Radiometric Dating—Is it reliable?

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There are many methods and techniques that geologist have used in the dating of the earth's surface and formations. One method that is commonly used is radiometric dating. Radiometric dating is called an *absolute* method because it supposedly is an independent technique that has no exceptions or qualification. Webster's dictionary defines *absolute* as follows: having no restriction, exception or qualification, unquestioned, and having no external reference. In other words radiometric dating, being an absolute method, is supposedly completely independent of any other outside method and can be relied upon without question.

It is the purpose of this paper to show that radiometric dating is not an absolute method. There are many external factors that can either increase or decrease the supposed absolute age of various geological formations and fossils. First the various dating methods will be analyzed so that an understanding of how they function will be established. Then we will look at the various problems with the three main types of radiometric dating. Finally we will examine how these methods can give unreliable dates.

Basic Principles

Radiometric dating is based on a process in which various elements emit atomic particles. This breakdown is called disintegration or decay. Through these emissions the radioactive element gives off particles and changes into a different form of matter. This decay rate can be shown by the following equation (Britannica 1998):

R=ë*N*	*R* is the rate of disintegration
	ë (lambda) is the decay constant
	N is the number of radioactive atoms

In these decay rates if the amount of material (parent) at the beginning of the decay is known and the present amount of material (daughter) is known, then it is a simple matter using the above equation to mathematically compute the age of the substance containing the element. This is the basic principle behind the disintegration of uranium into lead (U^{238} Th^{234} Pb^{206}), potassium into argon (K^{40} Ar^{40}), and to a lesser degree carbon14 (C^{14} N^{14}).

The accuracy of the above methods is based on the accuracy in which they are measured and on certain <u>assumptions</u> that enter into the picture. Since all evolutionary geologists are uniformitarianist they assume that these processes have been going on for many million if not billions of years. They also assume that these processes are unalterable and therefore absolute. Most of the dates given by these methods tend to support the evolutionary scenario. It can be very easily shown that these assumptions are totally based on preconceived ideas and highly suspect. In reality these methods have many limitations. Most of these limitations have not been properly addressed.

The Three main types

There are many types of radiometric dating that are used. The three main types include, carbon 14, potassium decay into argon, and uranium decay into thorium and then many steps later into lead. The same assumptions and weaknesses that are inherent in these three methods can be applied to the various other methods that are also used and are too numerous to mention here.

Overview of the C^{14} process

Outer space

Cosmic Rays

Cosmic rays are composed of protons (83%), helium nuclei called (á) alpha rays (16%), elemental nuclei, and electrons traveling @ the speed of light. These high-speed particles are emitted from the sun and supernova explosions.

Atmosphere

These rays strike the atoms in the upper atmosphere, mostly oxygen and nitrogen atoms.

Secondary Rays

They form secondary rays from broken up particles of the oxygen and nitrogen atoms. These secondary rays include slow moving neutrons.

neutrons

C^{14} formation (N^{14} C^{14})

C^{14} is formed when these neutrons strike the nitrogen atom causing the emission of a proton. The nitrogen is then converted into C^{14}. Over a period of time the carbon, as shown below, decays back into non-radioactive, stable N^{14}.

C^{14} Assumptions

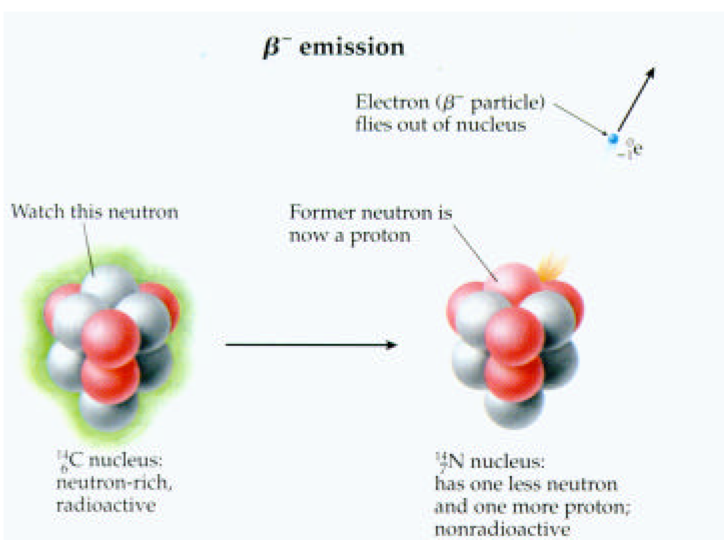

Figure 1. â$^{-}$ decay causing the conversion of C^{14} into N^{14}.
Photos adapted from Russo and Silver 2000

- It is assumed that the decay constant (ë), The rate of disentegration (*R*), and the number of radioactive atoms (*N*), are all unchangeable as shown by *R*=ë*N*. Therefore this is an absolute dating method.

- The decay constant gives a half-life for C^{14} of approximately 5,720 years.

Although scientists consider the above assumptions to be inviolable, there is not anything sacred about them. Scientists assume that what is occurring now has always occurred in the past (uniformitarianism). Therefore the formation rate for C^{14} is the same now as it was in the past. This is merely educated guessing because no one was present "at the beginning." The only source we have is Divine revelation.

If any of the variables in the radioactive disintegration equation are changed then the other variables will change in direct proportion. For example, if we have a final amount of C^{14} atoms, and we change the number of radioactive atoms that we began with then the rate of disintegration will have to be adjusted accordingly. Since scientists are looking at the end result of the C^{14} disintegration process and they do not know what the starting variables were then their assumptions became very crucial. If their assumptions are wrong or incomplete then nothing about radiocarbon dating can be know with any measure of exactness.

There are several radiochemical factors that can change either the formation or the decay of C^{14}. In some cases these factors will give an old age for artifacts that may be indeed very young. The following section will deal with these assumptions and show that these processes are dependent on many assumptions and therefore are not absolute.

These assumptions are very important since all living organisms incorporate carbon into their bodies, through respiration and metabolism. A small percentage of this incorporated carbon is C^{14}. At the death of the organism this accumulation of C^{14} stops. Since C^{14} has a known half-life the remaining C^{14} in the organism can be measured and its age determined.

Factors Affecting C^{14} Formation and/or Ratio, and Decay

1. The rate of cosmic radiation may have been different. If there were a decrease in the rate of cosmic radiation this would have caused the production of less C^{14}. If the earth were covered by a high altitude blanket of water vapor (Gen. 1:7 "firmament") this would cause a shielding effect and would lower the amount of cosmic radiation that could reach the earth. Radiocarbon tested artifacts before the fall of the water canopy (i.e. Noachian flood) would appear extremely old. This would explain why radiocarbon date for the recent past of about 4,000 years are accurate, but older dates do not correlate well with the Biblical record.
2. The composition of the atmosphere may have changed. The nitrogen and carbon ratio may have been different in the past. C^{12} is mainly CO_2, carbon dioxide and is non-radioactive. If there were more volcanoes this would cause a release of vast quantities of carbon monoxide (CO) into the atmosphere. This CO would be converted into CO_2 by reacting with atmospheric oxygen (Manahan 1999, p. 295). This would affect the C^{12}-C^{14} ratio. More non-radioactive carbon in the air would have caused an increase in the C^{12} as compared to the C^{14} and this would cause an apparent age increase. Other factors could change the composition of the atmosphere and the ratio of nitrogen and oxygen. These would include; smaller oceans trapping less organics and carbon, increased water vapor in the

atmosphere. Many other biological and chemical processes could alter the nitrogen-carbon-radiocarbon ratio.

3. Less oxygen and nitrogen in the upper atmosphere. Cosmic rays would strike these fewer atoms and produce less secondary rays of slow moving neutrons, which would then produce less C^{14}, causing an apparent increase in age.
4. Extraterrestrial sources such as comets and planetoid impacts. These impacts would put more non-radioactive carbon in the lower atmosphere, which would decrease the atmospheric C^{14} ratio. Many scientist believe that a small planetoid impact lead to the Cretaceous-Tertiary (K-T) mass extinctions, including the dinosaurs (Alvarez et.al. 1980).
5. The earth magnetic field affects cosmic ray patterns. Cosmic rays are observed less at the equator and more at the higher latitudes (e.g. aurora borealis). The sun's magnetic field will also affect the bombardment of the earth with solar cosmic rays. Our galaxy also has its own unique magnetic field. The historic composition of the magnetic fields of the earth, sun, and galaxy are completely unknown. A changed or nonexistent magnetic field in prehistoric time could have led to an increase or decrease of cosmic rays.
6. The lack of an atmosphere causing more cosmic rays to reach the ground. This would cause a faster decay of <u>existing</u> C^{14} into N^{14}. There may have been a time in the earth's past when the atmosphere was reorganized or missing. The Bible indicates that there was a time gap between the first two verses of Genesis. The primary radiation, especially á rays could have reached the earth without the filter of the atmosphere. These cosmic rays reaching the earth would have increased the energy level of the ã emissions (see fig. 1). This would cause a faster decay of the C^{14}, the rate would have been dependent on the amount of cosmic rays reaching the surface of the earth and this would be unknown. This would also cause an apparent age increase.
7. The explosion of nearby supernova[1] produces and/or accelerates already produced cosmic rays. After a supernova explosion a shell of high-speed particles would strike the earth. This shell would bathe the earth in a <u>100-1,000 fold increase in cosmic rays (á rays)</u> for a period of several hundred years. This increase in cosmic ray production would deplete the ozone, <u>alter the atmospheric content</u>, lower worldwide temperatures and lead to mass extinctions (Reid and McAfee 1978). If the atmosphere were missing at the time of the supernova explosion (see #6 above) the primary cosmic rays would strike the surface of the earth unimpeded. The effect would be the speeding up of radioactive decay processes on the surface of the earth. This would include accelerating the decay rates (*R*) of C^{14}, U^{238}, and many others radioactive processes.

The above processes can change the formation and rate of the production of radiocarbon. They can also affect other radioactive systems. Specifically, in this paper, many of these principles apply to the U^{238} decay into its final daughter element of lead.

When discussing the subject of radioactive dating the only thing that is certain now is the amount of daughter element present and the present decay rate. We do not know the past decay rate or the past amount of the parent and/or daughter isotope.

Overview of K^{40}-Ar^{40} Process

Unlike carbon dating the radioactive decay of potassium into argon cannot be used to date living matter. It, however, can be used to date rock and crystal, especially volcanic strata. If a fossil is found sandwiched between or associated with certain rocks then by dating the rocks the age of the fossil is implied.

A majority of the earth's rock contains potassium and the small percentage of this rock is radioactive K^{40}, which over time decays into Ar^{40}, see fig. 2. This method can be used to date igneous and metamorphic rocks that contain; muscovite, biotite, hornblende, and many other rocks. Thus K^{40}-Ar^{40} is often used to date ancient hominid fossils associated with lava flows. The half-life of K^{40} is 1.25 billion years.

This process relies heavily on the dating of igneous rocks including those produced by volcanoes. In theory the volcanic rock when super heated has all the argon driven out of its surface and core. Therefore any accumulation of Ar^{40} can be dated to the time of the volcanic eruption. This is the principle behind the dating of many human fossils found between layers of volcanic tuff and ash. If the layer above and the layer below can be dated then the fossil's age is somewhere between the two dates.

As in all radioactive dating processes the assumptions must be clearly understood. These assumptions are taken for granted by most geologists. A proper understanding of the weaknesses of these assumptions will show the inadequacies of the process. Once again remember that geologist/evolutionist support these assumptions because no one knows with any exactness what happened in the past. Uniformitarianists believe that the present is the key to the past. There is no sure way to test this statement. Once again Divine revelation is very important in understanding our past.

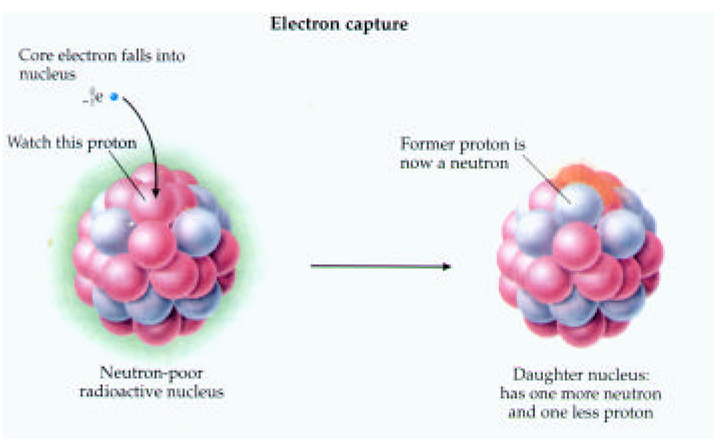

Figure 2. The decay process for K^{40}-Ar^{40} is shown. The potassium atom captures an electron and is converted into an Argon atom.

K^{40}-Ar^{40} Assumptions

There are several major explicit assumptions for this process to work. They include:

- The decay constant in the equation R=ëN must be known.
- The amount of the K^{40} at the start of the process must be known.
- No K^{40} or Ar^{40} must have been added to or been removed from the rock/system.
- Heating of the rock will drive out all argon and reset the radioactive timer to zero. This occurs at crystallization.

Factors Affecting the K^{40}-Ar^{40} Process

1. The decay processes and rates can be changed if enough energy is applied. The same principles that have been previously mentioned can be applied to changing the decay rates for K^{40}-Ar^{40}.
2. Note the following quote:

   > It follows that the thermal history of a dated sample is very significant in determining how valid its potassium-argon age is." (Britannica 1985, p.786-7)

   The thermal history of the rock is important because this resets the radioactive clock. There are many studies that have been done showing that it is possible for argon to have not been completely driven out at high temperatures (i.e. volcanic activity). If a rock has any residual argon in its system when it should have none then we cannot know the age of the rock. Some rocks have a history that is unknown. How can we be sure that a rock has not had its radioactive clock reset partly or incompletely in the past by having been reheated/melted?

3. Rock can gain argon by many ways. If any argon has accumulated or been added then it would be impossible to properly date a given sample. There are many chemical processes that will allow argon to enter a crystalline structure. One example is by acid degeneration of the rock/crystal surface, which would allow argon to enter. A rock with excess argon would show an older age.
4. Rocks can lose argon by many ways. If any argon has left the system then the sample would appear very old. Weathering, leaching, and reheating are just a few examples of how argon could leave a rock matrix. If a rock leaked argon then it would appear younger.
5. There are many examples and processes that could also cause potassium, the parent isotope, to enter or leave a rock system. They are similar to the processes in #3-4. If potassium enters or leaves a system we have no known starting place for our radioactive clock.
6. There are many examples of recent historic volcanic rock being dated at millions of years of age (Snelling 1999). Some specific examples include Glass Mountains in California, which erupted 500 years ago being dated as 12.6 million years and Kilauea basalt from Hawaii, which is from an eruption 200 years ago being dated as 21.8 million years ago, there are literally hundreds of such examples. Many of these are unpublished or not cited for obvious reasons!

Overview of the U^{238}-Pb^{206} Process

Uranium decay is another radioactive process that has been used to date geological formations. It has been used to show that the earth is many billions of years old. It has dated strata, giving ages of millions of years for certain life forms found in these rocks. These dates are then incorporated into the evolutionary scenario showing that man has actually descended from these ancient life forms. This dating process is actually a tool used by evolutionist to further advance their philosophy. It is important that we understand the weaknesses of these processes.

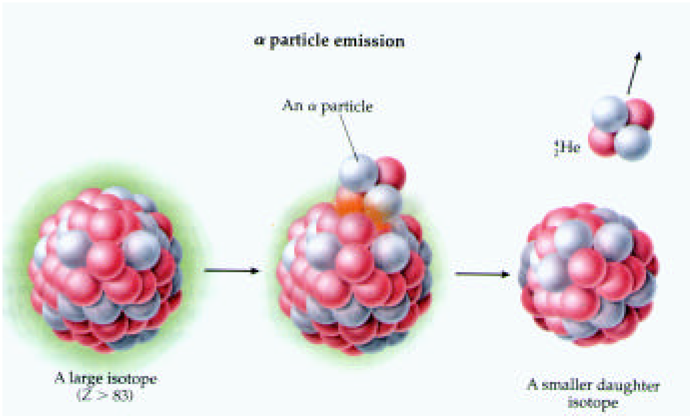

Figure 3. The alpha decay process. This along with beta decay is used in the U^{238}-Pb^{206} process.

Alpha particle Emission

Uranium decays into lead after a many-stepped process. This process includes the emission of eight alpha (á) particles and six beta (â$^{-}$) particles. An alpha particle is composed of the nucleus of a helium atom. A beta particle is an electron. The half-life for this process is 4.5 billion years. It is thus used to date extremely old rock and strata.

The decay process of U^{238} into Pb^{206} showing the emission of alpha and beta particles.

U^{238} á Th^{234} â$^{-}$ Pa^{234} â$^{-}$ U^{234} á Th^{230} á

Ra^{226} á Rn^{222} á Po^{218} á Pb^{214} â$^{-}$ Bi^{214} â$^{-}$

Po^{214} á Pb^{210} â$^{-}$ Bi^{210} â$^{-}$ Po^{210} á Pb^{206}

The Energy Barrier and the Decay Process

When uranium breaks down whether through alpha or beta decay, energy is required to break the atomic bonds that are holding the atoms together. The amounts of energy required to break these bonds is enormous. Thermal, electrical, or chemical processes cannot break these bonds. Therefore this bond breaking happens infrequently. This causes U^{238} atoms to have such long half-lives.

Alpha particles have an energy of 4 Mev. The uranium nucleus has a voltage barrier[2] of 27 Mev. If we could increase the alpha or beta particles electron volt energy we could break the bonds holding the alpha and beta particles to the nucleus of the atom. This would cause a faster decay rate, which would affect the half-life of the process. In other words if in the past history of the earth the alpha and beta particles were imparted with more energy the decay rate would have increased and the U^{238} decay process would give very old ages for very young geological rocks and formations.

This energy is available from a very common source—cosmic rays! The energy of most cosmic rays is one billion electron volts, some have energies of over a billion billion electron volts. This is many times more energy than is needed to break the 27 Mev barrier that is holding the alpha and beta particles in place. The atmosphere of the earth provides a barrier from the onslaught of these cosmic rays. If it were not for the atmospheres all life would cease to exist because the cosmic rays would reach the surface of the earth. Most cosmic rays do not even penetrate the upper reaches of the stratosphere.

What would happen if the earth were stripped of its atmosphere? The cosmic rays would be able to affect the rate of the nuclear decay processes here on earth. The U^{238} process would be accelerated along with all the other radioactive decay processes. The book of Genesis reveals that there was a world that existed before the time of man's creations. The world had become a dump, formless and void. God reorganized the atmosphere at this time. If the atmosphere were no longer insulating the earth all radioactive processes extant at that time would have been accelerated. The rock and the strata of the earth during the time before the recreation would appear very old.

Other astronomical processes could also have come into play. These would include the earth's magnetic fields, which deflect and reroute incoming cosmic rays. Also the earth may have been bombarded with the energy shell of a nearby exploding supernova. This supernova shell would contain large amounts of cosmic rays.

The True Age of the Earth

How old is the earth? The answer is not found in man's theories based on uniformitarian principles. The only true answer is found in the Bible. Since men have rejected this source of information they have had to develop their own ideas. Many of these manmade dating methods are highly suspect and are actually subservient to the theory of evolution.

Radiometric dating is not an absolute method. Absolute is defined as independent and without qualification. These methods have too many variables and too many assumptions. Those with preconceived notions about our origins often overlook these assumptions.

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Endnotes

1. The average cosmic ray intensity has been calculated to vary less than a factor of 2 for the last 10^9 years. This is based on studies done of cosmic ray impacts on meteorites and the moon. The production of large amounts of cosmic rays, by a supernova for a relatively small amount of time would not alter the average cosmic ray intensity. A supernova increase of cosmic rays by a factor of 1,000 for 1,000 years would only increase the cosmic ray flux by 1%. (Reid and McAfee 1978, Britannica 1985, p. 848)

2. Mev is one million electron volts. Bev is one billion electron volts. An electron volt is the acceleration energy of an electron when it charged to one volt.

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