Does excess ^{40}Ar support RATE's 6,000-year-old Earth?

In a recent article in the *Journal of Creation*, Dr Russ Humphreys writes that large amounts of argon 40 gas were collected from feldspars in a Precambrian granite from the GT-2 borehole at Fenton Hill, New Mexico. This suggests a young age for this granite, contrary to the conventional radiometric date of more than a billion years.[1] This claim reinforces earlier studies that found anomalously high helium concentrations in zircons of the same rock, work done several years ago as part of the RATE (Radioisotopes and the Age of The Earth[2]) studies.[3] Humphreys has written extensively on the results of this study[4–6] and now writes that he has silenced the 'dogs of war'.[7] I applaud the excellent research and results that Humphreys has demonstrated in addressing the problems of excessive helium and excessive argon gas diffusion in naturalistic radiometric dating methods. However, I have questions regarding the relevancy of using either excessive helium or excessive argon to empirically demonstrate a young earth.

RATE Results

The results of the RATE study suggest that young-earth creationists can adopt many of the methods of naturalistic radiometric dating, but the high concentrations of helium and argon gas in zircons and feldspars, respectively, suggest an event(s) of accelerated nuclear decay. RATE scientists claim that these excess gases can be used to convert the old naturalistic age to a young biblical one.[8] However, this appears to present a difficult idea that cannot be credibly defended with present knowledge. This concept of accelerated decay raises the question:

> "Are radiometric age-dating methods and their results appropriate for biblical geological studies (based on the premise of a young Earth) and could these methods and techniques be useful in deriving historical age-dates consistent within the biblical framework?" (figure 1).

I question this conceptual leap. First, why is this approach needed? The answer is found in the first volume of the RATE book, where the objective is stated:

> "… radioisotopes and the age of the earth were significant problems which must be addressed if young-earth creationism was to continue to have significant impact on the issue of origins both within and outside the Christian community."[9]

So the issue regarding the use of radiometric age-dates boils down to two competing ideas: (1) radiometric dating is flawed and cannot be used in any significant way in young-earth research, or (2) the basic methods of radiometric dating are valid, but there is a missing ingredient (accelerated decay) which has led secular scientists to invalid results.

Excess helium and excess ^{40}Ar

Another important question to resolve for this study: 'Is finding excess helium and/or excess argon 40 a unique or highly unusual condition in igneous rocks?' The answer is 'no'. Excess helium and excess argon 40 often occur in igneous rocks and it is *not* the result of radiometric decay:

> "Damon and Kulp have concluded that this [excess helium and excess ^{40}Ar] is not solely the result of deeper burial or the increased rate of production of helium and argon in the past. They have suggested that this effect may have been the result of increased heat production in both mantle and crust and consequent greater mobilization of the inert gases."[10]

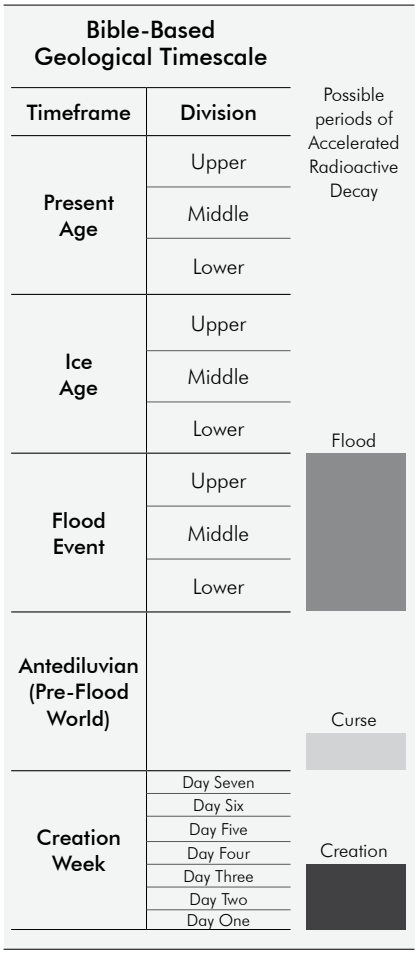

Figure 1. This diagram shows my proposed biblical geologic timescale with three shaded boxes corresponding to the three periods of time when RATE scientists claim that accelerated radiometric decay occurred. The darker the box the greater the level of accelerated radiometric decay based on the findings of the RATE project team.

The idea that the mantle is the source of excess helium has also been proposed for certain Icelandic basalts:

> "The possibility that primordial He has diffused into a reservoir with a composition typical of convecting upper mantle cannot be ruled out. If so, the process must have occurred after the development of existing mantle heterogeneity, and requires the existence of a deep, primordial He-rich reservoir."[11]

Could the same source be assumed for excess argon 40? The answer is provided by RATE scientist, Dr Andrew Snelling, who stated:

"All of this evidence clearly shows that excess ^{40}Ar is ubiquitous in volcanic rocks, and that the excess ^{40}Ar was inherited from the mantle source areas of the magmas."[12]

What about the He and ^{40}Ar age-dates?

Humphreys claims that the newly calculated ^{40}Ar age-date for the Precambrian granite corresponds to that derived earlier from helium. Is this empirically true? Humphreys reported the age of the igneous rock calculated from excess helium in zircons as "Combining rates and retentions gives a He diffusion age of 6,000±2,000 (1σ) years."[13]

Humphreys then calculated the age of the Precambrian granite using ^{40}Ar found in feldspar as 5,100 (+3,800/-2,100) years. Although both are within the timeframe of biblical history, the difference between the two declared ages is 15% and not statistically the same.[14] It would appear that excess helium radiometrically age-dates this rock to the Creation Week, where excess ^{40}Ar might correspond to either the Antediluvian or Flood timeframes (figure 1). So age-dating these igneous rocks using accelerated nuclear decay for excess helium and excess argon appears to be unresolved at present.

Where do we go from here?

RATE members propose that young-earth creationists can use accelerated nuclear decay to define biblical history and that the corresponding age-dates would align with the two primary periods (i.e. Creation Week and Flood) of accelerated decay.[8] However, the unknown source (i.e. radiometric decay vs mantle/crustal off-gassing) of the excess helium and excess ^{40}Ar appear to demonstrate that claiming radiometrically decay-derived age-dates does not work for naturalists *or* young-earth creationists. Finding excess (or in instances depleted) helium and ^{40}Ar in igneous rocks will not invalidate radiometric age-dating methods in naturalism. Rather, it demonstrates the model-driven results of their theory, none of which is relevant or required in creation science.

Humphreys' assessment that employing accelerated decay rates of radiometrically derived age-dating of igneous rocks containing excess helium and excess ^{40}Ar can support the biblical framework of earth history appears unfounded. The RATE proposal of accelerated nuclear decay cannot be based on ambiguous data that can yield almost any desired result, especially if the method (e.g. ^{40}K-^{40}Ar) has previously been rejected by young-earth creationists.[12,15]

Additionally, any resulting accelerated derivative age-date should be statistically relevant in age (i.e. concordant) when compared to the same rock or those immediately adjacent if we are to believe that accelerated radiometric dating is viable.

What young-earth creationists need is an empirical method of determining how excess He/Ar gases are the means by which old dates are interpolated into young ones, and this should be demonstrated by repeatable scientific methods. We would also expect a statistically valid correlation between the two sets of dates (i.e. excess He/Ar) since the accelerated decay would be considered a constant. Creation science would benefit in clarifying the role that excess helium and excess argon play in accelerated nuclear decay within the context of the young-earth Flood framework. I look forward to Dr Humphrey's reply to the questions and concerns that I have raised.

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13. Humphreys, ref. 3, p. 25.
14. Humphreys does not explain why there is such a significant age deviation calculated for the excess argon age. This wide range allows the proposed accelerated age to be highly variable, including the possibility that it is older than the 6,000-year-old Earth. This raises the question of the utility of accepting an accelerated age-date that lies beyond what we might define as biblical-age limits. Do young-earth creationists need to employ accelerated nuclear decay if the derived data give wide variability within test results?
15. Snelling, A.A., Potassium-Argon and Argon-Argon dating of crustal rocks and the problem of excess Argon, ICR *Impact* **#309**, 1999. Snelling states "We have no way of knowing if any of the ^{40}Ar measured in crustal rocks has any significance."

Russell Humphreys replies:

It is peculiar to find a young-earth creationist disliking the results of a young-earth creationist research initiative, Radioisotopes and the Age of the Earth (RATE), and only speaking up about it seven years after the project ended. After all, RATE offered good solutions to a major conundrum: a century of evidence for large amounts (up to billions of years' worth) of nuclear decay having occurred within the short (6,000 years or so) history of this planet. One would think every young-earther would welcome a straightforward answer to that problem.

In the particular case at hand, minerals in the granitic rock deep in borehole GT-2 at Fenton Lake, New Mexico, US, Mr Froede questions that the helium 4 in the zircons and argon 40 in the feldspar necessarily originated from nuclear decay in those minerals. Instead he suggests that those gases are 'excess' could have come from elsewhere. But a close consideration of the zircons in particular should dispel that notion.

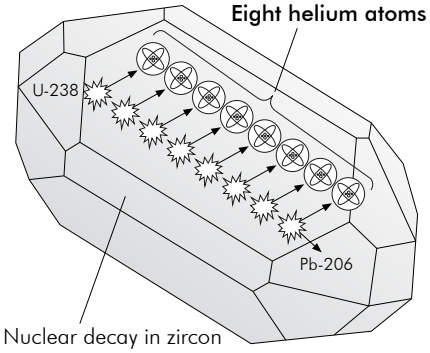

Figure 1. When zircons form, they chemically attract uranium atoms and reject lead. Afterward, the uranium decays, depositing both lead and helium within the crystal.

First of all, studies of zircon crystals forming from melts in the laboratory show that they chemically attract uranium atoms and reject lead atoms (figure 1). That is what geochemists expected from the size and valence (number of chemical 'hooks') of the ions (electrically charged atoms) in the melt. In particular, the most common type of lead ion is too big to fit into the zircon lattice as it forms, and it has the wrong valence. The upshot is that when a zircon forms, it contains a very low concentration of lead and a very high concentration of uranium. In fact, almost all of the uranium in this granitic rock is located in the zircons.

Next, after the zircon forms, it is a very hard, high-melting-point, dense crystal with a very tight lattice. It is very difficult for uranium or lead atoms to move into or out of it. It is almost the 'closed system' theorists dream about. So zircons start out with very little lead, and very little can move into them. But in the zircons we examined, looking at the amount of uranium present, we found as much lead as would be expected from 1.5 billion years worth of decay (at today's rates). Moreover the lead was mainly isotope 206, the descendant of the principal uranium isotope in the zircon, 238.

If the lead were produced by decay, then because each uranium 238 atom decaying to lead 206 releases eight helium 4 atoms, there should also be a lot of helium 4 deposited in the crystals. It turned out that in the coolest zircons we studied, we found 80% of the helium that would have been deposited by 1.5 billion years worth of decay. So in the very crystals where we find uranium 238 concentrated, we also find over a billion years worth of both helium 4 and lead 206 (at today's decay rates). Isn't the simplest explanation that over a billion years worth of nuclear decay occurred in the crystal? If so, the helium we found was not 'excess' helium from elsewhere, but simply that which nuclear decay released right in the zircons.

Similarly, since we find over a billion years worth of the nuclear decay product argon 40 in feldspars nearby, in the same rock, is it not even more reasonable to suppose that over a billion years worth of nuclear decay took place in the rock?

The fact that neither as much helium nor as much argon would be present in the minerals after more than thousands of years of diffusion is strong evidence that the 'billion years' worth of nuclear decay actually took place within thousands of years. It puzzles me that Mr. Froede apparently cannot see that for the helium and argon diffusion dates, the error bars overlap. I.e. for 6,000 (± 2,000) years and 5,100 (+3,800/–2,100) years, the dates overlap from 4,000 to 8,000 years. Within their limits of accuracy, the two methods agree.

My biggest puzzle is why Mr Froede resists the simple conclusion that accelerated nuclear decay has occurred. If he were a uniformitarian insisting that decay rates must stay the same throughout all time, I could understand. But he is not a uniformitarian.

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