Radiometric dating and old ages in disarray

A review of
Radioisotopes and the Age of the Earth, Volume II: Results of a Young-Earth Creationist Research Initiative
Edited by: Larry Vardiman, Andrew A. Snelling and Eugene F. Chaffin
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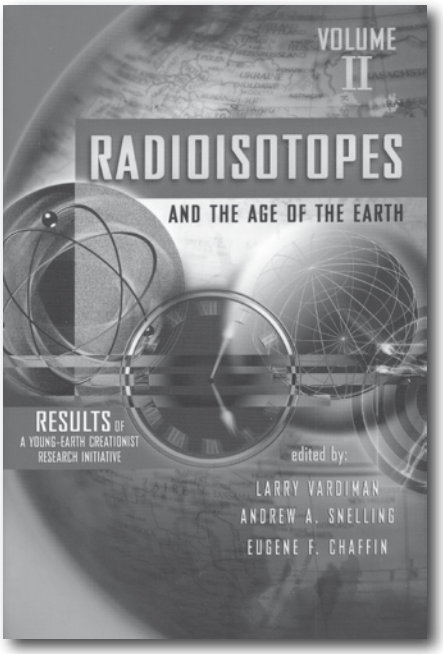

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The long-awaited results of an eight-year, $1.25 million research project have finally been published by the RATE group. RATE stands for radioisotopes and the age of the earth, and was a joint project between the Institute for Creation Research (ICR) and the Creation Research Society (CRS). This review will cover volume II of the technical RATE book. The RATE group presented their findings to an audience of about 2,000 people in El Cajon, California, on 5 November 2005. A DVD of the event is now available.[1]

Volume I of RATE was published in 2000 as an introduction and outline of the research plan.[2] Volume II does not supersede the first volume; there is much background information on radiometric dating. The 100-page glossary at the end of volume I is needed for the non-specialist to digest volume II.

A popular level book by Don DeYoung and a popular-level DVD, both titled *Thousands ... Not Billions*, cover the main results.[3,4] These publications are a little heavy for the layman, but the layman can still understand the basics of the important results of the RATE project. In the DVD, Humphreys shows a lucid animation of only 6,000 years of helium leakage out of zircons while 1.5 Ga of radioactivity transpired. Baumgardner's carbon-14 results were also well animated.

Introduction

Biblical creationists have long realized that the millions and billions of years resulting from radiometric dating was one of our major challenges. Similar to Larry Vardiman in his introduction to the RATE project at the 5 November conference, I saw that radiometric dating is the basis for upholding the hypotheses of evolution and the supposed old age of the earth. Radiometric dating is a key area leading to unbelief in the Bible.

As a result, I spent the better part of two years studying dating method with the goal of doing research on this problem. Then I found out that ICR was planning a major project on radiometric dating. So, I switched to other challenges, since ICR was better equipped and positioned to meet the challenge of radioisotopes. My study certainly was not a waste of time, since the earth sciences are filled with the results of dating methods, which guide many uniformitarian ideas in the earth sciences. Besides, it helps me review the results of the RATE project.[5]

The technical RATE books are not for new creationists or for someone with little background in geophysics or geochronology or nuclear physics. They are in-depth studies, as one would expect for the results of a research project that challenges radiometric dating. Many exciting results have come out of the RATE project. Instead of radiometric dating being a challenge to creationists, it is now a *challenge to uniformitarians*. But there are a few perplexing results for the creationist to think through.

After a preface by John Morris, chapter 1 is an introduction by Larry Vardiman giving the history of the RATE project, the key research results, and the significance of the project. He has a section on the future of RATE in which unanswered questions will be pursued as special projects, while other major research initiatives are developed. There is a thought-provoking appendix by the late Henry Morris on creationist peer review. He argued that overall peer review is needed and quite beneficial to the creationist movement, but there are shortcomings, as most all creationist and secular scientists realize.

Accelerated radiometric decay from helium diffusion

There are many assumptions behind radiometric dating, but there are three main ones. Uniformitarian scientists assume (1) the initial isotope amounts are known, (2) the decay rate has remained constant at today's rate, and (3) the sample has remained in a closed system for millions and billions of years. Evidence is presented that all three assumptions are violated in various contexts, but the RATE project concludes that the assumption of constant decay at today's rates is the most significant wrong assumption. The RATE group has discovered that one or more periods of accelerated radiometric decay occurred in the past.

The most powerful evidence is described in chapter 2 by Russ Humphreys on his results of helium diffusion out of zircons from the Precambrian

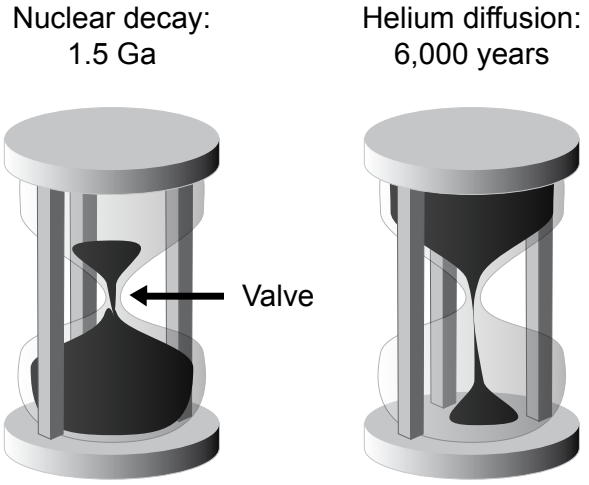
granite at Fenton Hills, New Mexico. This chapter is a masterpiece on how a research project should be written: clear with colour pictures, non-dogmatic style, systematic development with great graphics, and objections answered. At first, Humphreys was concerned about the diffusion rate in biotite that surrounded the relatively large zircon crystals. Did the biotite slow helium diffusion out of zircons? The RATE team subsequently found out, by subcontracting the diffusion experiment to a secular scientist critical of creationists, that the diffusion of helium through biotite is insignificant compared to diffusion out of the zircon crystals. So, the main variable is *the helium diffusion rate out of zircon crystals*, which depends upon the temperature.

Humphreys found only about 6,000 (± 2,000) years of helium diffusion out of zircon crystals while *at the same time* the zircons underwent 1.5 Ga of radioactive decay—assuming current rates! There is way too much helium in the zircons for the alleged age. Accelerated radioactive decay sometime in the past is thus strongly supported. The uniformitarian diffusion rate predicted from the radiometric 'age' is about 5 orders of magnitude too slow! Humphrey's results are actually conservative, because the uniformitarian scientists believe that several heating pulses occurred during 1.5 Ga of geological time, which would have driven off even more helium. Humphreys deals with objections in appendix D at the end of his chapter. Most of these objections seem like uniformitarian red herrings.

Humphrey's experimental results are enough to show that absolute radiometric dates by uniformitarian scientists are wrong.

Radiohalos offer further support for accelerated radioactive decay

In chapter 3, Andrew Snelling summarizes his results on uranium and polonium radiohalos in biotite. There is much to digest in this chapter. To form a radiohalo, there must be over 10^9 atoms concentrated into a very tiny spot, about 1 μm in diameter. There cannot be too many atoms or the alpha damage causes a dark diffuse sphere, making it difficult to recognize the type of halo. With ^{238}U halos, colouration initially develops after 100 Ma worth of alpha decay, becomes darker after about 500 Ma worth, and very dark after about 1 billion worth at today's rates. Within the biblical time frame, halos provide further evidence for accelerated radiometric decay.



Two hourglasses representing two methods of dating the same rock. In the first, 1.5 Ga worth of radiometric decay at today's rates has occurred, while in the second, only 6,000 years of helium diffusion has taken place.

The uniformitarian problem with halos is that the half-lives of polonium are much too short for the assumed slow cooling of magma. The polonium isotopes have decay half lives of 164 microseconds for ^{214}Po, 3.1 minutes for ^{218}Po, and 138 days for ^{210}Po.

Snelling discovered that polonium halos are commonly found *adjacent* to uranium halos along the *same* biotite cleavage plane at an average distance of only 1 mm—strong evidence that the polonium originated from the decay of uranium. However, there are some polonium halos that are several kilometres from the nearest uranium source, which would suggest rapid transport. Polonium-210 halos were much more abundant than halos from other polonium isotopes, as expected from its longer half life, and they are generally 6 to 12 times more abundant than ^{238}U halos. Polonium halos were much more abundant in granites that intruded Paleozoic and Mesozoic sedimentary rocks from the Flood than assumed pre-Flood and post-Flood granites. Snelling concludes that there was about 500 Ma worth of radiometric decay *during the Flood*.

Snelling developed a model in which ^{238}U decays within relatively tiny zircon crystals in the biotite, and the radioactive daughter isotopes ^{222}Rn and polonium diffuse out of the zircon. Pressurized hydrothermal fluids moving through the biotite cleavage planes pick up the daughter isotopes, progressively depositing polonium at the same location. What causes more than 10^9 atoms of the polonium to be deposited in a tiny spot? Snelling surmises that the polonium bonded to sulfur ions. Although there were no sulfur compounds at the centre of the polonium halo, there was a small empty spot, indicating that the sulfur compounds probably leached out of the biotite.

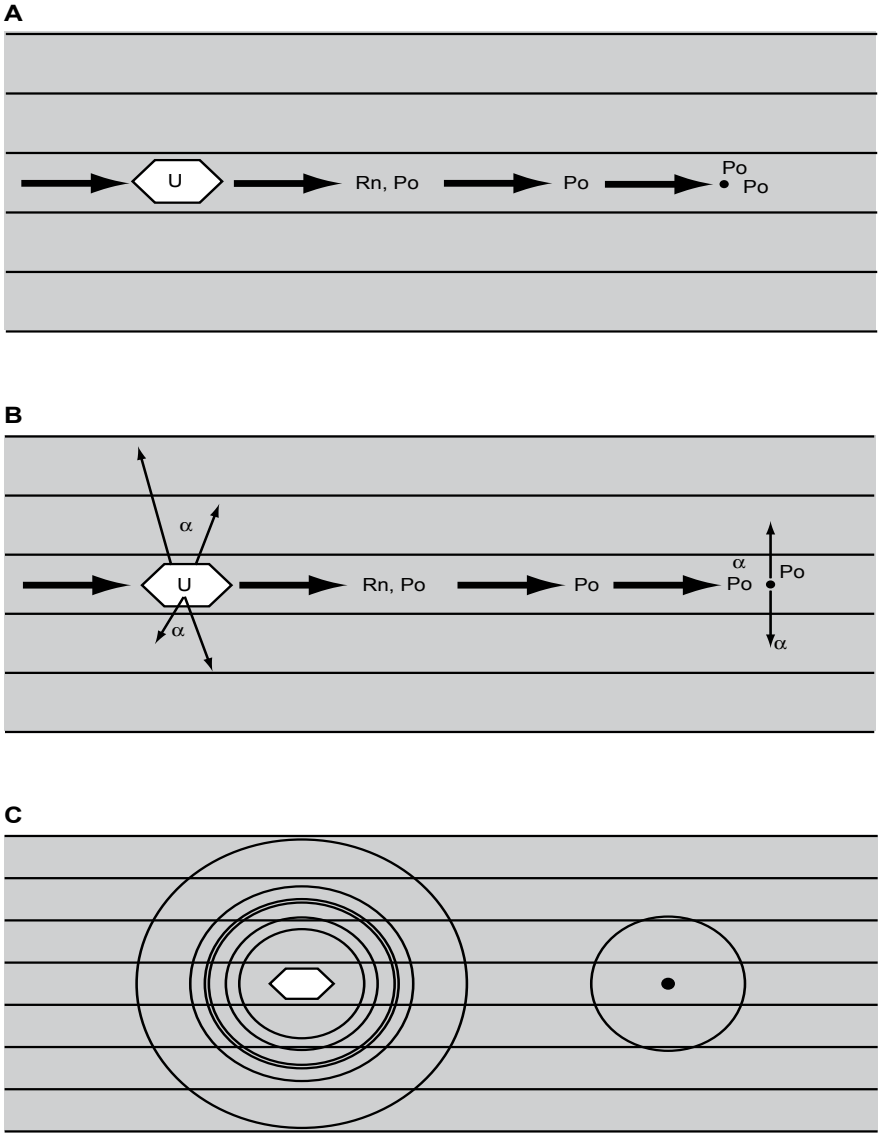
No halos are formed above the annealing temperature of 150°C. But, once the granite cooled below the annealing temperature, alpha decay from both the uranium and polonium atoms started forming the halos. Because of the short half-lives of the polonium isotopes, especially ^{214}Po, large quantities of polonium had to be transported very rapidly, and the polonium halos had to form within a few hours to a few days. Since uranium supplies the polonium, the uranium halo had to form almost at the *same* time as the polonium halo, requiring accelerated radiometric decay. If the cooling were very slow, as uniformitarians assert, most of the uranium, radon and polonium would have decayed, leaving little left to form a halo in the narrow window of hydrothermal transport below 150°C. This suggests that the

granite magma *solidified* and cooled below the annealing temperature in around 6 to 10 days!

Only one sample of 'post-Flood Cenozoic granite' from the Cascade Mountains of Washington, USA, had polonium halos, suggesting that this granite is a Flood rock. Radiohalos are more prolific in 'Flood' granites than 'pre-Flood' Precambrian granites. Snelling attributes the low number of halos in Precambrian granites to the annealing caused by the heat of accelerated decay during the Flood.

Snelling considers the finding of abundant polonium halos in 'Flood' granites as evidence that the polonium was emplaced by hot hydrothermal fluids. This is contrary to Robert Gentry's claim of granites created solid and remaining solid during the Flood—a concept that I believe has *not yet been falsified*, although RATE members believe so. However, Gentry's hypothesis has been significantly weakened. Gentry did have problems with the geology of his samples, some even coming from pegmatite dikes and granites that intruded Flood sedimentary rocks.

One of the most interesting results is that Snelling found radiohalos in metamorphic rocks, including, gneiss, schist, and biotite garnet eclogite. There are also many polonium halos in pegmatites, probably due to their high uranium content. These results suggest that metamorphic rocks and pegmatites also cooled very rapidly.



A) In Snelling's model, hydrothermal fluids rapidly transport Rn and Po from zircons containing U to sites with S forming PoS. These sites average 1 mm apart. **B)** Once the temperature drops below 150°C, alpha decay starts damaging the crystal. **C)** With further passing of time and more alpha decay, both ^{238}U and in this case ^{210}Po fully form. Since all Po halos have to form rapidly, especially ^{214}Po halos, 100 Ma to 1 Ga of radioactive decay has to occur at the same time from the U within the zircon crystal. This shows that the decay of U was greatly accelerated.

Fission tracks reinforce accelerated nuclear decay

Fission tracks are not caused by radioactive beta or alpha decay, but when the whole atom, mainly ^{238}U, splits apart into two fragments. As ^{238}U in relatively large zircon crystals breaks apart, the two atoms recoil from each other, damaging the crystal lattice in a straight line. The nuclear decay rate for fission is much less than the radioactive decay rate. The zircon crystals are treated with acid to etch and enlarge the damage tracks so that they can better be seen under a microscope. The fission tracks are counted, and the age of the zircon crystal is deduced, based on the half-life for uranium fission. However, the number of tracks depends not only on the age, but also on the temperature history of the sample and the cooling rate. High temperature, long time periods, and slow cooling anneal a higher proportion of fission tracks. These variables are spelled out in the appendix to chapter 4.

Many sources of error are inherent in fission track dating, in particular the low annealing temperature, possible errors during etching, and others. There is also a fudge factor called the 'zeta calibration,' which calibrates the results to material of 'known age'—which is circular reasoning. The lab that Snelling employed did use the zeta calibration, but kept the same value for all the samples, so that the effect of the calibration was less significant.

Snelling gathered zircon crystals from several volcanic tuffs around the Grand Canyon and the Colorado

Artist's impression of fission tracks on etched and polished zircon crystal from a sample of the Peach Springs Tuff obtained from an outcrop in the Snaggletooth area of southern California close to the Arizona border.

Plateau. The tuff samples were extracted from the Cambrian Tapeats Sandstone and Muav Limestone in the western Grand Canyon, the upper Mesozoic Morrison Formation, and the mid to upper Cenozoic Peach Spring tuff in western Arizona and southeast California.

The Tapeats and Muav Formation tuffs exhibited a wide range of fission track 'ages'. The 'ages' ranged from near zero to about 900 Ma and did *not* match the uniformitarian results. Uniformitarian scientists came up with a number of reasons for the age spread, such as differential annealing and inherited zircons from other sources. This makes one wonder about the integrity of all uniformitarian dates. Are all dates a pick-and-choose process, so that results close to the expected age are chosen while reasons are deduced for rejecting results that do not agree?

In regard to fission track ages, uniformitarian scientists commonly appeal to annealing events to cover unexpected results. Snelling apparently accepts some of this uniformitarian reasoning, especially that the divergent dates on the Cambrian samples are due to annealing. Although annealing of zircons is supposed to occur at temperatures between about 200°C to 300°C, the uniformitarian scientists deduced that the Cambrian formations were never above 130°C. So, how can the Cambrian tuff zircons be annealed? Snelling suggests that the heat of accelerated nuclear decay annealed the tracks, but this brings up a problem. How can the heat of accelerated decay be used when a mechanism is required during the Flood to take away the huge amount of heat?

The *average* of the Morrison Formation fission tracks ages was close to the expected age, but the spread was also quite large.

The Miocene Peach Springs tuff had a narrow spread close to the assumed uniformitarian date of about 20 Ma. Snelling assumes that the Peach Springs tuff is post-Flood. If it was formed post-Flood, then accelerated decay *continued after the Flood*—a questionable interpretation. I take this result to mean that the Peach Springs tuff is from the Flood. However, Snelling cautions that even Pleistocene samples can show a million years worth of nuclear and radioactive decay (but one wonders how much fudging, assumptions, and circular reasoning are involved in Pleistocene samples). We certainly need more research on this subject.

Snelling interprets the fission track results as physical evidence of millions of years of nuclear decay (nuclear referring to fission) that corresponds to millions of years of radiometric decay during the Flood. So, fission tracks reinforce Snelling's halo results that there was about 500 Ma worth of nuclear and radiometric decay during the Flood, since there is no doubt that the Cambrian and Morrison Formation tuffs are from the Flood.

Different dating methods result in different dates on the same rock

In chapter 5, Steven Austin examined the consistency of four main radiometric dating methods on Precambrian samples from two locations. The samples were collected from the Beartooth Mountains amphibolite and the Bass Rapids diabase sill in Grand Canyon. Austin used the isochron technique that employs different minerals from the same rock. The isochron method is considered superior because a straight line on the isochron plot informs us that two of the three main assumptions of radioactive dating (the closed system and initial conditions assumptions) are supposed to be validated.

Snelling takes Austin's study a step further in chapter 6 by analyzing igneous rocks of many supposed ages, ranging from the recent to the Precambrian. He reinforces Austin's results in chapter 5. Snelling also obtained some very anomalous dates. For instance, some 20th century lava flows from Mt Ngauruhoe, New Zealand, gave a Rb-Sr isochron age of 133 Ma, a Sm-Nd isochron age of 197 Ma, and a Pb-Pb age of 3.908 Ga for the cooling time of the modern lavas! Snelling makes a case that the millions and billions of years for these rocks is likely inherited from the mantle and/or due to Flood accelerated decay. There may also be some mixing of magma. In a summary statement, Snelling writes of the significance of these results for radiometric dating:

> 'All these considerations—isochron discordances, inheritance of mantle source isotopic signatures, and mixing of crustal contamination—must render radioisotope "dating" highly questionable at best, and useless at worst, as the absolute "dating" method is so unanimously and forthrightly claimed to be' (p. 456).

Both studies discovered that dates from the different methods on the same rock *disagree by a large amount*! Moreover, there are systematic relationships between the methods. The alpha emitters gave older ages than and the beta emitters, and the longer the half-life, the older the radiometric 'age'. Snelling and Austin suggest that a relationship may exist between the atomic weight of the parent radioisotopes: the greater the weight the greater

the isochron 'age'. They concluded that only accelerated radiometric decay, which affected each element and each type of decay differently, explains the anomalous results.

Snelling goes further and suggests that we can use radiometric dates in a relative sense, based on 3–4 Ga of accelerated decay during creation and 500 Ma of decay during the Flood. Within the Creation-Flood model, a rock with a radiometric 'age' of say 1 billion years would be older than one with a radiometric 'age' of 300 million years. But he also states that because of inheritance and mixing, there will be many anomalies to a relative 'age' progression. I would like to see more research on this relative age suggestion.

Possible mechanism for accelerated radiometric decay

Chapter 7 was the most difficult chapter for me to comprehend, probably because I know little of theoretical nuclear physics. In this chapter Eugene Chaffin presents theoretical considerations for accelerated decay. Chaffin essentially suggests a number of possibilities for accelerated decay. It is especially commendable that Chaffin has published his ideas in the standard physics literature.

One possibility for accelerated decay is a slight variation in the strength of the nuclear or strong force that would cause a dramatic increase in alpha decay—around 5 to 8 orders of magnitude! Alternatively, if the alpha energy increases by only 10%, the decay constant increases by about 5 orders of magnitude. These ideas have the most potential.

Chaffin then describes a possibility from the highly speculative string theory. He argues that if the radii of compact extra dimensions can be changed, then the strength of the strong force can be changed. The weak force determines beta decay and may also be changed by considering 'forbidden decays', as well as string theory. These concepts are highly theoretical and speculative. The different mechanisms causing accelerated alpha and beta decay would likely explain the different isochron ages from these two mechanisms applied to the same rock.

Carbon-14 everywhere

Chapter 8 presents John Baumgardner's carbon-14 results on coal, diamonds, and other carbon samples. ^{14}C is ubiquitous in the 'old' material studied. Even the uniformitarian geologists have reported such results numerous times. Baumgardner sent carbon samples to an AMS dating lab. If a sample is over 100,000 years old, there should be no detectible ^{14}C. All his samples still contained measurable ^{14}C. So, all these 'old' samples must be less than 100,000 years old!

The uniformitarian scientists of course cry 'contamination', but their claim becomes hollow when considering diamonds. It would indeed be difficult to contaminate a diamond, as it is the hardest substance known!

Furthermore, Baumgardner finds *no* correlation between the ^{14}C abundance in coal and its putative age in the geological timescale, offering support that the coal samples are all the *same* age (e.g. the time of the Flood). Then if a more realistic past $^{14}C/^{12}C$ ratio is substituted in the dating equation, the dates telescope to a maximum date of around 5,000 years! This is the Flood model version in which much more ^{12}C existed before the Flood and was taken out of the biosphere by subsequent Flood burial.

Baumgardner takes his measurements a step further. He measured Precambrian $^{14}C/^{12}C$ and got a mean of 0.062 % of the modern carbon ratio (pmc). Phanerozoic ratios average about 0.292 pmc with a wide variation: significantly greater than Precambrian. Six diamonds from kimberlite pipes and one placer deposit gave an average ratio of about 0.12 pmc. He then dated 6 more placer diamonds and obtained an average $^{14}C/^{12}C$ ratio of about 0.2 pmc with a wide spread of values, significantly different than the first sample of diamonds.

How does he explain all these different average values? He suggests that accelerated radiometric decay, which produces an extreme neutron flux, formed ^{14}C in about the right ratios in his various samples. Baumgardner suggests that the diamonds from kimberlite pipes were less influenced by accelerated decay than the placer diamonds, a deduction that needs more research.

Baumgardner's research provides an example of what would result *if creationists could ask the research questions, instead of evolutionists holding the purse strings to taxpayer dollars*. We would likely find ready answers to ideas that at first appear contradictory to the Bible. For the ^{14}C challenge, we would long ago have found young ^{14}C ages and had answers to why uniformitarian ^{14}C dates are 'old'. This example indicates that with more research using the creation/Flood model, instead of the evolution/uniformitarian model, we should be able to find answers to many other current challenges in the earth sciences.

Genesis 1–2:3 is historical narrative

Chapter 9 summarizes the results of the new topic added late in the RATE project—the grammatical analysis of poetic and historical texts by Steven Boyd. In analyzing poetic and historical texts, he found that historical texts predominantly use the preterite verb form (one type out of four), while poetic texts hardly use it at all. Boyd's analysis and research are superb; the difference between historical narrative and poetic texts is stark. Genesis 1–2:3 uses predominantly preterite verbs. So the probability that these verses are historical narrative is in the neighbourhood of 99.99%. Genesis is real history, intended to be read as real history! A larger glossary would have been helpful, since Boyd uses many Hebrew grammatical terms that would be unfamiliar to non-Hebraists.

RATE problems

The last chapter discusses three problems with the conclusions of the RATE project. The first problem is theological. Four billion years worth of radioactive decay does not seem to deserve God's praise of *very good*. But, I agree with the RATE group that this is likely a terminology problem. Change the word 'decay' to 'transformation' would rid the terminology of ominous connotations. Such accelerated elemental transformations likely were part of God's process of creation of matter during the first few days. Rather, the Fall resulted in death of humans and animals called *nephesh chayyâh*, and radioactive atoms do not qualify as *nephesh chayyâh*!

The RATE group concludes that there was about 4 Ga of accelerated decay at creation and about 500 Ma worth at the time of the Flood. However, the amount of heat released by this amount of decay *during the Flood* would raise the crust to 22,000 K, more than enough to melt the whole crust and boil away the oceans! This is called the heat problem.

However, we are still here, so the Flood heat must have been removed somehow. Conduction, convection, and radiation of heat are all orders of magnitude too slow. Humphreys suggests a hypothesis that God also 'stretched out the heavens' during the Flood, as well at creation. This stretching of the universe during the Flood would absorb the heat by the work of expansion and cool the granite magmas in 6 to 10 days. The problem with this idea is that material with little radioactivity would freeze, including the oceans. I am skeptical of this hypothesis but am open to further research. I also noted that heat from accelerated decay is called upon to explain some the results of the RATE project, while the effects of the cooling mechanism were not considered. As for a cooling mechanism, I can just as well believe that God caused a miracle to absorb the heat, after all God *was* involved in the Flood.

The third problem is the radiation given off by accelerated radiometric decay during the Flood. 500 Ga worth of decay during the Flood would zap the inhabitants of the ark with gamma radiation. The water of the Flood would provide much protection, but it may not be sufficient (water contains radioactive tritium (^{3}H) for one thing). Furthermore, just the radioactive potassium-40 in the bodies of those animals and the people on the ark would kill them when decay accelerated.

Although I believe the evidence for accelerated radiometric decay in earth's past is very convincing, I would like to see further research on the heat and radiation problem during the Flood. I believe it is possible that all the decay occurred during the first few days of the creation, but this would be difficult to demonstrate, since Snelling provides a strong case for accelerated decay during the Flood from halos and fission tracks. From the field of geomorphology, I have observed copious evidence that granites were uplifted solid late in the Flood (a hypothesis not without its problems). This evidence is independent of the reasons why Gentry believes that granites were created solid. Solid uplift of batholiths and plutons has always made me question whether granites were *ever* molten, but if the granites solidified in 6 to 10 days early in the Flood, then Snelling's evidence for Flood accelerated decay actually would fit with what I see in the field.

I would also like to see the helium diffusion research replicated on one more granite drill core. Although I wouldn't expect any significant difference, it always helps to tighten up the statistics and quiet critics with more than one sample.

Several assumptions in Snelling's great research and provocative interpretations should be better justified, for instance the classification of granites into pre-Flood, Flood, and post-Flood. Snelling believes that some of the Precambrian granites were the original creation rocks and were uplifted solid during the Flood. Although he has a section on the upward intrusion of liquid granite during the Flood, I believe the idea needs more research. Are S-type granites, derived from Flood sediments real, or just a geochemical deduction from the plutons of southeast Australia?[6–8]

Summary

The RATE books and DVDs are an excellent addition to the creationist bookshelf. They provide strong evidence that uniformitarian radiometric 'ages' are wrong, and that accelerated radiometric decay occurred in the earth's past. The RATE group is to be commended for providing solutions to the challenge of radiometric dating. Especially valuable is the variety of means used to disseminate the RATE results. The reader can choose the means most applicable to his background. The research is not finished. I look forward to further research on new questions.

References

1. RATE Group, *RATE Premier Conference: Thousands ... Not billions* (DVD), Institute for Creation Research, El Cajon, CA, 2006.
2. Vardiman, L.V., Snelling, A.A. and Chaffin, E.F. (Eds), *Radioisotopes and the Age of the Earth: A Young-Earth Creationist Research Initiative*, Institute for Creation Research and Creation Research Society, El Cajon, CA, and Chino Valley, AZ, 2000.
3. DeYoung, D., *Thousands ... Not Billions: Challenging an Icon of Evolution Questioning the Age of the Earth*, Master Books, Green Forest, AR, 2005
4. RATE Group, *Thousands ... Not Billions: Challenging an Icon of Evolution Questioning the Age of the Earth* (DVD), Institute for Creation Research, El Cajon, CA, 2005.
5. Oard, M.J., Review of *Radioisotopes and the Age of the Earth* by Vardiman, Snelling and Chaffin, *Journal of Creation* **15**(2):31–32, 2001.
6. Collins, W.J., Evaluation of petrogenetic models for Lachlan Fold Belt granitoids: Implications for crustal architecture and tectonic models, *Australian Journal of Earth Sciences* **45**:483–500, 1998.
7. Chappell, B.W. and White, A.J.R., Two contrasting granite types: 25 years later, *Australian Journal of Earth Sciences* **48**:489–499, 2001.
8. Clemens, J.D., S-type granitic magmas—Petrogenetic issues, models and evidence, *Earth-Science Reviews* **61**:1–18, 2003.