Dating the Earth, Doug Hayhoe, November 2021

Some people think the Bible says that the Earth is just six thousand years old. But the Bible is not a science text. Scientific analysis based on what creation tells us has proven that the earth is almost five billion years old.

The complete Bible is nearly two thousand years old – but did you know that the idea that the Earth is only six thousand years old is relatively recent? Bishop Ussher was a prolific scholar and archbishop in the Church of Ireland in the 1600s. Adding up the ages of people and length of royal reigns in the Bible, he was the first person to decide that Adam was created on October 28, 4004 BC. Since Genesis 1 says that Adam was created on the sixth day, the universe must have been created six days earlier, on October 22, he concluded. The discovery of ancient fossils and geological deposits in the early 1800s, however, made most people realize that the Earth must be a lot older. How could we reconcile this discrepancy between what science was revealing and what the Bible taught?

In 1814, a Church of Scotland minister, Thomas Chalmers, resurrected an older interpretation of Genesis 1:1-2 known as "the gap theory" – the idea that there must have been a lot going on between verses one and two in the Bible. For, while verse one says that God created the heaven and the Earth – which we would assume to be perfectly formed – verse two says, "The Earth was formless and empty." The gap could be hundreds of thousands or even a million years in length, long enough to fit any geological evidence being discovered in the 1800s.

By the end of the 1800s, however, scientists began to realize that the Earth must be billions, not millions, of years old. Here's how.

Radiometric dating of rocks

Radioactivity is the property of certain isotopes to spontaneously emit energy and particles from their atomic nucleus as they undergo decay. The rate of decay can be described with a half-life, the time it takes for half of the original sample to decay.

Radioactivity was discovered in 1896 and it took scientist Ernest Rutherford less than a decade to realize it could be used to determine the age of rocks on the Earth.

Perhaps you remember seeing a periodic table of the elements in your science classroom. It shows the 100+ elements arranged using their *atomic number*, the number of electrons or protons they have. Most of the elements also have neutrons. These don't affect their chemical characteristics; but they do affect the stability of their nucleus. The nuclei of some elements are not stable, and this can be used to determine the age of the Earth's rocks. Take Potassium, for example. It is a common element present in our bodies. It has 19 electrons in constant motion around its nucleus, and 19 protons inside its nucleus. Normally, there are 20 neutrons in its nucleus. So its *atomic mass* is 39, the sum of the 19 protons and 20 neutrons. The electrons, being so tiny, don't count.

Potassium-39 is very stable. But when the Earth's rocks were formed a long time ago, in addition to Potassium-39, they also contained a small amount of an *isotope* of Potassium that had one extra neutron in its nucleus. It's called Potassium-40, as it has 19 protons and 21 neutrons. The presence of the extra neutron makes it unstable. It decays into Argon-40

over many millions of years. This is because every so often one of its protons releases a positive Beta particle, which turns the proton into a neutron. So, there's one less proton and one more neutron in the nucleus, now. That makes it Argon-40, which has 18 protons and 22 neutrons (Figure 1).

 $^{40}_{19}$ K -----> β^+ + $^{40}_{18}$ Ar

Figure 1 Potassium-40 (K) gives off a positive beta particle, turning a proton into a neutron in its nucleus, when it decays into Argon-40 (Ar).

Here's how this helps us date the Earth's rocks. A rock that was initially formed with some Potassium-40 in it will have less and less Potassium-40 as time goes on, as it slowly decays. But it will have more and more Argon-40, since Potassium-40 turns into Argon. The half-life of this decay, the time taken for half of the Potassium-40 to turn into Argon-40, is 1.25 billion years. So, we can calculate when the rock was formed, assuming it initially had no Argon-40. In a certain rock, if three quarters of the initial Potassium-40 has turned into Argon-40 this means it has gone through two half-life periods. Half of the Potassium-40 decayed in the first 1.25 billion years, and half of the Potassium-40 left in the next 1.25 billion years: that means it is 2.5 billion years old. If only one tenth of the Potassium-40 had turned into Argon, the rock would be just several hundred million years old.

There are several other types of radioactive dating that can be used to measure things over shorter and longer time periods. For example, today we have the Uranium-235 to Lead-206 decay chain with a half-life of 704 million years that can also be used to measure the age of rocks and minerals that are billions of years old, and the Carbon-14 dating with a half-life of just 5730 years that can be used to measure the age of organic materials such as wood, fabric, and bone, up to around 50,000 years ago.¹

Arguments for a Young Earth

In the first half of the twentieth century, so-called scientific arguments for a six-thousandyear-old Earth were developed by a Seventh-Day Adventist teacher, George McCready Price. Although they were not accepted by the vast majority of geologists, the hydraulics engineering professor, Henry Morris, and theologian John C. Whitcomb adopted them and popularized them in their 1961 book, *The Genesis Flood*. I first read this when I was in high school, but wasn't convinced at the time. In my final undergraduate year of university, I took a physics course on the radioactive dating of rocks and I read the *The Genesis Flood* again, so I could compare the two arguments. As a physics student, I was impressed with how certain radioactive dating is and I became absolutely convinced that the Earth was billions of years old. Although other "creation scientists" have followed Morris and Whitcomb, such as Ken Ham, none of their arguments have convinced me either.

¹ See the National Parks Service <u>website on radiometric age-dating for more examples.</u>

I'm not a geologist, but I am an amateur astronomer and physics graduate as well as a science educator. I know what valid arguments look like, and I'm aware of arguments used to cloud and even twist the scientific evidence. Fellow Christian and misinformation expert Dr. John Cook maintains a website called Skeptical Science, which addresses invalid arguments against climate change. His classification of these invalid arguments and techniques, which he calls "<u>History of FLICC</u>," has a wide application, however.

When I look at the evidence that young Earth advocates such as Ken Ham refer to, it often envokes these types of arguments, and it all fails miserably. While there may be one or two Christian astronomers who believe in a young universe, there are thousands of astronomers who are absolutely convinced that the universe is ancient. Hundreds of them are Christians. Likewise, there are hundreds of Christian geologists who believe that the Earth is ancient.

The Canadian Shield

I've spent many summers north of Toronto on the Canadian Shield, an ancient rock formation that spans half of our country (Figure 2). It's a place of amazing beauty and variety, full of lakes and trees, as well as the intriguing patterns everywhere evident in the igneous and metamorphic rocks. These rocks have been carefully tested and dated by thousands of geology students and professors. It is no longer in dispute that they date back to 2.5 to 4.2 billion years ago.

This great age has never bothered me as a Bible-believing Christian. I've always known this was nothing compared to my Creator's eternal existence. When I observe galaxies



Figure 2 The rocks in the Canadian Shield, in reds and browns, date back to 2.5 to 4.2 billion years ago, when they were first formed.

through my telescope, I'm also reminded of their great age. Yet, I distinctly feel God speaking to me personally, through his magnificent and ancient creation, whether in the sky or in the rocks. For, as David put it so aptly many years ago, "the heavens declare the glory of God and the the Earth shows his handiwork" (Psalm 19:1). More recently, Brian Doerksen has expressed this beautifully in his 2002 hymn:

"Faithful one, so unchanging Ageless one, you're my rock of peace. Lord of all I depend on You I call out to you, again and again."

In fact, as Saint Augustine observed 1600 years ago, time is irrelevant to God, because he exists outside of it. That's why Moses said, speaking to God, "a thousand years in your sight ... are like a watch in the night" (Psalm 90:4). And when he had almost finished writing his five books of the Law, Moses encouraged us with this reminder, The eternal God is our refuge; and underneath are the everlasting arms" (Deuteronomy 33:25).