A Young Earth

Evidence that supports the biblical perspective

Answers in Genesis®

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Introduction

The question of the age of the earth has produced heated discussions on debate boards, in classrooms, on TV and radio, and in many churches, Christian colleges, and seminaries. The primary sides are young-earth proponents (biblical age of the earth and universe of about 6,000 years) and old-earth proponents (secular age of the earth and universe of about 4.5 billion years and 14 billion years, respectively).

The difference could not be greater! Where do these ideas come from, and upon what authority are they based? Can we accurately calculate an age for the earth?

From the earliest times, man has tried to estimate the age of the earth from historical records, secular chronologies, biblical sources, and more recently from scientific measurements. Only in the past few decades have secular scientists come to agreement based on radiometric dating methods. But are these methods accurate? Are there other methods for measuring the age of the earth that give different results?

This *Pocket Guide to a Young Earth* will aid you in understanding the debate, the dating methods, the problems with these methods, and upon what authority the different views are based. You will find that when we start from biblical assumptions and look at the world through the lens of Scripture, we can come to solid conclusions that are not only true to the scriptural record but also agree with sound science.

Radiometric Dating, Part 1:
Back to Basics

by Dr. Andrew A. Snelling

Most people think that radiometric dating has proven the earth is billions of years old. After all, textbooks, media, and museums glibly present ages of millions of years as fact.

Yet few people know how radiometric dating works or bother to ask what assumptions drive the conclusions. So let's take a closer look and see how reliable this dating method really is.

Atoms—Basics We Observe Today

Each chemical element, such as carbon and oxygen, consists of atoms. Each atom is thought to be made up of three basic parts.

The nucleus contains protons (tiny particles each with a single positive electric charge) and neutrons (particles without any electric charge). Orbiting around the nucleus are electrons (tiny particles each with a single negative electric charge).

The atoms of each element may vary slightly in the numbers of neutrons within their nuclei. These variations are called isotopes of that element. While the number of neutrons varies, every atom of any element always has the same number of protons and electrons.

For example, every carbon atom contains six protons and six electrons, but the number of neutrons in each nucleus can be six, seven, or even eight. Therefore, carbon has three isotopes (variations), which are specified carbon-12, carbon-13, and carbon-14 (*Figure 1*).

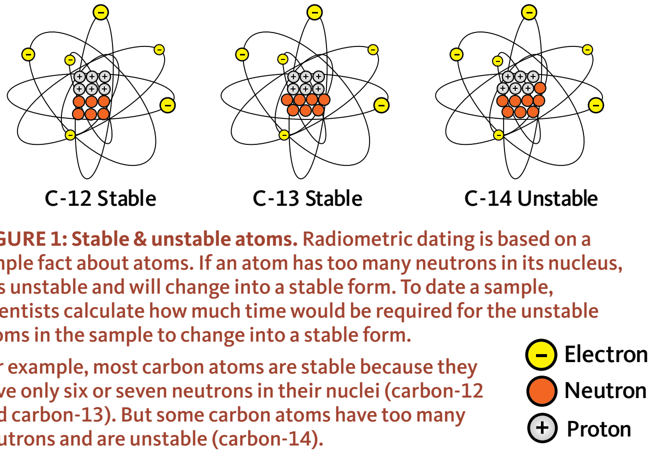


FIGURE 1: Stable & unstable atoms. Radiometric dating is based on a simple fact about atoms. If an atom has too many neutrons in its nucleus, it is unstable and will change into a stable form. To date a sample, scientists calculate how much time would be required for the unstable atoms in the sample to change into a stable form.

For example, most carbon atoms are stable because they have only six or seven neutrons in their nuclei (carbon-12 and carbon-13). But some carbon atoms have too many neutrons and are unstable (carbon-14).

Radioactive Decay

Some isotopes are radioactive; that is, they are unstable because their nuclei are too large. To achieve stability, the atom must make adjustments, particularly in its nucleus. In some cases, the isotopes eject particles, primarily neutrons and protons. (These are the moving particles measured by Geiger counters and the like.) The end result is a stable atom, but of a *different* chemical element (not carbon) because the atom now has a *different* number of protons and electrons.

This process of changing one element (designated as the parent isotope) into another element (referred to as the daughter isotope) is called radioactive decay. The parent isotopes that decay are called radioisotopes.

Actually, it isn't really a decay process in the normal sense of the word, like the decay of fruit. The daughter atoms are not lesser in quality than the parent atoms from which they were produced. Both are complete atoms in every sense of the word.

Geologists regularly use five parent isotopes to date rocks: uranium-238, uranium-235, potassium-40, rubidium-87, and samarium-147. These parent radioisotopes change into daughter lead-206, lead-207, argon-40, strontium-87, and neodymium-143 isotopes, respectively. Thus, geologists refer to uranium-lead (two versions), potassium-argon, rubidium-strontium, or samarium-neodymium dates for rocks. Note that the carbon-14 (or radiocarbon) method is not used to date rocks because most rocks do not contain carbon.

Chemical Analysis of Rocks Today

Geologists can't use just any old rock for dating. They must find rocks that have the isotopes listed above, even if these isotopes are present only in minute amounts. Most often, this is a rock body, or unit, that has formed from the cooling of molten rock material (called magma). Examples are granites (formed by cooling under the ground) and basalts (formed by cooling of lava at the earth's surface).

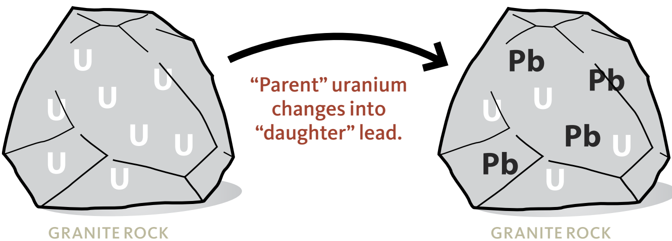
The next step is to measure the amount of the parent and daughter isotopes in a sample of the rock unit. Specially equipped laboratories can do this with accuracy and precision. So, in general, few people quarrel with the resulting chemical analyses.

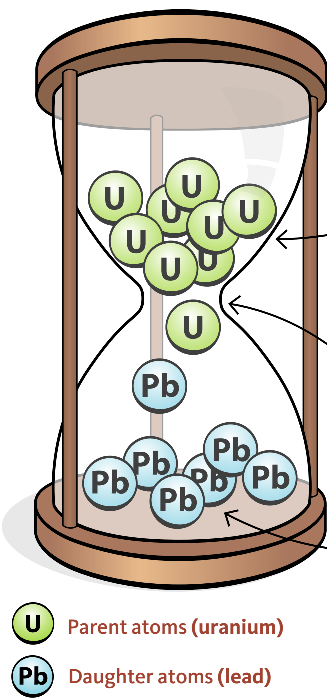
It is the interpretation of these chemical analyses that raises potential problems. To understand how geologists "read" the age of a rock from these chemical analyses, let's use the analogy of an hourglass "clock" (*Figure 2*).

In an hourglass, grains of fine sand fall at a steady rate from the top bowl to the bottom. After one hour, all the sand has fallen into the bottom bowl. So, after only half an hour, half the sand should be in the top bowl, and the other half should be in the bottom bowl.

FIGURE 2: Wrong assumptions, wrong dates

Unstable atoms, such as uranium (U), eventually change into stable atoms, such as lead (Pb). The original version is called a parent atom (or isotope), and the new version is called a daughter atom.





When scientists date rocks, they don't actually observe the atoms changing. They measure the products of the change, which they assume took place in the past. But what if they are wrong about their assumptions?

Assumption 1: The original number of unstable atoms can be known. Scientists assume how many unstable (parent) atoms existed at the beginning based on how many parent and daughter atoms are left today.

Assumption 2: The rate of change was constant. Scientists assume that radioactive atoms have changed at the same rate throughout time, ignoring the impact of creation or changes during Noah's flood.

Assumption 3: The daughter atoms were all produced by radioactive decay. Scientists assume that no outside forces, such as flowing groundwater, contaminated the sample.

Suppose that a person did not observe when the hourglass was turned over. He walks into the room when half the sand is in the top bowl, and half the sand is in the bottom bowl. Most people would assume that the "clock" started half an hour earlier.

By way of analogy, the sand grains in the top bowl represent atoms of the parent radioisotope (uranium-238, potassium-40, etc.) *(Figure 2)*. The falling sand represents radioactive decay, and the sand at the bottom represents the daughter isotope (lead-206, argon-40, etc).

When a geologist tests a rock sample, he assumes all the daughter atoms were produced by the decay of the parent since the rock formed. So if he knows the rate at which the parent decays, he can calculate how long it took for the daughter (measured in the rock today) to form.

But what if the assumptions are wrong? For example, what if radioactive material was added to the top bowl or if the decay rate has changed? Future chapters will explore the assumptions that can lead to incorrect dates and how the Bible's history helps us make better sense of the patterns of radioactive "dates" we find in the rocks today.

Dr. Andrew Snelling holds a PhD in geology from the University of Sydney, Australia. He serves as Answers in Genesis' director of research and is the editor in chief of the online *Answers Research Journal*. Dr. Snelling is a researcher, writer, and speaker on topics such as the flood, fossils, and the Grand Canyon.

Radiometric Dating, Part 2: Problems with the Assumptions

by Dr. Andrew A. Snelling

Most people think that radiometric dating has proven the earth is billions of years old. Yet this view is based on a misunderstanding of how radiometric dating works. The previous chapter explained how scientists observe unstable atoms changing into stable atoms in the present. This chapter explains how scientists run into problems when they make assumptions about what happened in the unobserved past.

The Hourglass "Clock"—an Analogy for Dating Rocks

An hourglass is a helpful analogy to explain how geologists calculate the ages of rocks. When we look at sand in an hourglass, we can estimate how much time has passed based on the amount of sand that has fallen to the bottom.

Radioactive rocks offer a similar "clock." Radioactive atoms, such as uranium (the parent isotopes), decay into stable atoms, such as lead (the daughter isotopes), at a measurable rate. To date a radioactive rock, geologists first measure the "sand grains" in the top glass bowl (the parent radioisotope, such as uranium-238 or potassium-40).

They also measure the sand grains in the bottom bowl (the daughter isotope, such as lead-206 or argon-40, respectively). Based on these observations and the known rate of radioactive decay, they estimate the time it has taken for the daughter isotope to accumulate in the rock.

However, unlike the hourglass whose accuracy can be tested by turning it upside down and comparing it to trustworthy clocks, the reliability of the radioactive "clock" is subject to three unprovable assumptions. No geologist was present when the rocks were formed to see their contents, and no geologist was present to measure how fast the radioactive "clock" has been running through the millions of years that supposedly passed after the rock was formed.

Assumption 1: Conditions at Time Zero

No geologists were present when most rocks formed, so they cannot test whether the original rocks already contained daughter isotopes alongside their parent radioisotopes. For example, with regard to the volcanic lavas that erupted, flowed, and cooled to form rocks in the unobserved past, evolutionary geologists simply assume that none of the daughter argon-40 atoms were in the lava rocks.

For the other radioactive "clocks," it is assumed that by analyzing multiple samples of a rock body, or unit, today it is possible to determine how much of the daughter isotopes (lead, strontium, or neodymium) were present when the rock formed (via the so-called isochron technique, which is still based on unproven assumptions 2 and 3).

Yet lava flows that have occurred in the present have been tested soon after they erupted, and they invariably contained much more argon-40 than expected.[1] For example, when a sample of the lava in the Mt. St. Helens crater (that had been observed to form and cool in 1986) *(Figure 1)* was analyzed in 1996, it contained so much argon-40 that it had a calculated "age" of 350,000 years![2] Similarly, lava flows on the sides of Mt. Ngauruhoe, New Zealand *(Figure 2)*, known to be less than 50 years old, yielded "ages" of up to 3.5 million years.[3]

So it is logical to conclude that if recent lava flows of *known* age yield incorrect old potassium-argon ages due to the extra argon-40 that they inherited from the erupting volcanoes, then ancient lava flows of unknown ages could likewise have inherited extra argon-40 and yield excessively old ages.

There are similar problems with the other radioactive "clocks." For example, consider the dating of Grand Canyon's basalts (rocks formed by lava cooling at the earth's

Assumption—conditions at time zero.

Scientists do not know how many "daughter atoms" were present when most rocks first formed. So when they test rocks produced by lava flows in recent years, their bad assumptions yield old "ages."

FIGURE 1: USGS/Cascades Volcano Observatory

FIGURE 1

FIGURE 2

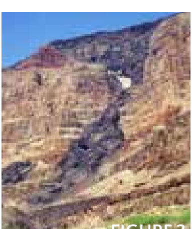


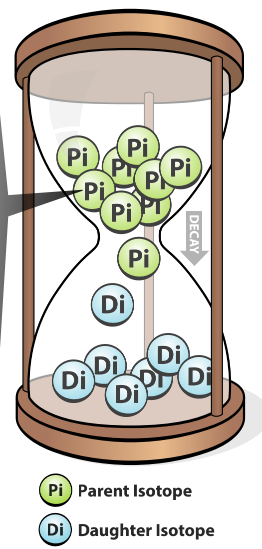
FIGURE 3

Bad results: "old" dates for recent eruptions.

A rock formed at Mount St. Helens in 1986 yielded a radiometric age of 350,000 years.

A rock formed by lava flows at Mt. Ngauruhoe in 1954 yielded a radiometric age of 3.5 million years.

A rock at the top of Grand Canyon, formed by a recent volcanic eruption, yielded the same age as volcanic rocks deep below the canyon wall—1.143 billion years.



surface). We find places on the North Rim where volcanoes erupted after the Canyon was formed, sending lavas cascading over the walls and down into the Canyon.

Obviously, these eruptions took place very recently, after the Canyon's layers were deposited (*Figure 3*). These basalts yield ages of up to 1 million years based on the amounts of potassium and argon isotopes in the rocks. But when we date the rocks using the rubidium and strontium isotopes, we get an age of 1.143 billion years. This is the same age that we get for the basalt layers deep below the walls of the eastern Grand Canyon.[4]

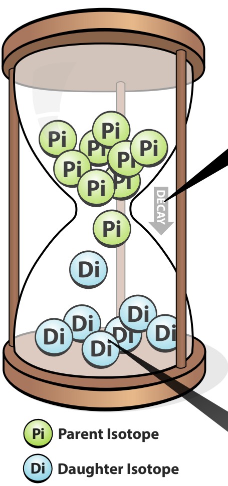
How could both lavas—one at the top and one at the bottom of the Canyon—be the same age based on these parent and daughter isotopes? One solution is that both the recent and early lava flows inherited the same rubidium-strontium chemistry—not age—from the same source, deep in the earth's upper mantle. This source already had both rubidium and strontium.

To make matters even worse for the claimed reliability of these radiometric dating methods, these same basalts that flowed from the top of the Canyon yield a samarium-neodymium age of about 916 million years,[5] and a uranium-lead age of about 2.6 billion years![6]

Assumption 2: No Contamination

The problems with contamination, as with inheritance, are already well-documented in the textbooks on radiometric dating of rocks.[7] Unlike the hourglass, where its two bowls are sealed, the radioactive "clock" in rocks is open to contamination by gain or loss of parent or daughter isotopes because of waters flowing in the ground from rainfall and from the molten rocks beneath volcanoes. Similarly, as molten lava rises through a conduit from deep inside the earth to be erupted through a volcano, pieces of the conduit wallrocks and their isotopes can mix into the lava and contaminate it.

Because of such contamination, the less than 50-year-old lava flows at Mt. Ngauruhoe, New Zealand (*Figure 4*), yield a rubidium-strontium “age” of 133 million years, a samarium-neodymium “age” of 197 million years, and a uranium-lead “age” of 3.908 billion years![8]



Assumption—constant decay rate.

Scientists do not know how quickly radioactive atoms decayed in the past. So they assume a constant rate. But when they tested zircon crystals from a borehole in New Mexico, they found two very different dates, depending on what measurement they used.

Bad results: contradictory decay rates.

Measuring the uranium in these crystals yields an “age” of 1.5 billion years. But measuring the amount of helium that leaked out as a result of the decay yields an age of 6,000 years.

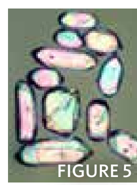


FIGURE 5

Assumption—no contamination.

Scientist do not know how much the rocks have been contaminated. So they usually assume no contamination.

Bad results: different dates from the same rocks.

Contamination of lava flows at Mt. Ngauruhoe, known to be less than 50 years old, yielded three different “ages” for rocks—133 million years, 197 million years, and 3.908 billion years.

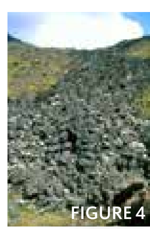


FIGURE 4

FIGURES 2–5: courtesy of Dr. Andrew Snelling

Assumption 3: Constant Decay Rate

Physicists have carefully measured the radioactive decay rates of parent radioisotopes in laboratories over the last 100 or so years and have found them to be essentially constant (within the measurement error margins). Furthermore, they have not been able to significantly change these decay rates by heat, pressure, or electrical and magnetic fields. So geologists have assumed these radioactive decay rates have been constant for billions of years.

However, this is an enormous extrapolation of seven orders of magnitude back through immense spans of unobserved time without any concrete proof that such an extrapolation is credible. Nevertheless, geologists insist the radioactive decay rates have always been constant, because it makes these radioactive clocks "work"!

New evidence, however, has recently been discovered that can only be explained by the radioactive decay rates *not* having been constant in the past.[9] For example, the radioactive decay of uranium in tiny crystals in a New Mexico granite (*Figure 5*) yields a uranium-lead "age" of 1.5 billion years. Yet the *same* uranium decay also produced abundant helium, but only 6,000 years worth of that helium was found to have leaked out of the tiny crystals.

This means that the uranium must have decayed very rapidly over the same 6,000 years that the helium was leaking. The rate of uranium decay must have been at least 250,000 times faster than today's measured rate![10]

The assumptions on which the radiometric dating is based are not only unprovable but plagued with problems. As this chapter has illustrated, rocks may have inherited parent and daughter isotopes from their sources, or they may have been contaminated when they moved through other rocks to their current locations. Or inflowing water may have mixed isotopes into the rocks. In addition, the radioactive decay rates have not been constant.

So if these clocks are based on faulty assumptions and yield unreliable results, then scientists should not trust or promote the claimed radioactive "ages" of countless millions of years, especially since they contradict the true history of the universe as recorded in God's Word.

Dr. Snelling (see page 11)

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10 For more details, see D. B. DeYoung, *Thousands . . . Not Billions* (Green Forest, Arkansas: Master Books, 2005), pp. 65–78.