

# What You Need to Know About Carbon Dating

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There are common misconceptions about carbon-14 dating. This article will clarify those points and also *introduce several other radiometric dating methods*. Readers who want additional technical details are encouraged to read the footnotes.

## Significant Discovery

The radioactive form of carbon (carbon-14 or  $^{14}\text{C}$ ) was discovered in 1940. This led to the 1946 invention of carbon dating. The inventor of carbon dating received the 1960 Nobel Prize in Chemistry.<sup>1</sup> Creationists and evolutionists can agree that carbon dating has become extremely useful in the areas of history and archaeology. The American Chemical Society (the world's largest scientific society) reports,

The introduction of radiocarbon dating had an enormous influence on both archaeology and geology—an impact often referred to as the “radiocarbon revolution.” ...Radiocarbon dating provided the first objective dating method—the ability to attach approximate numerical dates to organic remains. This method helped to disprove several previously held beliefs, including the notion that civilization originated in Europe and diffused throughout the world. By dating man-made artifacts from Europe, the Americas, Asia, Africa and Oceania, archaeologists established that civilizations developed in many independent sites across the world.<sup>2</sup>

## Useful Tools

Radiometric dating methods are useful tools. Carbon-14 dating allows us to determine with reasonable accuracy, *actual ages of organically sourced material* (wood, bones, shells, peat, linen, wool, etc.) from the

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<sup>1</sup> American Chemical Society, “Willard Libby and Radiocarbon Dating -A National Historic Chemical Landmark,” American Chemical Society webpage, October 10, 2016. [www.LutheranScience.org/ACSLibby](http://www.LutheranScience.org/ACSLibby) (accessed May 16, 2019)

<sup>2</sup> American Chemical Society.

recent past (several thousand years). Evolutionists believe carbon-14 can be used to estimate much older ages.

Other radiometric dating methods —such as potassium-40 discussed later in this article— allow us to determine *relative ages of some kinds of rocks* (including cooled magma such as granite and basalt). Evolutionists go farther and believe that these other dating methods produce not just *relative* ages, but *actual* ages, and actual ages of up to billions of years.

“Ages” obtained through all dating methods are based on many *unprovable* assumptions. If creationist assumptions are used, these methods produce presumed ages which generally agree with Scripture, a young earth, and a planetary flood. If evolutionist assumptions are used, these methods produce much older presumed ages which do not agree with Scripture.

## Misconceptions

It is important that we properly use scientific terminology and correctly describe scientific methods, or everything we say —including our gospel message— may be discredited. First let’s correct two common errors regarding carbon dating:

**Rocks:** Carbon-14 ( $^{14}\text{C}$ ) dating is NOT used to date rocks. Other types of radiometric dating are used to obtain presumed ages for rocks.  $^{14}\text{C}$  dating examines carbon in the item to be dated. Carbon dating is used to calculate the presumed age of things which were once living —and therefore contain organically sourced carbon— such as bones and wood.

**Millions of Years:**  $^{14}\text{C}$  dating is NOT used to date things that evolutionists think are millions or billions of years old.  $^{14}\text{C}$  dating is used to calculate much more recent ages. Evolutionists use carbon dating for ages they presume to be between 100 and 50,000 years ago.<sup>3</sup> These presumed ages are based on many *unprovable* assumptions, as we will see later in this article.

## What is “Radioactive”?

Atoms are the smallest units of matter. Some atoms are radioactive.<sup>4</sup> Radioactive atoms are unstable, meaning they will not last. Radio-

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<sup>3</sup> Robert J. Brooker et al., *Biology*, 2<sup>nd</sup> ed. (New York: McGraw-Hill, 2011), 458.

<sup>4</sup> *An atom is radioactive (unstable) when there are too many neutrons in its nucleus.*

active atoms decay (or break apart) into non-radioactive atoms, energy rays, and subatomic particles.<sup>5</sup> When atoms decay they release energy, often in the form of rapidly moving subatomic particles. This flow of energy is called *radiation*.<sup>6</sup> Radioactive atoms are a type of *isotope*,<sup>7</sup> which decay (break apart) into decay products.

## Apple Tree Branch

Say I cut a branch from an apple tree. How quickly will the radioactive carbon ( $^{14}\text{C}$ ) in that branch decay? It will take 5,730 years for half of the  $^{14}\text{C}$  to decay, so we say the half-life of  $^{14}\text{C}$  is 5,730 years. After twice that time period (11,460 years) only 25% of the  $^{14}\text{C}$  will remain. After three half-lives (17,190 years) only 12.5% of the  $^{14}\text{C}$  will remain. The half-lives of many radioactive atoms<sup>8,9</sup> (radioisotopes) have been precisely measured. For example: The half-life of uranium-235 is 710 million years, and that of rubidium-87 is 47 billion years.<sup>10</sup> Having accurate measurements of these decay rates is crucial to radiometric dating.

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<sup>5</sup> Some radioactive atoms decay into other radioactive atoms, which then also decay. The final result is stable non-radioactive atoms.

<sup>6</sup> "Radioactive decay is [or rather, results in] the emission of energy in the form of ionizing radiation. The ionizing radiation that is emitted can include alpha particles, beta particles and/or gamma rays." United States Environmental Protection Agency, "Radioactive Decay," (accessed May 16, 2019) <https://www.epa.gov/radiation/radioactive-decay#self>

<sup>7</sup> "A nuclide is an atomic species with a characteristic number of protons and neutrons. ...Isotopes are two or more nuclides which belong to the same element, i.e., they have the same number of protons, but differ by their number of neutrons. For example, the three carbon isotopes  $^{12}\text{C}$ ,  $^{13}\text{C}$ , and  $^{14}\text{C}$  all have 6 protons, but 6, 7, or 8 neutrons, respectively. Since isotopes belong to the same element they show essentially identical chemical –but not physical– behavior." Günther A. Wagner, *Age Determination of Young Rocks and Artifacts –Physical and Chemical Clocks in Quaternary Geology and Archaeology*, trans. Solveig Schiegl, (Berlin Germany: Springer-Verlag, 1998), 6.

<sup>8</sup> Matter is composed of elements such as hydrogen, carbon, sodium, calcium, and iron. The smallest unit of matter is the atom. The atoms of every element always have the same number of protons and electrons. Protons have a positive charge and electrons a negative charge, so with an equal number of protons and electrons these charges balance out. Each atom has a central nucleus which holds its protons and neutrons. Neutrons have no charge. Atoms of certain elements may vary in their number of neutrons. All the elements are listed in the periodic table in order according to their number of protons.

<sup>9</sup> See an interactive periodic table by the United Kingdom's Royal Society of Chemistry at <http://www.rsc.org/periodic-table> (accessed May 16, 2019)

<sup>10</sup> Brooker, 458.

## How Are Ages Calculated?

Select radioisotopes and/or their decay products in a sample are measured as an indirect method to calculate an inferred age for organic material (wood, bones, shells, peat, etc.) and rocks (cooled magma such as granite and basalt). This procedure is called radiometric dating (aka radioactive dating, radioisotope dating).

To calculate an inferred age of a sample (such as a rock) using radiometric dating, the rock must contain some measurable radioisotope. Scientists date a sample (rock, bone, etc.) by:

- 1) Very accurately *measuring* the amount of radioisotope and/or its decay product in the sample *today*.
- 2) *Guessing* the amount in that sample *long ago*.
- 3) Very accurately calculating how much time it would have taken for the guessed amount to result in the measured amount. That calculated time is *assumed* to be how long ago the living thing died, or the rock formed from molten magma.

How accurate is the #2 guess? That guess is based on *unprovable* assumptions. Beyond that, there are other *unprovable* assumptions involved too.

## Dating of Living Things —carbon dating

Living plants, animals, and people have an extremely small amount of radioactive carbon (carbon-14 or  $^{14}\text{C}$ ) in their bodies. This  $^{14}\text{C}$  gets into their bodies through their food.<sup>11</sup> The relative quantity of radioactive carbon ( $^{14}\text{C}$ ) to normal non-radioactive carbon ( $^{12}\text{C}$ ) is the same in almost everything living, reflecting the ratio of  $^{14}\text{C}$  to  $^{12}\text{C}$  in atmospheric carbon dioxide.<sup>12</sup> Once plants, animals, and people die, they no longer

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<sup>11</sup> Cosmic rays striking earth's upper atmosphere produce neutrons which smash into nitrogen-14 ( $^{14}\text{N}$ ) atoms, turning stable nitrogen atoms into radioactive carbon (carbon-14 or  $^{14}\text{C}$ ) atoms. That radioactive carbon makes its way into atmospheric carbon dioxide ( $\text{CO}_2$ ) molecules. This radioactive  $\text{CO}_2$  is taken into plants through photosynthesis, and therefore into all animals and people through the food chain.

<sup>12</sup> A few creatures have very little  $^{14}\text{C}$  in their bodies even when alive, due to their unique diet. This includes mollusks and even some rabbits. Roadside grass could contain carbon from auto emissions, and rabbits eating that grass as a significant part of their diet may have lower levels of  $^{14}\text{C}$ .

eat,<sup>13</sup> and therefore they no longer constantly replace the decaying radioactive carbon in their bodies. This results in the amount of  $^{14}\text{C}$  in their dead bodies slowly going down over time.

An award-winning expert in radiometric dating puts it this way in a book published by Cambridge University,

As long as an organism is alive and exchanging  $\text{CO}_2$  (directly or indirectly) with the atmosphere, its tissues will have equilibrium with atmospheric  $^{14}\text{C}$  concentration. Once the exchange with the atmosphere stops due to its death or other reasons, the equilibrium  $^{14}\text{C}$  abundance begins to decrease exponentially with time.<sup>14</sup>

The presumed age of a sample (such as bone, coal, parchment, linen, wool, or a cereal grain) is calculated using the measured ratio of  $^{14}\text{C}$  to  $^{12}\text{C}$  in the sample today and the presumed (guessed) ratio in that sample when the organism died.<sup>15</sup>

A college archaeology textbook describes the great impact carbon dating has had on archaeology,

Radiocarbon dating has grown exponentially, and many problems and inaccuracies have been isolated and examined, some leading to major adjustments of the results. Despite many problems, radiocarbon dates now provide a framework for the prehistory of the world; for the first time, its study has become more like that of historical periods, and emphasis has shifted away from pure chronology towards more fundamental social and economic factors. Without a doubt, it has made the greatest single contribution to the development of archaeology since geologists and prehistorians escaped from the constraints of historical chronology in the nineteenth century.<sup>16</sup>

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<sup>13</sup> *Dead plants no longer use photosynthesis (their form of “eating”).*

<sup>14</sup> Kunchithapadam Gopalan, *Principles of Radiometric Dating*, (Cambridge UK: Cambridge University Press, 2017), 54.

<sup>15</sup> University of Oxford Radiocarbon Accelerator Unit (ORAU), “Radiocarbon Dating -The dating principle,” ORAU website <http://c14.arch.ox.ac.uk/dating.html> (accessed May 16, 2019)

<sup>16</sup> Kevin Greene and Tom Moore, *Archaeology: An Introduction*, 4<sup>th</sup> ed. (New York: Routledge, 2002).

## Unprovable Assumptions —carbon dating

The accuracy of carbon dating depends upon *many unprovable* assumptions. One assumption of evolutionists is that the atmospheric ratio of  $^{14}\text{C}$  to  $^{12}\text{C}$  in the past (over the last 50,000 years per evolutionary assumptions) has always been about the same as the ratio today (the assumption of  *$^{14}\text{C}$  to  $^{12}\text{C}$  equilibrium*).<sup>17</sup> There are many reasons why this assumption could be false. One reason every creationist should keep in mind is: *Since God created the earth only thousands of years ago, we know that this assumption of equilibrium is false.* Unless God created a world with radioactive  $^{14}\text{C}$  in the atmosphere, the starting level would be zero. So for much of earth's history, the amount of  $^{14}\text{C}$  in the atmosphere was much lower than today, slowly growing toward today's larger level.

A second reason to question the  $^{14}\text{C}$  to  $^{12}\text{C}$  equilibrium assumption: There is strong evidence that the earth had a much stronger magnetic field for most of earth's past.<sup>18</sup> Therefore the rate at which  $^{14}\text{C}$  was produced in the atmosphere would have been much lower in the past. Creationist Russ Humphreys (PhD in physics) developed a scientific model which has the earth's magnetic field starting very strong at creation and then decaying until the Flood, when the field rapidly became very weak and reversed multiple times. After the Flood, the field again became strong and has been slowly decaying to today's level. Humphreys' 1983 model has stood

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<sup>17</sup> Radiocarbon dates are "calibrated" (or adjusted) to take into account "a few percent" difference in atmospheric carbon-14 in the past. Creationists claim that a much larger calibration is needed due to significantly lower atmospheric C-14 in the past. University of Oxford Radiocarbon Accelerator Unit (ORAU), "Radiocarbon Calibration," ORAU website

<http://c14.arch.ox.ac.uk/calibration.html> (accessed May 16, 2019)

<sup>18</sup> "The evidence for the earth having a progressively stronger magnetic field going back into the past is based on reliable historical measurements and 'fossil' magnetism trapped in ancient pottery. A stronger magnetic field is significant because the magnetic field partly shields the earth from the influx of cosmic rays, which change nitrogen atoms into radioactive carbon-14 atoms. So a stronger magnetic field in the past would have reduced the influx of cosmic rays. This in turn would have reduced the amount of radiocarbon produced in the atmosphere. If this were the case, the biosphere in the past would have had a lower carbon-14 concentration than it does today." Andrew Snelling, "Radiocarbon Dating," in *How Do We Know the Bible Is True? Volume 2*, ed. Ken Ham and Bodie Hodge (Green Forest: Master Books, 2012), 140-141. Online version at (accessed May 16, 2019) <https://answersingenesis.org/geology/carbon-14/radiocarbon-dating/>

the test of time and still provides a solid explanation for the magnetic fields of the earth and other planets.<sup>19, 20, 21</sup>

A third reason to question the  $^{14}\text{C}$  to  $^{12}\text{C}$  equilibrium assumption is the pre-Flood world,

What role might the Genesis Flood have played in the amount of carbon? The Flood would have buried large amounts of carbon from living organisms (plant and animal) to form today's fossil fuels (coal, oil, etc.). The amount of fossil fuels indicates there must have been a vastly larger quantity of vegetation in existence prior to the Flood than exists today. This means that the biosphere just prior to the Flood might have had 500 times more carbon in living organisms than today. This would further dilute the amount of  $^{14}\text{C}$  and cause the  $^{14}\text{C}/^{12}\text{C}$  ratio to be much smaller than today.<sup>22</sup>

***A creationist can accept the accuracy of carbon dating for the past few thousand years, while knowing that older items are dated inaccurately (with calculated ages far exceeding their actual age).***

## No Creator, No Flood, Deep Time

Three of the most basic assumptions of evolutionists were discussed in a previous *LSI Journal* article: The “no creator,” “no flood,” and “deep time” assumptions.<sup>23</sup> The “no creator” assumption leads the evolutionist to reject supernatural explanations and attempt to develop natural

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19 Andrew A. Snelling, “More Evidence of Rapid Geomagnetic Reversals Confirms a Young Earth,” *Answers in Depth*, vol. 10 (January 8, 2015).

[www.LutheranScience.org/AIGmagRev](http://www.LutheranScience.org/AIGmagRev) (accessed May 16, 2019)

20 Russell Humphreys, “Reversals of the Earth’s Magnetic Field During the Genesis Flood,” *Proceedings of the First International Conference on Creationism*, ed. R. E. Walsh, C. L. Brooks, & R. S. Crowell, 1986, 113–123.

[www.LutheranScience.org/RH1986](http://www.LutheranScience.org/RH1986) (accessed May 17, 2019)

21 Russell Humphreys, “The Earth’s Magnetic Field Is Young.” *Acts & Facts*.

22, no. 8 (August 1993). <https://www.icr.org/article/earths-magnetic-field-young> (accessed May 17, 2019)

22 Mike Riddle, “Doesn’t Carbon-14 Dating Disprove the Bible?” in *The New Answers Book 1*, ed. Ken Ham (Green Forest: Master Books, 2006), 84. Online version at [www.LutheranScience.org/mrC14](http://www.LutheranScience.org/mrC14) (accessed May 17, 2019)

23 Mark Bergemann, “Assumptions of Evolutionists,” *LSI Journal* 31, no. 4 (fall 2017): 7-16. [www.LutheranScience.org/2017fall](http://www.LutheranScience.org/2017fall) (accessed May 16, 2019)

explanations (even when no natural explanation exists). The “no flood” assumption leads the evolutionist to interpret the earth’s fossil containing rock layers as being slowly deposited over millennia. The “deep time” (millions and billions of years) assumption provides vast times over which the evolutionist can imagine slow processes accumulating change.

The assumption that the quantity of radioactive carbon in the atmosphere has been relatively stable for 50,000 years is based on the above general evolutionary assumptions. This carbon assumption would seem more reasonable if the earth and its atmosphere had existed for millions of years. It would also seem more reasonable if there had been no planetary flood only a few thousand years ago, an event which would cause major planet-wide changes.

## Evolutionists Admit Their Assumptions

Evolutionists are aware that carbon dating is based on evolutionary assumptions of “deep time” and “no Flood.” This is clear from an article on a university website. By listing two creationist assumptions, this article supports the opposite assumptions of “deep time” and “no Flood,”

The creationist argument that the ratio of C-14 to C-12 [in the atmosphere] is not constant is actually based on the assumption of a young earth with an age of 10,000 years, and sudden changes in the amount of carbon dioxide in the atmosphere caused by the assumed catastrophic events of the Genesis flood.<sup>24, 25</sup>

## Dating of Rocks —other radiometric dating methods

While presumed ages for organic material (wood, bones, shells, peat, etc.) are obtained using carbon dating, presumed ages for certain types of rock (cooled magma such as granite and basalt) are obtained using other radiometric dating methods including potassium-40, rubidium-87, uranium-235, and uranium-238.<sup>26</sup> In addition to rocks formed on earth

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<sup>24</sup> Frank Steiger, “Carbon 14 Dating,” on Tufts University website.

<http://chem.tufts.edu/science/FrankSteiger/carbon14.htm> (accessed May 16, 2019)

<sup>25</sup> Frank Steiger’s website credits Howard Hershey for much of this 1996 article.

<http://www.fsteiger.com/carbon14.html> (accessed May 16, 2019)

<sup>26</sup> Brooker, 458.



from cooled magma, presumed ages for other types of rocks can also be obtained through radiometric dating. An example is the dating of meteorites which have been dated using multiple radioactive isotopes.<sup>27</sup>

The amount of a radioactive isotope and its atomic decay product are measured in the rock to be dated. It is *assumed* that the decay product measured resulted from decay of the radioactive isotope in that rock since it solidified from molten magma. The length of time it took to decay provides a presumed age of the rock.

*What could go wrong?* Plenty. Just like with carbon dating, we can measure the quantity of radioactive isotopes and decay products in the sample *today*. We cannot measure the quantity that was in that sample in the *past* (thousands, millions, or billions of years ago). We must make an educated *guess* at that. For carbon dating, it is assumed that the starting amount of <sup>14</sup>C in the sample to be dated was the same as in living things today, and that is based on the evolutionist's unprovable assumption that <sup>14</sup>C in the atmosphere has been fairly constant for 50,000 years.

## Unprovable Assumptions —other radiometric dating methods

**1) Starting Conditions:** Evolutionists need to know how much of the desired decay product was in the rock when it was formed (when it cooled from molten magma into solid rock). This cannot be measured (since no one was there in the past to measure), so evolutionists use unprovable assumptions to make this determination.

**2) No Contamination:** Evolutionists assume that none of the radioisotope or its decay products leached into or out of the rock since it was formed. To evolutionists, this means no leaching into or out of the rock during a period of up to several billion years. This is a risky assumption, since we have found such leaching to occur in the present!<sup>28</sup>

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<sup>27</sup> Gopalan, 129.

<sup>28</sup> *Examples of assumptions #1 and #2 being violated are mentioned by a research university, "Argon loss and excess argon are two common problems that may cause erroneous ages to be determined."* New Mexico Bureau of Geology & Mineral Resources, "New Mexico Geochronology Research Laboratory K/Ar and <sup>40</sup>Ar/<sup>39</sup>Ar Methods," New Mexico Institute of Mining and Technology, (accessed May 16, 2019): <https://geoinfo.nmt.edu/labs/argon/methods/home.html>

**3) Unchanging Decay Rate:** Evolutionists assume that radioactive decay has continued at a constant rate for billions of years. Radioactivity was discovered in 1896.<sup>29</sup> For about 110 years or so, we have been able to accurately measure the decay rates of radioisotopes, and over that time the rates have remained constant (within the accuracy of our instrumentation). We have found that decay rates are not significantly affected by pressure, heat, or electrical and magnetic fields,<sup>30</sup> so evolutionists simply assume rates were the same in the past as they are today. This is an unprovable assumption.

### Evolutionists Attempt to Minimize Errors Due to Their Unprovable Assumptions

While evolutionists simply take for granted that decay rates are constant (assumption #3), they put forth great effort to minimize errors due to unexpected starting conditions (assumption #1) and due to contamination (assumption #2). In the end, all of their efforts still rest on all three unprovable assumptions.

Very sophisticated scientific methods are used, including the argon-argon (Ar-Ar) isochron laser technique, which is a type of potassium-argon (K-Ar) dating, the “most popular of isotopic dating techniques.”<sup>31</sup> This advanced and widely used Ar-Ar technique produces precise *relative* ages for a pair of rocks (such as one rock being 14 times older than the other). The presumed *actual* “age” (such as 65 million years) for one of these two rocks (the “standard”) has previously been established, usually using the conventional K-Ar method. The presumed *actual* “age” of this standard rock is then used to determine the presumed *actual* age of the other rock. So, the presumed actual age of both these rocks now rests on conventional K-Ar dating, which is based on the three assumptions listed above. The

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<sup>29</sup> Wagner, 6.

<sup>30</sup> Snelling, “Radioactive Dating of Rocks?” in *How Do We Know the Bible Is True? Volume 2*, ed. Ken Ham and Bodie Hodge (Green Forest: Master Books, 2012), 152. Online version at [www.LutheranScience.org/BibleTrueChap12](http://www.LutheranScience.org/BibleTrueChap12) (accessed May 16, 2019)

<sup>31</sup> Kelley, Simon P., “K-Ar and Ar-Ar Dating,” *Reviews in Mineralogy and Geochemistry*, vol. 47 no. 1 (2002) 785 (page 1 in pdf). [www.LutheranScience.org/KellyArAr](http://www.LutheranScience.org/KellyArAr) Pdf available on the website of the University of Arizona Department of Geosciences at (both accessed May 16, 2019) <https://www.geo.arizona.edu/~reiners/geos474-574/Kelley2002.pdf>

rocks used as a “standard” for this method are ones which evolutionists believe to be least likely to give false ages due to assumptions #1 and #2. Even so, *it is unprovable that ANY rock satisfies ANY of the three assumptions.*

Evolutionists admit that assumptions #1 (starting conditions) and #2 (contamination) are unproven. The New Mexico Bureau of Geology & Mineral Resources operates a laboratory which dates rocks using these methods. Regarding assumptions #1 and #2 for the conventional K-Ar method, their website states, “There is not a reliable way to determine if the assumptions are valid.”<sup>32</sup> Yet this K-Ar method is used to obtain the actual ages used for the Ar-Ar method.

So, the advanced Ar-Ar method which evolutionists propose to minimize assumptions #1 and #2, rests on those unproven assumptions just like the conventional K-Ar method does.

The following is for those who wish to learn more.  
The rest of us can skip to the conclusion on page 23.

## Potassium-Argon Dating

Potassium-argon dating uses potassium-40 ( $^{40}\text{K}$ ) which decays into calcium-40 ( $^{40}\text{Ca}$ ) and argon-40 ( $^{40}\text{Ar}$ ). For starting conditions, evolutionists assume the rock started without any  $^{40}\text{Ar}$ . The University of California website explains that it is assumed that all  $^{40}\text{Ar}$  gas in a rock escapes before that rock solidified in the past,

How is the Atomic Clock Set? When rocks are heated to the melting point, any Ar-40 contained in them is released into the atmosphere. When the rock recrystallizes it becomes impermeable to gasses again. As the K-40 in the rock decays into Ar-40, the gas is trapped in the rock.<sup>33</sup>

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<sup>32</sup> New Mexico Bureau of Geology & Mineral Resources.

<sup>33</sup> George H. Michaels and Stuart T. Smith, “Chronological Methods 9 - Potassium-Argon Dating,” Department of Anthropology, University of California – Santa Barbara, revised May 15, 2003. [www.LutheranScience.org/MichaelsKA](http://www.LutheranScience.org/MichaelsKA) (accessed May 16, 2019)

This assumption of zero  $^{40}\text{Ar}$  when the rock forms is a poor assumption. Evolutionists are well aware that rocks they date may contain “extraneous” or “excess” argon which was there when the rock formed (not from decay of  $^{40}\text{K}$  after the rock formed).

The New Mexico Bureau of Geology & Mineral Resources website lists six assumptions of K/Ar dating. Here are two assumptions that they list,

Certain assumptions must be satisfied before the age of a rock or mineral can be calculated with the Potassium-Argon dating technique. These are:

- The material in question is a closed system. In other words, no radiogenic  $^{40}\text{Ar}$  has escaped from the rock/mineral since it formed. In the case of a volcanic mineral, this means rapid cooling. Likewise, potassium has not been gained or lost.
- No non-atmospheric  $^{40}\text{Ar}$  was incorporated into the rock/mineral during or after its formation.<sup>34</sup>

That research university website then reveals that “There is not a reliable way to determine if the assumptions are valid” when using the K/Ar method. Later we will see how evolutionists attempt to solve this problem. The website states [bold title in original],

#### **Problems and Limitations of the K/Ar dating technique**

Because the K/Ar dating technique relies on determining the absolute abundances of both  $^{40}\text{Ar}$  and potassium, there is not a reliable way to determine if the assumptions are valid. Argon loss and excess argon are two common problems that may cause erroneous ages to be determined. ... Conversely, excess argon ( $^{40}\text{Ar}_E$ ) can cause the calculated K/Ar age to be older than the “true” age of the dated material. Excess argon is simply  $^{40}\text{Ar}$  that is attributed to radiogenic  $^{40}\text{Ar}$  and/or atmospheric  $^{40}\text{Ar}$ . Excess argon may be derived from the mantle, as bubbles trapped in a melt, in the case of a magma.

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<sup>34</sup> New Mexico Bureau of Geology & Mineral Resources.

Or it could be a xenocryst/xenolith trapped in a magma/lava during emplacement.<sup>35</sup>

A paper published by the Mineralogical Society of America states [“assumption 3” in the following refers to “All radiometric  $^{40}\text{Ar}$  measured in the sample results from  $^{40}\text{K}$  decay.”<sup>36</sup>],

One of the fundamental assumptions of K-Ar dating (assumption 3, above) is that after correcting for atmospheric argon, all  $^{40}\text{Ar}$  in the sample is the result of the in situ decay of  $^{40}\text{K}$ , an assumption which is not always valid. However, the amounts of extraneous argon (see earlier definition) are small and generally remain undetected.<sup>37</sup>

## Argon-Argon Dating

The quote above reports another assumption that evolutionists make to address the problem of excess argon: They assume the amount of excess argon is “small.” That article also discusses one of the many potassium-argon associated techniques, in this case the *argon-argon isochron technique*. The quote below states that this Ar-Ar technique has been successful in accounting for excess argon from partially open systems, as long as the amount of excess argon is homogeneous (evenly dispersed in the rock) and small.

The sample, whether mineral or whole rock, must have remained a closed system since the event being dated. This includes gain or loss of either argon or potassium. This assumption is sometimes invalid, particularly in systems with complex geological and thermal histories. However, Ar-Ar stepwise heating and laser spot techniques can often be used to extract thermal history information from partially opened systems, taking advantage of the manner and extent of argon loss.<sup>38</sup>

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<sup>35</sup> New Mexico Bureau of Geology & Mineral Resources.

<sup>36</sup> Kelley, 788 (page 4 in pdf).

<sup>37</sup> Kelley, 798 (page 14 in pdf).

<sup>38</sup> Kelley, 788 (page 4 in pdf).

The step heating technique has been quite successful in discriminating against low concentrations of homogeneously distributed excess argon (e.g., Renne et al. 1997) which can be plotted on an isochron diagram (e.g., Heizler and Harrison 1988; Roddick 1978). In fact many published Ar-Ar ages contain small amounts of excess argon reflected in an initial  $^{40}\text{Ar}/^{36}\text{Ar}$  ratio that is within a few percent of the atmospheric ratio. Such determinations yield precise results when the ratio of the contaminating component is close to that of atmospheric argon. However, as the ratio of the contaminant increases and the small  $^{36}\text{Ar}$  peak becomes more difficult to measure, and the possibility of obtaining a precise age is quickly compromised. In extreme cases, excess argon may be undetected (e.g., Arnaud and Kelley 1995; Foland 1983; Pankhurst et al. 1973; Sherlock and Arnaud 1999). Further, the initial ratio correction only works when the isotope ratio within the samples is homogeneous, in cases of heterogeneous excess argon, a spread of data makes precise age determination impossible (e.g., Cumbest et al. 1994; Pickles et al. 1997).<sup>39</sup>

One of our previously quoted sources gives a good description of the argon-argon isochron technique. [The heating described below can be of areas “100 microns or less” using a laser probe.<sup>40</sup>]

Argon-Argon Isochron Technique. In order to test whether the K-Ar system is disturbed by excess argon, isochron diagrams are frequently used. They presuppose various cogenetic fractions from the same rock to be dated, but which have different potassium contents. In the isochron diagram the ratio  $^{40}\text{Ar}/^{36}\text{Ar}$  is plotted against the ratio  $^{40}\text{K}/^{36}\text{Ar}$  (conventional technique) or against  $^{39}\text{Ar}/^{36}\text{Ar}$  (argon-argon technique; Fig. 15). All data points of the subsamples lie on a straight line whose slope defines the age and whose intercept with the  $^{40}\text{Ar}/^{36}\text{Ar}$  axis reveals the initial  $^{40}\text{Ar}/^{36}\text{Ar}$  ratio. If no extraneous argon is present, the isochron intercept is at the atmospheric ratio of 295.5 and if

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<sup>39</sup> Kelley, pages 798-799 (pages 14-15 in pdf).

<sup>40</sup> New Mexico Bureau of Geology & Mineral Resources.

present at a higher value.  $^{36}\text{Ar}/^{40}\text{Ar}$  versus  $^{39}\text{Ar}/^{40}\text{Ar}$  diagrams are also used. In this case, straight lines of negative slope define systems of fixed age. Usually isochron plots are applied in connection with argon-argon laser single grain analysis.<sup>41</sup>

The New Mexico Bureau of Geology & Mineral Resources operates a laboratory which dates rocks using the K/Ar and  $^{40}\text{Ar}/^{39}\text{Ar}$  methods. Their website states,

... a standard of known age must be irradiated with the samples of unknown age. Because this (primary) standard ultimately cannot be determined by  $^{40}\text{Ar}/^{39}\text{Ar}$ , it must be first determined by another isotopic dating method. The method most commonly used to date the primary standard is the conventional K/Ar technique. The primary standard must be a mineral that is homogeneous, abundant and easily dated by the K/Ar and  $^{40}\text{Ar}/^{39}\text{Ar}$  methods. Traditionally, this primary standard has been a hornblende from the McClure Mountains, Colorado (a.k.a. MMhb-1). Once an accurate and precise age is determined for the primary standard, other minerals can be dated relative to it by the  $^{40}\text{Ar}/^{39}\text{Ar}$  method.<sup>42</sup>

The paper published by the Mineralogical Society of America from which we previously quoted also mentions this,

K-Ar can be regarded as an absolute dating technique, dependent only on the value of the decay constant, and calibration of  $^{38}\text{Ar}$  spike. However, all Ar-Ar ages are derived relative to the age of mineral standards, which are irradiated at the same time as the sample. The external precision of Ar-Ar ages is thus limited by the external precision of the age of the mineral standard as determined by the K-Ar method. The most widely used international standards are the hornblendes Hb3gr and MMHb1; biotites GA1550, GHC-305 and B4B, muscovite B4M, and sanidines from the Fish Canyon Tuff, Taylor Creek

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<sup>41</sup> Wagner, 63-65.

<sup>42</sup> New Mexico Bureau of Geology & Mineral Resources.

and Alder Creek.<sup>43</sup>

## Summary of These Quotes

The combination of all the above quotes reveals that the most popular rock dating method (potassium-argon, or K-Ar) can produce dates much older than actual, due to unexpected argon gas which was present in the rock when it formed or which leaked into the rock after it formed. Evolutionists propose a solution: To use the argon-argon isochron technique. That technique produces relative ages which are converted to absolute ages by calibration using minerals (rocks) dated with the K-Ar method.<sup>44</sup> Of course, that K-Ar method is susceptible to gross errors due to excess argon. Evolutionists assume that these mineral standards do not contain excess argon (which would greatly exaggerate their “ages”), based on their judgment that it is unlikely those minerals have excess argon. This is an unprovable assumption on their part.

## Conclusion

Radiometric dating methods are useful tools. These dating methods allow us to determine with reasonable accuracy, *actual ages* from the recent past (several thousand years) for organic material (such as bone, coal, parchment, linen, wool, a cereal grain, etc.) and *relative ages* for some kinds of rocks (cooled magma such as granite and basalt).

Evolutionists use these dating tools for much more. They use many *unprovable* assumptions including “deep time” (millions and billions of years) and “no flood” (no planetary Noachian Flood). These assumptions lead to calculated carbon dating ages of up to 50,000 years for organic matter. These assumptions also lead to calculated rock ages of millions and billions of years instead of relative ages.

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<sup>43</sup> Kelley, 793 (page 9 in pdf).

<sup>44</sup> *These various mineral standards are given ages including about 28, 65, and 520 million years ago (these ages have been slightly revised several times over the decades).* Kelley, 793-794 (page 9-10 in pdf).



Evolutionists require “deep time” (millions and billions of years) to make the Theory of Evolution more reasonable in their eyes. By assuming that the earth is billions of years old, and *imposing that unprovable assumption on their calculations*, evolutionists obtain radiometric dating ages of millions and billions of years. God reveals in Scripture that the earth is only thousands of years old, so we know that the assumption of deep time is wrong. Evolutionists base their radiometric dating calculations on that false assumption, so the dates they calculate are invalid.

## By Faith

By faith we accept things which we cannot understand using our sin-darkened reason, such as God being three persons in one, and Jesus being fully God yet fully human. By faith we are certain that God created the universe over a six-day period thousands of years ago, and that the Flood covered the entire earth killing all people and land animals not aboard Noah’s Ark.

Maybe someday evolutionists will propose a dating technique which seems reasonable to us. That day has not yet come, as current radiometric dating methods are all based on multiple unprovable assumptions. Even if that day does come, by faith and God’s grace, we would still accept the Biblical account of creation.

*This article is an updated version of an October 2018 text used for Martin Luther College online course “Creation Apologetics 102” [SCI9002].*

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