

Current scientific dating methods are sufficient to establish the age of the earth as over four billion years.

December 2000

This is Essay 4A in the NMSR/CSFNM Debate Series.

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Today's physicists and geologists are very confident that the earth is billions of years old. For one, the earth *looks* old. Kilometers-thick sedimentary deposits of vastly different kinds cover many parts of the earth. There is no way these layers could all have been deposited in the single year of the Noachian Flood. In the mile-thick Permian salt deposits of the Paradox Basin in Utah, there are 29 separate cycles of salt deposition. Geologist Donald Wise estimates that "To deposit these beds in a single year would require the salt to form at an average of 4 meters [over 13 feet] per day...and this by evaporation during a world-wide flood event![5,[16](#)]"

Although several early attempts to find the earth's age were made, it has only been a few decades since the age of the earth was established as some 4,500,000,000 years. Early scientists such as John Joly used the amount of salt currently in the oceans, along with measures of its influx from land, to estimate the age of the earth at less than 150 million years[2]. But, sodium is withdrawn from the ocean by various means; the amount of salt in the oceans is roughly constant, because this process has come to *equilibrium*. It cannot be using for dating. In 1897, Lord Kelvin studied cooling of the earth, and estimated its age as 20 to 40 million years, but he didn't yet know about radioactive heating[[1](#),[2](#)], which allows a much older earth. Some early geologists used sediment depths to estimate the earth's age, but rates of deposition are not constant, and such methods give a wide range of answers[2]. Creationists make much ado about there being "not enough helium in the atmosphere" for the earth to be billions of years old, but helium balance is far more complicated than they realize. Factors such as geomagnetic "sweeping" of helium at the earth's poles must be considered[[12](#)]. Creationists use many other inappropriate methods in their attempts to show the earth is young[[6](#),[13](#)].

It wasn't until the discovery of radioactivity that scientists found a reliable "clock" that was useful over very long times - billions of years. Some naturally occurring minerals give off radioactive decay products at fixed, constant rates which can be measured in the laboratory. The rates at which different isotopes decay are remarkably independent of chemical environments, pressure, temperature, and gravitational and electromagnetic fields. In one experiment[2,4], a specimen was crushed by a force equivalent to a depth of 750 km below ground; but this caused a decrease of just 0.6% in the isotope's decay constant. Like the old Timex commercial, "It Takes a Licking and Keeps On Ticking!" Furthermore, an ancient natural uranium reactor in Gabon, Africa, active long ago because natural uranium ore was then as "hot" as the refined stuff used today for nuclear power, provides convincing evidence that radioactive decays had the exact same energies two billion years ago that they do now[9].

Creationists cite many supposed flaws with radiometric dating, but these problems have been explored and explained by geoscientists. One purported flaw is the "initial daughter product" problem. We can

consider radioactive dating to be like an hourglass: the radioactive isotope (the atom that decays) is represented by the sand in the top part of the hourglass, and the "daughter product" isotope (the atom resulting from expulsion of a sub-atomic particle) by the sand accumulating at the bottom of the hourglass. What if some "daughter product" was already present when the rock was formed? By analogy, how would the measured time be altered if an hourglass was started with some sand *already in the bottom vessel*? Advanced methods have been developed that address this very problem. Of these, the isochron method allows scientists to use measurements on several different minerals from a single rock to very precisely determine the amount of daughter product present when the rock was formed[2,8,12]. Isochrons also provide indications of chemical migrations into or out of the rock that might affect the age determinations. The isochron method provides its own quality control!

Creationists try to discredit all radiometric dates by pointing out some wrong dates which have been published[17]. But scientists originally published most of these examples to point out potential problems, such as using the argon method on lava extruded under the ocean. Creationists don't mention the multitudes of cases in which different radiometric methods yield essentially the same answer for the same material. Samples have been measured with many methods (for example, samarium-neodymium, rubidium-strontium, argon-argon, and lead-lead), and the results are usually consistent to within a percent or so[2,10,12]. Getting the same result from all of these different methods is reassuring - like checking the time on Rolex, Timex, and Hamilton watches, and getting the same answer from each watch. Similarly, geological horizons are found to have consistent ages at locations all over the world[3,8,10,11,12,14,15].

Finally, if the earth were just 10 thousand years old, we would expect to find many more naturally occurring isotopes than are actually found in nature[2,7]. Consider element number 43 - Technetium. This element isn't found on earth, and must be produced artificially. It turns out that technetium is radioactive, with a half-life of over a million years. That means that if technetium was present in the world right after the 6-day creation some ten thousand years ago, we would expect around 99 percent of that technetium to still be around. But there is no technetium. In fact, we can't find *any* naturally-occurring isotopes with half-lives of less than 70 million years or so, unless they are products of on-going processes, like carbon 14. We only find the very slowly-decaying isotopes, those with half-lives much longer than 70 million years. This is exactly what we would expect of an earth that is billions of years old.

The scientific debate no longer rages. Current scientific dating methods are sufficient to establish the age of the earth as over four billion years.

REFERENCES (not part of word count)

[1] Bartelt, K., 1998, "A Visit to the Institute for Creation Research,"
<<http://www.talkorigins.org/faqs/icr-visit/bartelt7.html>>

[2] Dalrymple, B. G., The Age of the Earth, Stanford University Press, Stanford, California, 1991.
ISBN 0-8047-1569-6

- [3] Harland, W.B.; Armstrong, R.L.; Cox, A.V.; Craig, L.E.; Smith, A.G.; Smith, D.G., 1990. A Geologic Time Scale, 1989 edition. Cambridge University Press: Cambridge. ISBN 0-521-38765-5
- [4] Hensley, W., Bassett, W., Huizenga, J., 1973, "Pressure dependence of the radioactive decay constant of beryllium-7," *Science*, Vol. 181, pp. 1164-65.
- [5] Hite, R. J. 1960. "Stratigraphy of the saline facies of the Paradox Member of the Hermosa Formation of southeastern Utah and southwestern Colorado." Four Corners Geological Association, 3rd Annual Field Conference Guidebook, p. 86-89.
- [6] Humphreys, D. R., 1997, "Scientific Evidence Heavily Favors a Young World,"
<https://web.archive.org/web/20040223194246/http://www.swcp.com/creation/resources/young_html/index.htm>
- [7] Lindsay, D., 2000, "Radioactives Missing From The Earth,"
<https://web.archive.org/web/20030217120729/http://www.cs.colorado.edu/~lindsay/creation/isotope_list.html>
- [8] Macrae, A., 1998, "Radiometric Dating and the Geological Time Scale,"
<<http://www.talkorigins.org/faqs/dating.html>>
- [9] Morrison, P., 1998, "Wonders: Where Fiction Became Ancient Fact," *Scientific American*, June 1998, <<https://web.archive.org/web/19990222002037/http://www.sciam.com/1998/0698issue/0698wonders.html>>
- [10] Meert, J. "Consistent Radiometric Dates ," Indiana State University,
<<https://web.archive.org/web/20000311003041/http://www.indstate.edu/gga/pmag/radiomet.htm>> ,
- [11] Poling, J., 1997, "Geologic Ages of Earth History,"
<<https://web.archive.org/web/19970607214015/http://www.dinosauria.com/dml/history.htm>>
- [12] Stassen, C., 1997, "The Age of the Earth," <<http://www.talkorigins.org/faqs/faq-age-of-earth.html>>
- [13] Thomas, D. E., 1998, " 'Creation Physicist' D. Russell Humphreys, and his Questionable 'Evidence for a Young World'," <<https://web.archive.org/web/20050325094644/https://www.cesame-nm.org/Viewpoint/contributions/Hump.html>>
- [14] Thompson, T., 2000, "A Radiometric Dating Resource List,"
<<https://web.archive.org/web/20010415160929/http://www.geocities.com/CapeCanaveral/8851/radiometric.html>>
- [15] Watson, K., 1997, "Geological Time," United States Geological Survey,
<<http://pubs.usgs.gov/gip/geotime/contents.html>>
- [16] Wise, Donald, 1998, "Creationist Geologic Time Scale: an attack strategy for the sciences." *American Scientist*, March/April 1998, Vol. 86, No. 2, p. 160-173;
<<http://www.csun.edu/~vcgeo005/wise.htm>>
- [17] Woodmorappe, J., 1999, The Mythology of Modern Dating Methods, Institute for Creation Research, El Cajon, CA.

THIS ESSAY WAS POSTED ON DECEMBER 6TH.

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