Geochronology and Thermochronology by the ⁴⁰Ar/³⁹Ar Method*, 2d ed. (Oxford: Oxford University Press, 1999), 143-54.
- ³P. W. Reiners, "Zircon (U-Th)/He Thermochronometry," *Reviews in Mineralogy and Geochemistry* 58, no. 1 (January 2005): 151-79.
- ⁴R. V. Gentry, *Geophysical Research Letters* 9, no. 10 (October 1982): 1129-30.
- ⁵Vardiman, *Radioisotopes and the Age of the Earth 2*, 53.

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⁶R. A. Wolf, K. A. Farley, and D. M. Kass, "Modeling of the Temperature Sensitivity of the Apatite (U-Th)/He Thermochronometer," *Chemical Geology* 148 (1998): 105–14.

⁷C. W. Hunt, L. G. Collins, and E. A. Skobelin, *Expanding Geospheres, Energy and Mass Transfers from Earth's Interior* (Calgary: Polar Publishing, 1992).

⁸L. G. Collins, www.csun.edu/~vcgeo005/creation.html

⁹G. Brent Dalrymple, *The Age of the Earth* (Stanford, CA: Stanford University Press, 1991)

¹⁰Vardiman, *Radioisotopes and the Age of the Earth*, 465.

¹¹V. V. Flambaum, "Variation of Fundamental Constants: Theory and Observations," http://arxiv.org/PS_cache/arxiv/pdf/0705/0705.3704v2.pdf; and J. P. Uzan, "The Fundamental Constants and Their Variation: Observational and Theoretical Status," *Review of Modern Physics* 75 (2003): 403–55.

¹²Vardiman, *Radioisotopes and the Age of the Earth*, 284.

¹³*Ibid.*, 183.

¹⁴*Ibid.*, 763.

¹⁵*Ibid.*, 184.

¹⁶Glenn Morton and George L. Murphy, "Flaws in a Young-Earth Cooling Mechanism," *Reports of the National Center for Science Education* 24, no.1 (2004): 31–2.

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Intrinsic Radiocarbon?

I am concerned that readers may come away from Robert Rogland's recent article¹ with mistaken impressions about radiocarbon and nuclear decay rates. Rogland suggests that an increase in nuclear decay rates over time could account for "residual radiocarbon" in "radioactively dead" samples, though he puts "little stock in the hypothesis." I concur with Rogland's skepticism; there is no scientific support (either theoretical or experimental) for the notion that the decay rate of radiocarbon has changed with time.

So what should we make of RATE's claims of "intrinsic radiocarbon," which they claim is inconsistent with "the uniformitarian assumption of time-invariant decay rates"?² They present two classes of data. First is a set of ninety previously published radiocarbon AMS dates of old samples (most >100k years). Second is a set of new samples that they collected and sent to a leading radiocarbon AMS laboratory for analysis. In both cases, I am convinced that their "intrinsic radiocarbon" is nothing more than contamination and background.

Modern radiocarbon dating by AMS is a complex process with numerous potential sources of contamination. Furthermore, the instrument itself always introduces a background (similar to most other high-sensitivity analytical instruments).³ A sample originally containing absolutely no radiocarbon will still give a nonzero measurement due to these contributions.

Baumgardner's first class of data is a set of previously published radiocarbon AMS dates. He has selectively divided these into two groups: Precambrian geological samples and Phanerozoic biological samples. His geological samples have a mean radiocarbon content of 0.06 pMC (percent modern carbon) and the biological samples, a content of 0.29 +/- 0.16 pMC. He concludes that all biological material contains intrinsic radiocarbon (and suggests the same of all geological carbon). But he fails to note that all of these geological samples are actually of geological *graphite*, so did not undergo the combustion and graphitization required for the biological samples. Many of Baumgardner's references document controlled tests to characterize the contamination introduced by this sample chemistry (including two re-processed geological samples that he omitted from his analysis).⁴ Sample chemistry is shown to add from 0.1 to 0.7 pMC, highly dependent on sample size and procedure. It is clear that the main difference Baumgardner sees between geological and biological samples is simply laboratory contamination introduced by sample chemistry. Further, the radiocarbon content of his geological samples of <0.1 pMC is in good agreement with the instrument backgrounds characterized in many of his references. These previously published dates give no evidence of intrinsic radiocarbon.

Baumgardner's second class of data consists of samples that the RATE team collected and sent to a leading radiocarbon AMS laboratory for analysis. This includes a set of 10 coal samples (0.10 to 0.46 pMC) and later, a number of diamond samples. The measurements showed large variations, suggesting contamination. Both materials are problematic in general.

Coal is easily contaminated *in situ* by the mobile humic acids that are generally present, and potentially by biological activity, natural uranium content and cosmic rays.⁵ It is also possible that the samples were contaminated while stored in a DOE geology lab refrigerator.⁶ Geology labs often have elevated levels of radiocarbon due to tracer studies, neutron activation studies, and dust from uranium-bearing rocks. Carbon is highly mobile and contamination can spread through an entire lab and persist for decades.⁷

With extreme care and specialized techniques, anthracite coal has been measured with an apparent age of more than 75,000 years (<0.01 pMC), the detection limit of the procedure.⁸ Diamond is difficult to combust, but unprocessed diamond has been measured by AMS as low as 0.005 pMC.⁹ This is claimed to be the instrument background, a claim supported by the fact that samples yielding higher ion source currents also gave older dates, indicating that the measured carbon did not actually come from the sample itself. This provides clear evidence that coal and diamond exist which do not contain measurable radiocarbon. The RATE claim that all carbonaceous

material contains intrinsic radiocarbon is not supported by the data.

Notes

- ¹R. Rogland, "Residual Radiocarbon in an Old-Earth Scenario," *Perspectives on Science and Christian Faith* 59, no. 3 (2007): 226–8.
- ²J. Baumgardner et al., "Measurable ¹⁴C in Fossilized Organic Materials: Confirming the Young-Earth Creation-Flood Model," in *Proceedings of the Fifth International Conference on Creationism*, ed. R. L. Ivey, Jr. (Pittsburgh, PA: Creation Science Fellowship, 2003), 127–42. www.globalflood.org/papers/2003ICCC14.html
- ³R. E. Taylor and J. Southon, "Use of Natural Diamonds to Monitor ¹⁴C Instrument Backgrounds," *Nuclear Instruments and Methods B* 259 (2007): 282–7.
- ⁴See, for example, M. Arnold et al., "¹⁴C Dating with the Gif-sur-Yvette Tandem Accelerator: Status Report," *Nuclear Instruments and Methods B* 29 (1987): 120–3; K. van der Borg et al., "Precision and Mass Fractionation in ¹⁴C Analysis with AMS," *Nuclear Instruments and Methods B* 123 (1997): 97–101.
- ⁵P. Grootes, "Carbon-14 Time Scale Extended: Comparison of Chronologies," *Science* 200 (1978): 11–15; and D. Lowe, "Problems With the Use of Coal as a Source of ¹⁴C-Free Background Material," *Radiocarbon* 31 (1989): 117–20.
- ⁶Baumgardner et al., "Measurable ¹⁴C in Fossilized Organic Materials."
- ⁷P. Zermeño et al., "Prevention and Removal of Elevated Radiocarbon Contamination in the LLNL/CAMS Natural Radiocarbon Sample Preparation Laboratory," *Nuclear Instruments and Methods B* 223–224 (2004): 293–7.
- ⁸Grootes, "Carbon-14 Time Scale Extended: Comparison of Chronologies."
- ⁹Taylor and Southon, "Use of Natural Diamonds to Monitor ¹⁴C Instrument Backgrounds."

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Poe Exchange

Historically Inaccurate and Seriously Misleading Argument

"From Scientific Method to Methodological Naturalism: The Evolution of an Idea" (Harry L. Poe and Chelsea R. Mytyk, *PSCF* 59 [2007]: 213–8) presents a discussion of methodological naturalism as a very recent development in thought about science and scientific method. The discussion is framed primarily in philosophical terms, and the general tenor of the authors' argument is that "methodological naturalism" is an unnecessary *addition* to the general principles of scientific method and could just as well be dispensed with.

The authors' argument is *historically inaccurate* and seriously *misleading* in respect to essential issues in science.

It also *rests on and supports* an extremely naive view of "scientific method," one that taken to its logical extreme would imply that all sorts of methods of inquiry and argument have an equally valid claim to be regarded as "science." Although the authors mention neither "intelligent design" in biology, nor "creation science" in relation to modern physical science, it is clear to any thoughtful reader that their argument tends to support the idea that such alternatives are (in principle) equally valid approaches to science. It is not clear how far the authors themselves might go in actually supporting these or other specific alternatives, but this only illustrates the deceptive and insidious effect of making philosophical arguments about science without reference either to the history of science or to the specific scientific questions entailed.

I make no particular issue out of defending "methodological naturalism" in the context of most contemporary debate about the term. However, the effort of Poe and Mytyk to present the idea as though it were a recent and unnecessary addition to "scientific method" is completely inaccurate historically. What we today call *physical science* has its origins in an approach to understanding the physical world championed by Robert Boyle, Isaac Newton, and their seventeenth-century contemporaries, which they called "*the mechanical philosophy*." Since these men (especially Boyle) held clear and explicit theological views about God's sovereignty and agency in creation, it is obvious their advocacy of *mechanical philosophy* was purely "methodological" — specifically, as an approach to physical science. In a long article published in *PSCF* (March 2002),¹ I presented an extended discussion of the theological context legitimizing such a naturalistic approach to science. Part of my purpose in doing so was to anchor this "naturalism" by affirming its continuity and coherence with the point of view taken by Boyle in relation to physical science. I cannot develop these arguments here, but I think for the sake of historical accuracy alone, Poe and Mytyk ought to have been aware of their force and connection with the scientific past.

The authors' argument is also seriously *misleading* in respect to the effectiveness and success of "naturalism" in the approach of physical science to explaining the physical world. Over more than three centuries, firm adherence to this "naturalism" as a basis for application of the scientific method to physical phenomena has spectacularly succeeded in understanding the physical world. Alternative approaches based on "non-naturalistic" assumptions have *never* done so. Since that is the case, it is specious and misleading to conduct a purely philosophical discussion (as Poe and Mytyk do) suggesting that "methodological naturalism" is really irrelevant to the success of physical science. As someone has said in relation to recent generic attacks on methodological naturalism by some Christian writers, *if it isn't broken, don't fix it!*