

## Chapter 2. How Old Is Earth?

The age of Earth is hotly debated among Christians. Some Christians believe that Earth was created in six, twenty-four-hour days between six and ten thousand years ago--the young-Earth view. Others believe that it was created around 3.5 billion years ago--the old-Earth view. I have an old-Earth view, and some Christians with a young-Earth view consider me to be a heretic. I believe that God created everything that has been created, and that Genesis 1 is an authentic account of God's creation. Is it a contradiction for me to believe that Earth is old and that Genesis 1 is authentic?

Although I take an old-Earth view, which is also taken by evolutionists, I absolutely do not endorse the theory of Darwinian evolution as you will see in the next chapter. Nor do I believe in theistic evolution (God guided evolution) because both scientific evidence and the clear meaning of Genesis 1 are against it. I suppose you could call me a progressive creationist since I believe that creation was done over a long period of time. I do not believe that creation was progressive because God had to experiment or because He had to correct mistakes during creation. I believe that God had a reason and a specific plan for progressive creation. I view creation as a consequence of God's word, since He spoke creation into existence. Evidence from creation and God's Word, the Bible, should be mutually consistent. If it does not appear so, we are misinterpreting one or the other or both.

### Creation Theories

There have been many theories concerning Genesis 1. They attempt to find common ground between the language in Genesis 1 and scientific evidence. Some of the more popular theories are listed below.

1. Genesis 1 is just a story and is representative of other mythological literature from its time period. The problem with this theory is that, as you have seen in Chapter 1, creation of the universe by an outside agent is the best explanation for why the universe exists and why it is fine-tuned to support complex life. As you will see in Chapter 3, the best explanation for the existence of life is that it was designed by a supernatural agent.

2. Genesis 1 is **only** symbolic. Genesis 1 may contain symbolic elements, but the problem with this second theory is that Genesis lays out specific acts of creation that have an order and for which there is scientific evidence. It is much more than symbolism.

3. Genesis can be interpreted broadly and still be literal. The Hebrew word for day can mean either a 24-hour day or an unspecified period of time (such as "in my grandfather's day"). According to Schroeder, the evening to morning transition could refer to a transition from disorder into order, obscure to discernible, veiled to unveiled, or simply to time passing<sup>1</sup>. We will consider the meaning of these words later in the chapter.

4. There are long periods of time between each day. A period of time inserted between each day of creation would allow for the time observed by scientific studies. This interpretation is possible and accommodates both the 24-hour day interpretation and the scientific evidence for an old-Earth interpretation.

5. The seven days refer to creation being revealed to Moses over seven days. Since Moses was not there for the creation, God must have revealed the story to him. God could have done this over a seven-day period when Moses spoke with Him on Mt Sinai in Exodus 24:4.

6. The seven days refer to divine fiat <sup>2</sup>. Since God spoke creation into existence, His decrees could have been given over a seven-day period with implementation accomplished over a longer period, perhaps billions of years.

7. There was a total re-creation between Genesis 1:1 and 1:2. Genesis 1:1 could have been a complete creation that was subsequently destroyed, leaving a scientific record. Genesis 1:2 could have been an account of Earth's re-creation.

8. In Genesis 1:1 and 1:2 God created Earth over billions of years, then completed it over 6 days.

9. Time is relative and is given according to God's perspective. Relativity can cause the passing of time at one location in the universe to be much different than in another.

10. God created Earth in six 24-hour days with the appearance of age. One example of the appearance of age would be the fossil record. Many people who believe Earth is old also believe that God created animals and even man as adults, having the appearance of age. If animals and man were created with the appearance of age, why not the universe?

11. Creation took six 24-hour days. Earth is a few thousand years old. Interpretation of most scientific evidence is wrong. This is the most straight-forward interpretation of the English translation of Genesis 1. Unlike theory 10, proponents argue that the Earth was not created with the appearance of age but that things which appear to be old have been misinterpreted or were formed by events between the time of Adam and Noah. They present scientific evidence supporting their young-Earth view.

Each of theories 2 through 11 seek to find common ground between scientific evidence and an interpretation of Genesis 1. In the next section we will consider evidence for an old Earth, a Young Earth, and then I will discuss a possible interpretation of the language in Genesis 1.

## Selected Evidence for an Old Earth

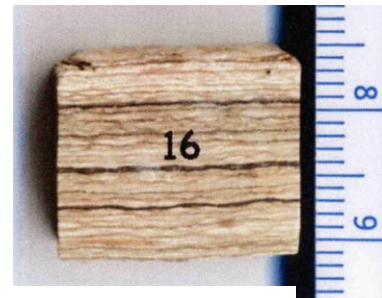
There are many areas of scientific evidence that argue for an old Earth. The following are some areas that stand out.

**The fossil record** shows an orderly progression of animal types that has changed from one-celled organisms in the bottom layer to modern animals in the top layer. There is no single complete, contiguous fossil record anywhere in the world, but pieces of the fossil record from different places mesh sufficiently to affirm that, taken together, they represent a continuum. The orderliness of the fossil record and the changes in animal types implies a rather great age. When this is combined with radiological dating, the evidence for an old Earth is very good. This evidence for age and a progression of animal types does not argue for Neo-Darwinian evolution, since, in the fossil record, animal types appear suddenly and with few if any intermediate forms.

**Ice Cores from Antarctica**, more than 3 km thick, are estimated to be over 740,000 years old. The layers trap atmospheric gasses and debris that allow them to be dated. Atmospheric gases contain stable isotopes of oxygen and hydrogen, O-16, O-18, H-1 and H-2. Because of their different evaporation and condensation properties at different temperatures, the ratio of O-16 to O-18 and H-1 to H-2 in the ice molecules can identify annual layers and long-term temperature histories. Annual layers can be identified and counted for about 15,000 years into the past. For ages greater than 15,000 years the layers are difficult to read, so age is estimated using ice thickness <sup>3</sup>.



**The Green River shale deposits** in Utah, Colorado, and Wyoming contain 7.5 million paper thin annual layers. We know that they are annual layers because each layer consists of a couplet with pollen in one of the layers and no pollen in the other <sup>5</sup>. The layers were formed in quiet lakes and ponds when clay and pollen in the water precipitated to the bottom. The process can be seen today.



Green River shale sample, scale is centimeters



**Coral reefs** thousands of feet thick can be found in both the Pacific and Atlantic oceans. Based on reasonable growth rates, they are estimated to be 100 thousand to millions of years old <sup>4</sup>.

**The Earth's period of rotation increases** by 0.000015 seconds each year because of tidal action. That is, every year a day takes 0.000015 seconds longer. But, the length of a year (the period of Earth's revolution) is not changing. This means that, in the past, days were shorter and a year would contain more than  $365\frac{1}{4}$  days. Some corals show daily as well as annual growth bands, and some very old corals,

Earth-3

geologically estimated to be 500 million years old, show 400 daily growth bands in an annual growth band. A 400-day year makes the day 21.9 hours long—2.1 hours shorter than today’s day. A 2.1-hour difference divided by 0.000015 seconds per year works out to an age of 500 million years. Both the geologically estimated age of the reef and the age based on the change in Earth’s rotation are in agreement <sup>6</sup>. Confidence in the age estimate increases when independent means of estimating age agree, as is the case here.

**Radiological dating:** Atoms are composed of positively charged protons and neutrally charged neutrons in the atom’s nucleus with negatively charged electrons “orbiting” the nucleus. Atoms with the same number of protons are the same chemical element. Atoms with the same number of protons but different numbers of neutrons are called isotopes. Some nuclei are unstable and decay from a parent element into a daughter element. The time it takes for half of a parent to decay is called the half-life of the isotope. Since the number of atoms in a sample of an unstable element changes over time, the element can be used as a nuclear clock to estimate time. Examples are the decay of carbon-14 into nitrogen-14 and the decay of potassium-40 into argon-40. By measuring the ratio of daughter element to parent element in a sample, the age of the sample can be determined. See the breakouts at the end of the chapter for a more complete explanation. Radiological dating consistently shows the oldest rocks on Earth to be about 3.6 billion years old (their age is measured from when they solidified) using a few different radiological dating methods including uranium-lead, rubidium-strontium, lutetium-hafnium, and samarium-neodymium <sup>7</sup>. These are independent measurements which are in close agreement.

**The Big Bang and nucleosynthesis theories** are consistent with an old-Earth. “Big Bang” is the theory that the universe started very small and very hot. As it expanded and cooled its constituents condensed into quarks and electrons, quarks into protons and neutrons, protons and neutrons into hydrogen and helium nuclei, and nuclei and electrons into atoms. As it expanded further, gravity pulled these atoms into galaxies and stars. The density and temperature inside stars allowed the nuclear fusion of hydrogen and helium into heavier elements. Nucleosynthesis is the formation of all the known elements by the nuclear fusion of lighter elements into heavier elements in stars and explains the existence of elements heavier than hydrogen and helium in our universe. This whole process requires billions of years.

Schroeder gives an interesting quote from a Commentary on the Torah by Nahmanides, a 13<sup>th</sup> century Jewish scholar <sup>8</sup>:

“At the briefest instant following creation all the matter of the universe was concentrated in a very small place, no larger than a grain of mustard. The matter at this time was so thin, so intangible, that it did not have real substance. It did have, however, a potential to gain substance and form and to become tangible matter. From the initial concentration of this intangible substance in its minute location, the substance expanded, expanding the universe as it did so. As the expansion progressed, a change in the substance occurred. This initially thin noncorporeal substance took on the tangible aspects of matter as we know it.

From this initial act of creation, from this ethereally thin pseudosubstance, everything that has existed, or will ever exist, was, is, and will be formed.”

It would appear that Nahmanides thought Genesis implied a Big Bang long before the modern theory was conceivable. Unfortunately, he did not record his reasoning.

## Scientific Arguments for a Young Earth and their Critique

The primary scientific advocate in the U.S. for a young Earth is the Creation Science Fellowship (CSF) and their Institute for Creation Research (ICR). They present scientific evidence supporting a young Earth view. Some of this evidence and my critiques are summarized below.

**The big bang (an old-Earth view) violates the Second Law of Thermodynamics:** The big bang theory posits that cosmic matter in the universe condensed into galaxies and stars by gravitational attraction and that the universe is 13.5 billion years old. The condensation of cosmic matter into galaxies, stars, and planets increases order in the universe and therefore decreases entropy. The Second Law of Thermodynamics says that entropy in a closed system must increase, not decrease; therefore, the big bang theory and a 13.5 billion year-old universe must be wrong.

Critique: While galaxies, stars, and planets are more orderly than dispersed cosmic matter, the condensation process that forms galaxies and stars requires collisions of matter. Without collisions galaxies, stars, and planets cannot be formed. The energy from these collisions either increases the matter’s temperature, increasing entropy, or is radiated away carrying entropy with it. So, while the galaxies, stars, and planets are more orderly than the material from which they were formed, the total entropy, which includes temperature increase and the entropy of radiated energy, has increased. The Second Law has not been violated by the big bang.

**Relativity can explain the time difference between young- and old-Earth views:** In Russ Humphreys’ book *Starlight and Time*, he develops a cosmological model to show how time can be affected by gravity and how time in one reference frame can run faster or slower than in another reference frame<sup>9</sup>. This is offered as an explanation for how Earth, created over six 24-hour days six thousand years ago, can appear to be billions of years old.

Critique: In relativity theory, two observers observing the same event will see that the event obeys the laws of physics within their reference frame. If an observer in one frame sees two cars colliding, an observer in another frame witnessing the same event must also see the cars colliding. The cars cannot collide in one frame, and miss each other in the other frame. Consider observer A on Earth observing the revolutions of Earth around the sun (he uses the stars to time a revolution). Also consider observer B somewhere in space in a relativistic situation such that his clock runs much slower than a clock on Earth. Observer A sees an Earth revolution as taking a year (32.6 million seconds). Observer B sees that, according to his clock, a revolution only takes 1 second, as an extreme example. Observer A sees 3 billion years pass,

but observer B sees only 3 billion seconds pass. However, observer B still sees that Earth has revolved around the sun 3 billion times. He would know that 3 billion Earth years have passed, and there would be no confusion about the number of Earth years that have passed. Relativity arguments cannot explain the time difference between the young-Earth and old-Earth views.

**Spiral galaxies have not completely wound up, indicating that the universe is young.**

According to the young-Earth community, galaxies should have “wound up” long ago if the universe is billions of years old, and we should see them as uniform disks without distinct spiral arms.

Critique: Stars in a galaxy orbit the center of mass of the galaxy, and their orbital speed can be found using the mathematical equations of orbital mechanics which balance the gravitational pull toward the center of the galaxy with the star’s speed keeping it from falling into the center of the galaxy, just like Earth’s speed and the sun’s gravity are balanced keeping Earth in orbit. Stars near the center of the galaxy have a higher angular speed than those more distant, and spiral arms tend to “wind-up.” The orbital speed of a star in a galaxy depends on the mass distribution in the galaxy. If nearly all of a galaxy’s mass is concentrated at the center, wind-up is faster. If the mass in a galaxy is uniformly distributed, windup is much slower. Measurements of galaxy rotation speed indicate that the mass density is somewhere in between.



The rotation speed for most stars is very slow. For example, the sun makes one revolution every 250 million years, so it has made only a few revolutions during the life of the galaxy. We would expect to see more “wind up” toward the center of the galaxy than toward the outer edge of the galaxy, which is exactly what we see. In fact, if the universe were young, only a few thousand years old, we would expect to see little if any “wind-up,” but we do see “wind-up.”

**The quantity of carbon-14 in some carbon deposits indicate that Earth is young:** In his book Thousands not Billions, Don DeYoung lists measurements which show that some carbon deposits have C-14 to C-12 ratios too high for an old-Earth interpretation and indicate that the deposits are only between 40,000 and 60,000 years old, not millions or billions <sup>10</sup>. If the deposits were millions or billions of years old, they should contain an amount of C-14 that is currently not measurable since the half-life of C-14 is roughly 5700 years. (See the breakout on Carbon-14 dating at the end of this chapter.)

Critique: It is likely that the high C-14 content in fossil carbon reported by De Young is due to the spontaneous fission of uranium and thorium in and around the carbon deposits. Neutrons from the fissions would interact with N-14 to generate C-14, just like cosmic neutrons interact with N-14 in the atmosphere to form C-14. Uranium deposits exist with sufficient concentrations to produce the reported C-14 in fossil carbon. Because of the spontaneous fission of uranium and thorium, the high concentrations of C-14 do not imply that the carbon samples

are only 40,000 to 60,000 years old--they may be significantly older. Many fossil carbon deposits contain no measurable C-14 implying that they are more than 50 thousand years old.

**Radioactive decay accelerated during Noah's flood making Earth look older than it is:**

DeYoung goes on to say that while the data indicate an age of 40 to 50 thousand years, the age of the samples is really only a few thousand years because the decay rate accelerated during the flood around 5000 years ago.

Critique: This view presumes that the electromagnetic force and nuclear strong and weak forces, three of the four basic forces in physics which govern radiological decay, have changed. One problem with this view is that C-14 data uses tree ring data for calibration, and tree ring dating reaches back about 12,000 years, implying that there has been no decay acceleration in that time period. Any decay rate change theories that date things at less than 12,000 years before the present must also contend with tree ring dating, and this was not discussed in DeYoung's book.

**Radiological dates supporting an old-Earth view are inconsistent and should not be**

**trusted:** Creation scientists assert that there are inconsistencies in radiological dating methods. For example, "recent" volcanic lava flows have been inaccurately dated by potassium-argon (K-Ar) radiological dating <sup>11</sup>. Sunset Crater in Arizona erupted about 1000 years ago according to Native American tradition which is confirmed by tree ring dating. Potassium-argon (K-Ar) dating estimates the eruption was 210,000 to 230,000 years ago. Mt. St. Helens in Washington erupted in 1980, but K-Ar dating puts its eruption at 300,000 to 2.8 million years ago. The Hualalai Volcano in Hawaii erupted 200 years ago and was witnessed by people who lived there. K-Ar dating puts the eruption at 140 million to 3 billion years ago.

Critique: This would appear to put radiological dating into question; however, Potassium-40 has a half-life of 1.2 billion years, and with this half-life K-Ar dating cannot be legitimately used for measuring ages less than about 20 million years <sup>12</sup> because relatively little Ar would be produced compared to background Ar and instruments are not sufficiently sensitive to measure such small amounts. It would be like trying to measure microns with a yard stick. Since the Sunset Crater, Mt. St. Helens, and Hualalai Volcano K-Ar measurements were made within 1,000 years of their known eruptions, they are not valid and cannot be legitimately used to question the reliability of radiological dating. The Hualalai comparison is even more interesting. According to geologist Brent Dalrymple, the volcanic flows from Hualalai contain inclusions of xenolithic grains and rocks which did not melt in this lava flow and retained a high level of fossil Argon <sup>13</sup>. The K-Ar measurements were made on volcanic rock which included the xenoliths and exaggerated the quantity of Ar.

**The fossil record was laid down by Noah's flood only a few thousand years ago:** The young-Earth view is that geological layers and the fossils in them were laid down by Noah's flood. Proponents of this view explain that the fossilized organisms are found in particular strata because of their density or because some were able to climb, swim, or fly higher than others.

Critique: The record is far too orderly to have been laid down by a catastrophic flood. The fossil record shows that the different kinds of animals that lived on Earth at different times are constrained to geologic layers from those times <sup>14</sup>. There is no good evidence that the fossil record has more dense animals and plants in the lower strata, and less dense plants and animals in the upper strata. Bacteria, turtles, and many fish are found at many levels in the fossil record. There is no good evidence that the animals found in the upper strata could climb higher than the ones found in the lower strata. Many animals including some birds and some dinosaurs should be higher in the record than man because of their climbing or flying ability, but they are not. Turtles should be found at very low levels since their climbing ability is limited, but they are found at many levels. There is no mixing except where geologic forces have displaced the layers. Dr. Carol Hill is a geologist who studied the strata and fossils in the Grand Canyon. In The Grand Canyon, Monument to an Ancient Earth, she concluded that the canyon is very old <sup>15</sup>.

**Soft tissue, blood proteins, and DNA have been found in dinosaur bones indicating they lived only a few thousand years ago:** In an Institute for Creation Research (ICR) article in 2012, Brian Thomas cited recent reports of finding dinosaur soft tissue, blood proteins, and DNA in tyrannosaur and hadrosaur bones. He argued that preservation of these tissues, proteins, and DNA was not possible if dinosaurs lived millions of years ago, indicating that the fossils were only thousands of years old <sup>16</sup>.

Critique: Mary Schweitzer's team at North Carolina State University did indeed find soft tissue (collagen), osteocyte (bone) protein, hemoglobin fragments, and osteocyte histones (proteins that help organize DNA but are not DNA) in T-rex and other dinosaur bones <sup>17,18</sup>. Schweitzer has a theory that tightly wound proteins (histones) may be able to survive much longer than previously assumed. She also believes that iron helps preserve soft tissue and proteins <sup>19</sup>. Perhaps previous assumptions about protein lifetimes were incorrect.

**Other young-Earth arguments.** The young-Earth community has made many more arguments for scientific evidence supporting a young Earth. Some of these arguments and their critiques are summarized in the table below.



<b>Argument</b>	<b>Critique</b>	<b>Reference</b>
<b>The high helium content in minerals implies that Earth is young.</b>	As Uranium and Thorium in Earth's crust decay, alpha particles are produced which are the nuclei of helium atoms. DeYoung's study did not adequately consider helium produced in the matrix surrounding the mineral specimens.	10
<b>Comets disintegrate too quickly and should not exist if the solar system is old.</b>	New short-period comets come from the Kuiper belt located beyond the orbit of Neptune. New long-period comets may come from a hypothesized Ort cloud beyond the orbit of Pluto.	20
<b>Moon dust thickness indicates a young age.</b>	Measurements of moon dust thickness by Apollo 16 are consistent with an old moon.	21, 22
<b>Earth's magnetic field is decaying too fast for Earth to be more than 6,000 to 10,000 years old.</b>	The Earth's magnetic field reverses periodically as seen in the Atlantic sea floor, so young-Earth extrapolations are in error. The last reversal was 780,000 years ago.	23, 24, 25
<b>Dinosaur and human footprints appear together indicating they lived at the same time a few thousand years ago.</b>	Near Glen Rose, Texas, the footprints attributed to man are 18 inches long, sometimes with claw marks, and the stride is very long. The prints appear to have been made by a carnivorous dinosaur.	26
<b>There is not enough mud on the sea floor to explain an old Earth.</b>	The Louisiana delta was measured to be more than 7 miles deep. This is consistent with millions of years of deposition, not thousands.	27
<b>There is not enough sodium in the sea to explain an old Earth.</b>	The young-Earth view does not adequately consider long term geophysical changes.	28, 29
<b>Ice core ages used as evidence for an old Earth can be confused by storms.</b>	Ice core dating uses hydrogen and oxygen isotopes to see seasonal bands in ice.	30
<b>At the current recession rate, the moon should be farther away if Earth is old.</b>	Past and present recession rates are consistent with the current distance and an old Earth.	31

## An Interpretation of “Day” in Genesis 1

A six-day (24 hours per day) creation is one possible interpretation of Genesis 1, but other interpretations are also possible. Perhaps the main reasons for believing that the six days of creation in Genesis 1 are each 24 hours long is because the account in Genesis 1 of each day of creation ends with the phrase “and there was evening and there was morning, day one” (or, a second, third, fourth, fifth day, or the sixth day) and because Exodus 20:11 says “For in six days the LORD made the heavens and the earth...” Because of this, the interpretation of the words “evening,” “morning,” and “day” are very important. The word day (Genesis 1:5a, 8, 13, 19, 23, 31) is the word “*yom*” in Hebrew. In Hebrew the word has a range of meanings: daylight period, a 24-hour day, or an indefinite period of time, just like in English. In Genesis 1:5, 16, and 18, “*yom*” is clearly used to mean the daylight period.

Genesis 2:4 makes a very interesting reference to the creation that is slightly different in different English versions.

NASV--This is the account of the heavens and the earth when they were created, in the day that the LORD God made earth and heaven.

NIV--This is the account of the heavens and the earth when they were created. When the LORD God made the earth and the heavens.

KJV--These are the generations of the heavens and of the earth when they were created, in the day that the LORD God made the earth and the heavens.

ASV--These are the generations of the heavens and of the earth when they were created, in the day that Jehovah God made earth and heaven.

NLT--This is the account of the creation of the heavens and the earth. When the LORD God made the heavens and the earth.

### **Bible Versions**

NASV or NASB-New American Standard Version

NIV-New International Version

KJV-King James Version

ASV-American Standard Version

NLT-New Living Translation

A word or group of words is underlined in the five translations each of which is designated as Strong's # 3117 (*yom*). Strong's word #3117 means day and is singular. NIV and NLT translate the word as when. NASV, KJV, and ASV translate the word as in the day. Note that each of the translations that translate it as in the day uses the singular form. The word "*yom*" does not mean "when," so the NIV and NLT do not give literal translations.

The phrase "in the day that the LORD God made the earth and the heavens (KJV)" or "in the day that Jehovah God made earth and heaven (ASV)" must be referring to the six days of creation since the verses leading up to Genesis 2:4 describe God creating the earth and heavens. Thus, "in the day" (singular) refers to six days. This is an example of the word "day" referring to an extended period of time--six days--and not 24 hours in this case. This use in Genesis 2:4 demonstrates the fact that the word "day" can refer to an extended period of time, even in this context.

Even though the word "day" can refer to an extended period of time, the use of the words "And there was evening, and there was morning" (Genesis 1:5,8,13,19,23,31) would appear to support the interpretation that the word "day" used in these verses refers to 24-hour days; however, evening and morning do not make a 24-hour day. Since they do not make a 24-hour day, perhaps the writer used them to convey an idea other than a 24-hour day. One should also note that God did not make the sun until day four, and yet, the words evening and morning are used for days one through three. This suggests that the words interpreted as evening and morning might have a different interpretation.

The Hebrew word translated "evening" is "*erev*" with Strong's # 6153. According to Zodhiates it means dusk, evening, night, covered with a texture, a web, mingled, or mixed <sup>32</sup>. The root is "*arav*," Strong's # 6148, which means to braid or intermix. Schroeder says that the root of "*erev*" carries the connotation of obscured, blurred, mixed up, stirred together, disorderly, chaotic <sup>31</sup>. These are completely consistent with Zodhiates' definition.

The Hebrew word translated "morning" is "*boqer*" with Strong's # 1242. According to Zodhiates it means dawn, morning, daybreak <sup>32</sup>. The root is "*baqar*," Strong's # 1239, which means plowed, or to break forth. Schroeder, says the root has the connotation of being discernable, distinguishable, or orderly <sup>33</sup>.

Ross and Whitefield point out that the KJV translated the evening-morning phrase incorrectly as "And the evening and the morning **were** the first day <sup>34,35</sup>." A much better translation is "And there was evening and there was morning, one day" as given in the NASB. The KJV translation implies that the day is 24 hours long much more strongly than the NASB translation, but the KJV interpretation is incorrect. The proper translation of this phrase is thoroughly discussed by Whitefield. His interpretation is that "evening and morning" "do not involve the passage of a specific amount of time."

Schroeder interprets the evening-morning phrase as a flow from disorder into order <sup>33</sup>. This interpretation, although somewhat figurative, fits within a reasonable range of definitions.

Ancient people had the concept that the creative powers of the gods brought order out of chaos. Schroeder's interpretation would fit this concept very well.

Stoner suggests that the evening-morning phrase can simply refer to the passing of time<sup>36</sup>. He gives examples from the Bible where similar phrases imply continuous action, not a 24-hour period (Leviticus 24:3, 1 Chronicles 16:40, Job 4:20).

What if the evening-morning phrase had been translated "And there was dusk and there was dawn?" Dusk and dawn can be used more figuratively than evening and morning, and dusk and dawn clearly fall within the range of meaning for *erev* and *boqer*. Dusk can have the connotation of hidden or obscure, and dawn can have the connotation of brought to light or broke forth. Could this phrase refer to God's creative plan, which was hidden or obscure, being brought to light or having broken forth? God's creative plan certainly broke forth. While these alternate interpretations are somewhat figurative, they are appropriate to the context, and they derive from the literal range of meanings for *erev* and *boqer*.

But, is it reasonable to use a somewhat figurative interpretation of *erev* and *boqer*? It is fairly clear that the style of Genesis 1 is significantly different than that of Genesis 2. Genesis 1 seems to be more poetic or structured than the remainder of Genesis: Genesis 1 contains repetitive phrases; each day of creation starts with "Then God said..." (Genesis 1:3, 6, 9, 14, 20, 24); and each day of creation ends with "And there was evening, and there was morning, day one" (or, a second, third, fourth, fifth day, or the sixth day) (Genesis 1:5, 8, 13, 19, 23, 31). In addition, the phrase "And God saw that it was good" or "very good" follows most acts of creation (Genesis 1: 4, 10, 12, 18, 21, 25, 31). Hebrew scholars do not classify Genesis 1 as Hebrew poetry, but these repetitive phrases appear to be poetic elements. If they are poetic elements, the words might be interpreted a little less rigidly and perhaps more figuratively than for non-poetic elements. While I argue for a more figurative interpretation of Genesis 1, I don't believe that poetic elements make it less reliable, but I do believe that they may give some interpretive flexibility within bounds.

Is it reasonable to consider a range of definitions for the words evening and morning, even going back to the root word definitions? Some scholars speculate that Genesis 1 may have been recorded first in a different language than Hebrew, perhaps even orally transmitted, long before Moses wrote it down sometime around 1400 BCE. Since words sometimes shift slightly in meaning over time and through translation; and since Moses may have translated Genesis 1 from a different language, it seems reasonable that we should not be too dogmatic about the meaning of the words evening and morning. A range of meanings should be considered; however, I reject the argument that any interpretation will do. There are boundaries on interpretation even if there is flexibility within those boundaries.

## The Possibility that Genesis 1 May Not Describe Sequential “Days.”

In addition to different interpretations of the words “day,” “evening,” and “morning, there are interpretations of Genesis 1 that do not see the days as sequential. According to John Lennox, 18<sup>th</sup> century Johann Gotfried suggested that the Genesis days form a literary or artistic framework with two triads of days and a day of rest<sup>37</sup>. On day one, light was created to provide the light necessary for the stars, sun, and moon made on day 4. On day two, the waters were gathered and separated by a firmament (sky) to provide seas for the sea creatures and sky for the birds created on day 5. On day 3, the waters were gathered so that dry land appeared, and the earth brought forth vegetation to provide for the land animals on day 6.

<b>Day 1</b> <b>Light</b> <b>Day and Night</b>	<b>Day 4</b> <b>Stars</b> <b>Sun and Moon</b>
<b>Day 2</b> <b>Waters</b> <b>Firmament (Sky)</b>	<b>Day 5</b> <b>Sea creatures</b> <b>Birds in the sky</b>
<b>Day 3</b> <b>Dry land</b> <b>Vegetation on the land</b>	<b>Day 6</b> <b>Land animals</b> <b>Man (male and female)</b>
<b>Day 7 Rest</b>	

There is some evidence that these may not be sequential, 24-hour days. On day one, God created light and separated the light from the darkness. He called the light “day” and the darkness “night.” On the fourth day, God made the lights (stars) in the heaven to separate the day from the night, and He made the sun. There is no problem with having light before the sun was made. There could be many sources of light in a developing universe, possibly even God himself. The problem is that He separated day (light) from night (darkness or absence of light) on the first day, before the sun existed. If God is the source of light, his omnipresence would illuminate everything, and there would be no darkness or night. If the source of light is pre-galactic matter in the universe, light would be everywhere, and there would be no darkness or night. The only way to have darkness is to have a localized source of light that can be blocked by opaque matter. On the fourth day, God made the lights in the heavens to separate the day from the night, but He already separated the day from the night on the first day. Why is the day separated from the night on two different days? This problem is resolved more easily by the two-triad interpretation given in the table above than by the sequential 24-hour day interpretation. Under the two-triad interpretation, days one and four are not necessarily separate and distinct, but are both part of a continuum in which God created light, formed the sun, and set up the geometry to give both day and night.

On day three, God created plants and fruit trees. Genesis 2:5 says that there was no shrub of the field and no plant of the field because there was no rain. This verse is referring either to day 6 when God created man or to a time after day 6 depending on one's interpretation of Genesis 2:4. In either case it says that there were no shrubs or plants of the field although God created plants on day three, but why would they not exist due to lack of rain while plants created three or more days earlier were already in existence? Also, if there was no rain anywhere, how could the garden be at the confluence of three rivers? This problem can be resolved by assuming the garden was a special creation or by assuming that shrubs and plants of the field were special agricultural plants, but it is more easily resolved by the two-triad interpretation where days three and six are not separate and distinct but a continuum of God's creation.

On day six, God created man, male and female. Genesis 2 gives the story of Adam and Eve's creation, but assuming that this account gives details for their creation on day six presents some difficulties. In Genesis 2, Adam and Eve were not created at the same time; although, according to creation on day six, they were created on the same day. A chronology in Genesis 2 goes as follows: God created Adam; God planted a garden; God moved Adam to the garden; God caused trees to grow; God showed Adam around the garden; God formed every beast; Adam gave them all names; and none of the beasts were suitable as a helper for Adam, so God made Eve. Adam was a busy man on day six between his creation and Eve's creation. Not only did he move to a new place and watch the garden grow, but he named every animal. In addition, he had time to be lonely. Could all of these things have happened in a single day? If days three and six, and the time in Genesis 2, represent a continuum of God's creation, the story fits better than for a six 24-hour, sequential day interpretation.

## **In Conclusion:**

- 1) The Hebrew word "*yom*" used throughout Genesis 1 can imply either a 24-hour day or an indefinite period of time.
- 2) Alternate, perhaps figurative, interpretations of the Hebrew words "*erev*" and "*boqer*" (evening and morning) can be used that are within their normal range of meanings and are consistent with their context.
- 3) The repeated phrases "and there was evening and there was morning" and "God saw that it was good (or very good)" are poetic elements allowing some flexibility, perhaps a figurative interpretation.
- 4) The original language of Genesis 1 may not have been Hebrew, and arguments that Genesis 1 is not Hebrew poetry may not apply.
- 5) The material in Genesis 1 fits a topical, two-triad interpretation better than a six 24-hour, sequential day interpretation.

These considerations lead me to believe that the six days of creation in Genesis 1 need not be rigidly interpreted as sequential 24-hour days. Flexibility within the range of literal interpretation, in combination with scientific evidence that favor an old Earth, leads me to believe that the 24-hour day interpretation is not the original meaning.

If we accept the six days of creation as topical periods of God's creation, from the birth of each Godly decree to its completion, then our interpretation of Genesis 1 and the scientific evidence are in good agreement, and that is the way it should be.

## Radiological Dating Methods

The unstable nuclides can be used for radiological dating.

Carbon-14 (C-14) is produced by cosmic radiation in the upper atmosphere when nitrogen (N-14) absorbs a neutron, emits a proton and becomes C-14. Plants, while alive, absorb carbon in the atmosphere. When the plant dies, no new carbon is absorbed, and the C-14 nucleus decays into N-14 with a half-life of 5700 years. The ratio of C-14 to C-12 is used to estimate the time of decay.

A K-40 nucleus decays to Ar-40 by emitting an electron with  $t_{1/2}$  of  $1.2 \times 10^9$  years. The K-40 naturally occurs in the Earth's rock including magma that comes to the Earth's surface. Ar is a stable gas that does not chemically react with other elements and is trapped in magma until the magma reaches the Earth's surface at which point it escapes. When liquid rock solidifies, Ar produced by the decay of K-40 is again trapped and the time that has passed since the rock solidified can be estimated from the quantity of Ar in the rock. K-Ar dating can be used for ages of several million to billions of years.

Other dating methods, all of which can be used to measure age in millions to billions of years, are as follows:

Rb-87 decays to Sr-87 by  $\beta$  with  $t_{1/2} = 47$  billion years

Sm-147 decays to Nd-143 by  $\alpha$  with  $t_{1/2} = 110$  billion years

Lu-176 decays to Hf-176 by  $\beta$  with  $t_{1/2} = 21$  billion years

Re-187 decays to Os-187 by  $\beta$  with  $t_{1/2} = 70$  billion years

Th-232 decays to Pb-208 by a series

U-235 decays to Pb-207 by a series

U-238 decays to Pb-206 by a series

$\beta$  decay is the emission of an electron from the nucleus.

$\alpha$  decay is the emission of 2 protons and 2 neutrons (a helium nucleus) from the nucleus.

There is no good radiological dating method for ages between 50 thousand and a few million years.



## Radiological Dating Using Carbon-14

Nearly all carbon on Earth is C-12 which has a nucleus with 6 protons and 6 neutrons. C-14 has 6 protons and 8 neutrons. C-14 is produced in the atmosphere when cosmic rays generate neutrons that interact with nitrogen (N-14), which has 7 protons and 7 neutrons, to produce C-14 and a proton. The cosmic neutron replaces a proton in the nitrogen nucleus with a neutron. The ratio of C-14 to C-12 in the atmosphere is fairly constant over time. One way we know it is constant over time, at least over the last 12,000 years, is through tree ring dating which is used to calibrate C-14 dating. C-14 decays into N-14 when a neutron in C-14 emits an electron to become a proton.

C-14 dating measures the ratio of C-14 to C-12. The average atmospheric ratio of C-14 to C-12 is roughly  $1 \times 10^{-12}$  or 1 part in a trillion. Both C-12 and C-14 are ingested by plants, and when the plant dies the C-14 decays into N-14 with a half-life of roughly 5700 years. Over time the ratio of C-14 to C-12 in the plant decreases. The following table shows the correspondence between the ratio of C-14 to C-12 and age of the carbon.

<u>Age in years</u>	<u>Ratio of C-14 to C-12</u>
0	$1.0 \times 10^{-12}$
5,000	$5.4 \times 10^{-13}$
10,000	$3.0 \times 10^{-13}$
20,000	$8.7 \times 10^{-14}$
30,000	$2.6 \times 10^{-14}$
40,000	$7.5 \times 10^{-15}$
50,000	$2.2 \times 10^{-15}$
60,000	$6.6 \times 10^{-16}$

Currently, we cannot measure concentration ratios less than  $1 \times 10^{-15}$  so the C-14 in deposits more than about 50,000 years old cannot be measured. C-14 dates up to about 12,000 years old are calibrated by tree ring dating.

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