WHY RADIOMETRIC DATING?

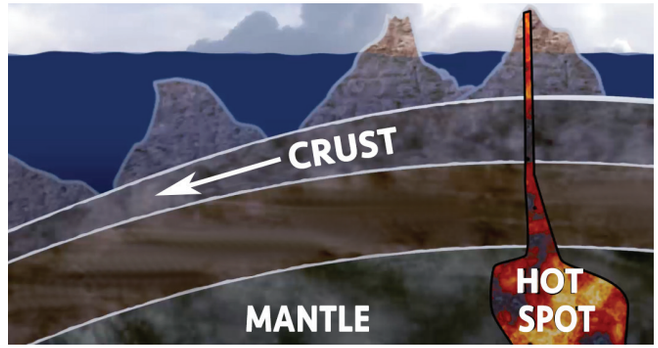
Those who studied creation in the 19th century were known as "natural philosophers." Many were Christians who contributed to the development of the science of geology by examining rocks and fossils. They observed that the great diversity of fossils was not random, but highly organized in the sedimentary layers. Wherever they looked, specific groups of fossils were *always* above others – deposited more recently. They developed the Principle of Superposition: the older rocks are below and the younger rocks above (hence ***relative*** age). They named the major divisions *eras*: Paleozoic for old animal life, Mesozoic for middle animal life, and Cenozoic for recent animal life. This became the Geologic Time Scale, and between 1820 and 1880, they named eleven *periods* after locations in Europe where the fossil groups were found. This *relative* age of sedimentary rocks was found to be the same in the USA, and ultimately around the world.

Geologic Time Scale

Eras	Periods		millions of years ago
			0
Cenozoic	Quaternary - Q	Holocene	0.01
		Pleistocene	2.6
	Neogene - N	Pliocene	5.3
		Miocene	23
	Paleogene - Pg	Oligocene	34
		Eocene	56
		Paleocene	66
Mesozoic	Cretaceous - K		145
	Jurassic - J		201
	Triassic - Tr		252
Paleozoic	Permian - P		299
	Pennsylvanian* - IP		323
	Mississippian* - M		359
	Devonian - D		419
	Silurian - S		444
	Ordovician - O		485
	Cambrian - Ꞓ		541
Precambrian	pЄ	Proterozoic - P	2,500
		Archean - A	4,600

*Mississippian and Pennsylvanian were known first in the UK as 'Carboniferous'.

But there was no method of finding an ***absolute*** age (number of years old) for each of the eleven fossil systems. Radioactivity was discovered in 1896, and when scientists understood the physics of radioactive decay, geologists realized they could determine when an igneous rock had formed in the past (as liquid lava that cooled and formed solid minerals). The rate of radioactive decay follows the "half" rule. In each interval of time, called a ***half-life***, half of the remaining "parent" atoms, on average, decay to become "daughter" atoms that are stable. One significant "parent-daughter" pair for radiometric dating is uranium-238 that becomes lead-206 after a long decay chain. By the end of the 1930s, geologists had developed these techniques to determine how long ago igneous rocks had formed.



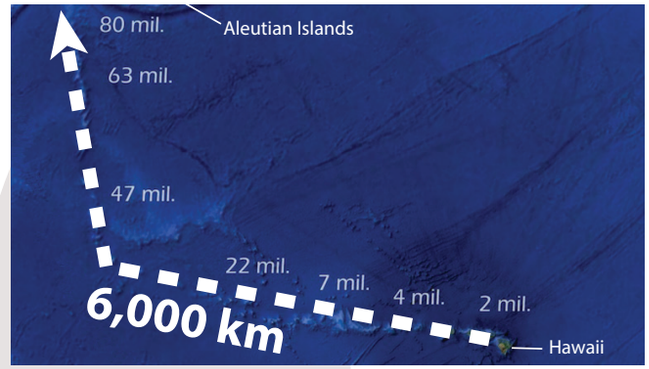
HAWAIIAN ISLANDS ON THE PACIFIC PLATE

The Hawaiian Islands, made of igneous rock, are a powerful example demonstrating that radiometric dating works. During the spring of 2018, continuous eruptions of Kilauea Volcano resulted in rivers of lava flowing to the coast and into the ocean – destroying forests and buildings along the way. Kilauea is one of the most active volcanoes in the world, having added 570 acres to the Big Island since 1983.

That lava comes from what geologists call a "Hot Spot" in the mantle, oozing up through a plume in the oceanic crust and building the islands. The Pacific Plate is moving to the northwest, so for over 80 million years submarine mountains formed, resulting in the Hawaiian Island Chain over the last 5 million years. Kauai to the northwest is the oldest, and the Big Island with Kilauea Volcano and its current eruptions is the youngest. This Pacific tectonic plate moves across that mantle plume at the blistering pace of a few centimetres per year. This process is much like moving a sheet of paper over a stationary candle: the movement of the paper is recorded as a trail of burn marks from the heat of the candle beneath. The Big Island of Hawaii is presently over the "candle."

These igneous rocks all contain potassium atoms that are radioactive – potassium-40 (parent) – decaying to argon-40 (daughter). Radiometric ages have thus been determined for many of the islands and the submarine mountains northwest of Hawaii from rocks collected by research ships. As shown, the ages range up to 80 million years at the north end, close to the Aleutian Islands.

The total distance is 6,000 km, which divided by 80 million years works out to an average movement of 7.4 cm/yr. In addition, geologists have measured the movement between the many islands and seamounts ranging from 6.6 to 9.1 cm/yr (based on potassium-argon dating). The fact that we find a very regular increase in radiometric ages from the present eruptions on Hawaii's Big Island northwest toward the Aleutian Islands demonstrates the reliability and internal consistency of the method. But this story has even *more* unique evidence.



SATELLITES MEASURE THE BLISTERING PACE

With satellites, we can measure the movement of the Big Island, to see if the current speed of the Pacific Plate is within the range of 6.6 to 9.1 cm/yr. If the radiometric dating is way off, then the measured speed should be nowhere close to that range. Results show the speed of the Hawaiian Islands today over the "Hot Spot" averages (drum roll) 7.9 cm/yr! Here we have two *independent* and mutually-confirming lines of evidence: (1) radiometric dating and (2) satellite measurements of tectonic plate movement. God has given us amazing tools to *test* and *verify* our understanding of the Earth's history!

Some young-earth advocates suggest that radioactive decay and/or tectonic plate movement were much faster in the past. But squeezing 4.6 billion years of radioactive decay (releasing heat) into 10,000 years or less would melt the earth's crust and boil off our oceans! Speeding up tectonic plates would also create too much heat (friction). Radiometric dating, which continues to be refined, is a valid and powerful tool for dating rock

sequences, and for establishing the age of the earth itself.

FIND OUT MORE

Pacific Plate movement video (extended length): "How Old Are the Hawaiian Islands?" BioLogos YouTube Channel. youtu.be/oRKEvB00cYI

Gregg Davidson and Ken Wolgemuth, "How Old Are the Hawaiian Islands?" BioLogos (2018). www.biologos.org/blogs/guest/how-old-are-the-hawaiian-islands

Carol Hill, Gregg Davidson, Tim Helble, and Wayne Ranney (eds), *The Grand Canyon, Monument to an Ancient Earth: Can Noah's Flood Explain the Grand Canyon?* (Kregel Publications, 2016).

Cherry Lewis, *The Dating Game: One Man's Search for the Age of the Earth* (Cambridge University Press, 2000).

Roger C. Wiens, "Radiometric Dating: A Christian Perspective," American Scientific Affiliation (2002). www.asa3.org/ASA/resources/Wiens2002.pdf

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CHRISTIANITY AND MAINSTREAM SCIENCE IN DIALOGUE

CANADIAN Scientific & Christian AFFILIATION

The **Canadian Scientific and Christian Affiliation** is a fellowship of scientists and those interested in science, who want to understand how science should best interact with the life-giving Christian tradition. We have many local chapters across the country, holding free public events on faith and science. We are affiliated with the American Scientific Affiliation (asa3.org). As an organization, we do not take a position when there is honest disagreement between Christians on an issue. Find out more below!

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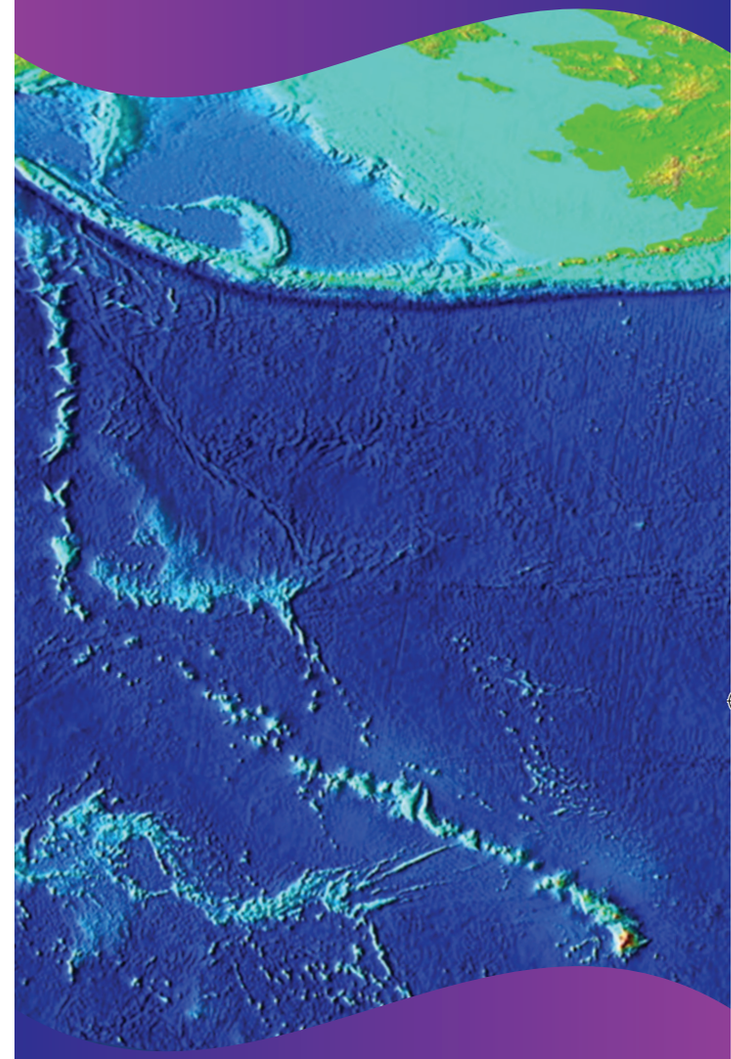
"Faith and Science, eh?"



Radiometric Dating and Tectonic Plates

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