Age of the Earth as indicated by Missing Isotopes

The 84 elements found on Earth occur as 339 isotopes. Only 269 of these are stable, and the other 70 are radioactive. An additional 1650 radioactive isotopes have been created in nuclear reactors and in particle accelerators.

The following is a table of all 29 known radioactive isotopes that have a half-life of one million years or more, and that are not being continually produced by natural nuclear reactions **(see Note A)**. It has been sorted in order of half-life. For each isotope, the table shows whether it is one of the ones found on Earth.

Isotope	**Half-Life (megayears)**	**Found on Earth?**	**Existing Daughter *stable element**
Vanadium 50	6,000,000,000	yes	
Neodymium 144	2,400,000,000	yes	
Hafnium 174	2,000,000,000	yes	
Platinum 192	1,000,000,000	yes	
Indium 115	600,000,000	yes	
Gadolinium 152	110,000,000	yes	
Tellurium 123	12,000,000	yes	
Platinum 190	690,000	yes	
Lanthanum 138	112,000	yes	
Samarium 147	106,000	yes	
Rubidium 87	48,800	yes	
Rhenium 187	43,000	yes	
Lutetium 176	35,000	yes	
Thorium 232	14,000	yes	
Uranium 238	4,470	yes	
Potassium 40	1,250	yes	
Uranium 235	704	yes	
Plutonium 244	82	by extreme effort **see Note D**	
Samarium 146	68	**no**-Trace **see Note E**	Neodymium 142 *
Curium 247	16	**no**	Uranium 235
Lead 205	15	**no**	Thallium 205 *
Hafnium 182	9	**no**	Tungsten 182 *
Palladium 107	7	**no**	Silver 107 *
Cesium 135	3	**no**	Barium 135 *
Technetium 97	3	**no**	Molybdenum 97 *
Gadolinium 150	2	**no**	Neodymium 142 *
Zirconium 93	2	**no**	Niobium 93 *
Technetium 98	2	**no**	Ruthenium 98 *
Dysprosium 154	1	**no**	Neodymium 142 *
- NOT shown -		**27 no's**	**to 1,000 year half-lives**

The thing to notice is that this list falls naturally into two halves. Short-lived radioactives are suspiciously absent from the Earth. If we had carried this list all the way down to 1,000 year half-lives, the block of **no**'s would be 37 long instead of 10 long.

The most obvious explanation for the above is that all these elements were present when the Earth was formed **(see Note B)**, but by now the short-lived ones have decayed away. **"Their former existence is inferred from a superabundance of their stable or nearly stable decay products."**(Wipedia-Extinct radionuclide) **This explanation is compatible with the age scientists accept for the Earth (see Note C)**.

Of course, this list cannot be considered as formal proof that the Earth is old. **But the list is exactly what we would expect if the Earth is old, and it is a very puzzling list if the Earth is young.**

Footnotes:

Note A

- **The list is of isotopes not being continually produced on Earth.** Four isotopes are left out because of this rule.

  - Manganese 53 and Beryllium 10 are produced by cosmic-ray radiation hitting dust in the upper atmosphere.
  - Uranium 236 is produced in uranium ores by neutrons from other radioactives.
  - Iodine 129 is produced from Tellurium 130 by cosmic-ray muons.

Radioactives with half-lives shorter than one million years are also produced: for example, Carbon 14 with a half life of 5730 years.

Note B

- **The missing isotopes could have been present when the Earth was formed.** It is reasonable to ask if they are missing because they were somehow never created in the first place. The answer is that they are not particularly difficult to produce "artificially", and current scientific theories about stars and supernovas say that these elements should have been produced in fairly large quantities. For example, Technetium 97 is in the **no** list above, but it has been detected in stars. One recent scientific theory about stars proposes how they manufacture Technetium 97 and also how Supernova 1987a manufactured Cobalt-56. (Supernova 1987a was special because it was not very far away. Theory predicts that such a supernova would create about 0.1 solar masses of nickel-56, which is radioactive. Nickel-56 decays with a half-life of 6.1 days into cobalt-56, which in turn decays with a half-life of 77.1 days. Both kinds of decay give off very distinctive gamma rays. Analysis of the gamma rays from SN1987a showed mostly cobalt-56, exactly as predicted. And, the amount of those gamma rays died away with exactly the half-life of cobalt-56.)

Note C

- **<u>The list is essentially compatible with the age many scientists propose for the earth.</u>** That age is 4.55 billion years. For most practical purposes, a radioactive material is no longer present after 10 or 20 of its half-lives. This is because 2^{10} is about a thousand, and 2^{20} is about a million. So, after 20 half-lives, only one millionth of the original amount remains.

Uranium 235's half life is 704 million years, so 4.55 billion years is just a bit over six half-lives. It's reasonable for Uranium 235 to still be around in small quantities after that amount of time. And, in fact, it makes up about one percent of the Uranium now on Earth. The amounts of Uranium 235 and Uranium 238 would have been about equal, 4.55 billion years ago.

Note D

- **Finding Plutonium 244.** Its half life is 82 million years, so 4.55 billion years is 55 half lives. You might reasonably ask how come Plutonium 244 isn't listed as *no*. The answer is that someone made a very serious effort to find it: their article is referenced below. Eighty five kilograms of molybdenum ore were chemically concentrated, and then the lot was tediously run through a mass spectrometer. The amount of Plutonium 244 they found, 10^{-14} grams, was so small that it would have averaged one single radioactive decay every six years. Clearly, they could not have detected this Plutonium 244 with a geiger counter. However, 55 half lives ago, it would have been about one kilogram of plutonium metal. That's believable in 85 kilograms of metal ore. *Plutonium-244 was first reported to have been found in 1971, but a later study in 2015 was unable to confirm this finding. "Live interstellar plutonium-244 has been detected in meteorite dust." (Wikipedia-Plutonium-244)*

Note E

Samarium 146's half life is 103 million years, so 4.55 billion years is 44 half lives. This means that Samarium 146 could be 200 billion times rarer than Uranium 235, but could be a thousand times commoner than Plutonium 244. I predict that if anyone tries very very hard to find Samarium 146, they will succeed. *Samarium 146 is found in trace amounts per Wikipedia-Isotopes of samarium.* Curium 247, at almost 300 half lives, is completely out of the question."

source: http://www.don-lindsay-archive.org/creation/isotope_list.html : with some editing.