A Short History of Nearly Everything
Bill Bryson

Chapter 10
GETTING THE LEAD OUT

Quotes

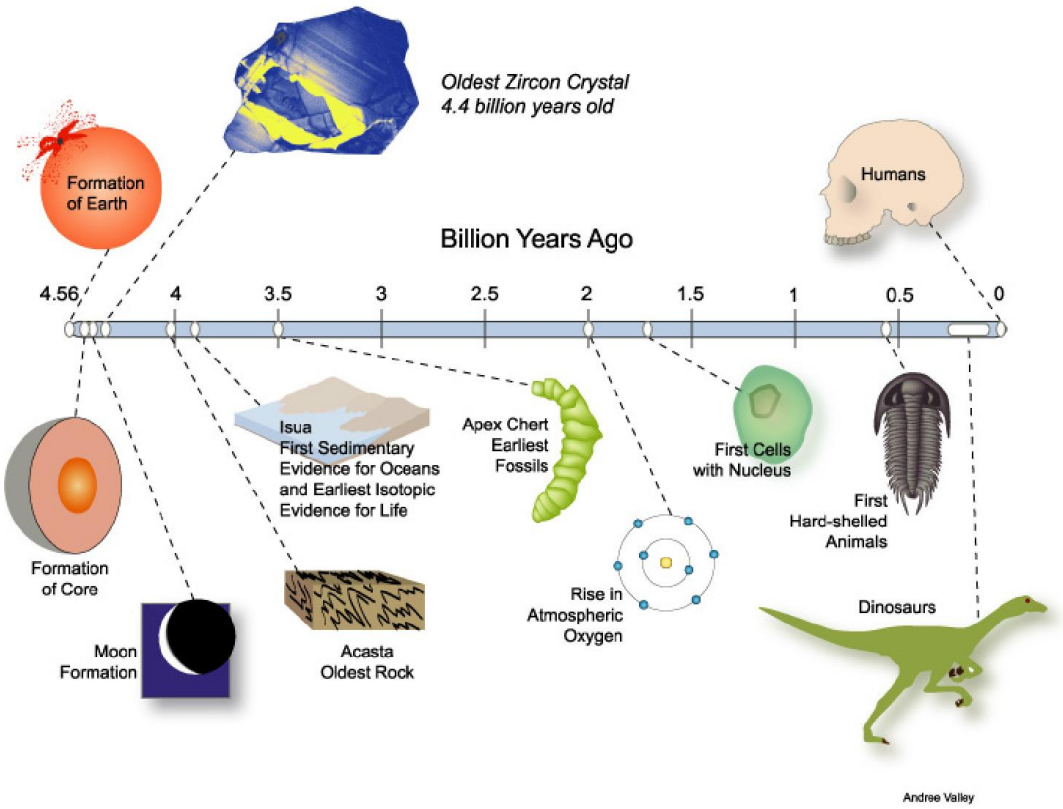
‘‘The work an unknown good man has done is like a vein of water flowing hidden underground, secretly making the ground green.’’ (Thomas Carlyle)

“You must be the change you want to see in the world.” (Mahatma Gandhi)

“A lie can travel half way around the world while the truth is putting on its shoes.” (Mark Twain)

“If a star’s life was compared to that of a man’s, the sun is one week old, life has been on the planet, two to three days, the whole of human history lies in the last second, and we have 80 years to come.”

Timeline of the Earth



http://www.geology.wisc.edu/zircon/Earliest%20Piece/Earliest.html

Vocabulary List

1.	**dissertation**	thesis
2.	**march of progress**	development and advancement
3.	**lead** +	a heavy metal
4.	exceeding*ly*	very
5.	*tedious*	boring
6.	*anti-climactic*	without a climax (moment of high energy or excitement)
7.	*sterile*	clean
8.	**lab**	room where scientists conduct experiments
9.	*precise*	exact/specific
10.	**ratios**	comparative/relative amounts
11.	**plate-tectonics**	the movement of the earth's plates
12.	**make sense** of **things**	make things clear
13.	*ingeniously*	cleverly
14.	occurred to him to V	he [realized/had the idea that] he could V
15.	circumvent	go around/avoid
16.	**meteorite**	rocks from space that have landed on Earth
17.	**assumption**	guess
18.	**The** *solar* **system**	our sun and the collection of the planets around it including Earth
19.	*abundant*	common/easily found
20.	*easy* to get **hold** of…	easily found
21.	*finicky*	fiddly/difficult because of the precision needed
22.	in **the extreme**	to an extreme degree
23.	contaminate*d*	mixed with an unwanted thing
24.	**dose**	amount
25.	*atmospheric*	relating to the atmosphere
26.	*un***account***ably*	mysteriously/inexplicably
27.	**specimen**	[samples/objects] for [analysis/investigation]
28.	***minute*** +	very small
29.	**quantity**	amount
30.	*definitive*	final (and definite)

Have fun learning these words using digital flashcards. Go to Quizlet.com & search for the 'Peacemakerfoundation.com' class.

Text to read at home Text to read in class

10 GETTING THE LEAD OUT

1. *It was just at this time that Harrison Brown of the University of Chicago developed a new method for counting lead isotopes in igneous rocks (which is to say those that were created through heating, as opposed to the laying down of sediments). Realizing that the work would be exceedingly tedious, he assigned it to young Clair Patterson as his dissertation project. Famously he promised Patterson that determining the age of the Earth with his new method would be "duck soup." In fact, it would take years.*
2. *Patterson began work on the project in 1948. Compared with Thomas Midgley's colorful contributions to the march of progress, Patterson's discovery of the age of the Earth feels more than a touch anticlimactic. For seven years, first at the University of Chicago and then at the California Institute of Technology (where he moved in 1952), he worked in a sterile lab, making very precise measurements of the lead/uranium ratios in carefully selected samples of old rock.*
3. *The problem with measuring the age of the Earth was that you needed rocks that were extremely ancient, containing lead- and uranium-bearing crystals that were about as old as the planet itself-anything much younger would obviously give you misleadingly youthful dates-but really ancient rocks are only rarely found on Earth. In the late 1940s no one altogether understood why this should be. Indeed, and rather extraordinarily, we would be well into the space age before anyone could plausibly account for where all the Earth's old rocks went. (The answer was plate tectonics, which we shall of course get to.) Patterson, meantime, was left to try to make sense of things with very limited materials. Eventually, and ingeniously, it occurred to him that he could circumvent the rock shortage by using rocks from beyond Earth. He turned to meteorites.*
4. *The assumption he made-rather a large one, but correct as it turned out-was that many meteorites are essentially leftover building materials from the early days of the solar system, and thus have managed to preserve a more or less pristine interior chemistry. Measure the age of these wandering rocks and you would have the age also (near enough) of the Earth.*
5. *As always, however, nothing was quite as straightforward as such a breezy description makes it sound. Meteorites are not abundant and meteoritic samples not especially easy to get hold of. Moreover, Brown's measurement technique proved finicky in the extreme and needed much refinement. Above all, there was the problem that Patterson's samples were continuously and unaccountably contaminated with large doses of atmospheric lead whenever they were exposed to air. It was this that eventually led him to create a sterile laboratory-the world's first, according to at least one account.*

6. It took Patterson seven years of patient work just to assemble suitable samples for final testing. In the spring of 1953 he traveled to the Argonne National Laboratory in Illinois, where he was granted time on a late-model mass spectrograph, a machine capable of detecting and measuring the minute quantities of uranium and lead locked up in ancient crystals. When at last he had his results, Patterson was so excited that he drove straight to his boyhood home in Iowa and had his mother check him into a hospital because he thought he was having a heart attack.

7. Soon afterward, at a meeting in Wisconsin, Patterson announced a definitive age for the Earth of 4,550 million years (plus or minus 70 million years)-"a figure that stands unchanged 50 years later," as McGrayne admiringly notes. After two hundred years of trying, the Earth finally had an age.
8. His main work done, Patterson now turned his attention to the nagging question of all that lead in the atmosphere. He was astounded to find that what little was known about the effects of lead on humans was almost invariably wrong or misleading-and not surprisingly, he discovered, since for forty years every study of lead's effects had been funded exclusively by manufacturers of lead additives.
9. In one such study, a doctor who had no specialized training in chemical pathology undertook a five-year program in which volunteers were asked to breathe in or swallow lead in elevated quantities. Then their urine and feces were tested. Unfortunately, as the doctor appears not to have known, lead is not excreted as a waste product. Rather, it accumulates in the bones and blood-that's what makes it so dangerous-and neither bone nor blood was tested. In consequence, lead was given a clean bill of health.
10. Patterson quickly established that we had a lot of lead in the atmosphere-still do, in fact, since lead never goes away-and that about 90 percent of it appeared to come from automobile exhaust pipes, but he couldn't prove it. What he needed was a way to compare lead levels in the atmosphere now with the levels that existed before 1923, when tetraethyl lead was introduced. It occurred to him that ice cores could provide the answer.
11. It was known that snowfall in places like Greenland accumulates into discrete annual layers (because seasonal temperature differences produce slight changes in coloration from winter to summer). By counting back through these layers and measuring the amount of lead in each, he could work out global lead concentrations at any time for hundreds, or even thousands, of years. The notion became the foundation of ice core studies, on which much modern climatological work is based.
12. What Patterson found was that before 1923 there was almost no lead in the atmosphere, and that since that time its level had climbed steadily and dangerously. He now made it his life's quest to get lead taken out of gasoline. To that end, he became a constant and often vocal critic of the lead industry and its interests.
13. It would prove to be a hellish campaign. Ethyl was a powerful global corporation with many friends in high places. (Among its directors have been Supreme Court Justice Lewis Powell and Gilbert Grosvenor of the National Geographic Society.) Patterson suddenly found research funding withdrawn or difficult to acquire. The American Petroleum Institute canceled a research contract with him, as did the United States Public Health Service, a supposedly neutral government institution.
14. As Patterson increasingly became a liability to his institution, the school trustees were repeatedly pressed by lead industry officials to shut him up or let him go. According to Jamie Lincoln Kitman, writing in*The Nation* in 2000, Ethyl executives allegedly offered to endow a chair at Caltech "if Patterson was sent packing." Absurdly, he was excluded from a 1971 National Research Council panel appointed to investigate the dangers of atmospheric lead poisoning even though he was by now unquestionably the leading expert on atmospheric lead.
15. To his great credit, Patterson never wavered or buckled. Eventually his efforts led to the introduction of the Clean Air Act of 1970 and finally to the removal from sale of all leaded gasoline in the United States in 1986. *Almost immediately lead levels in the blood of Americans fell by 80 percent. But because lead is forever, those of us alive today have about 625 times more lead in our blood than people did a century ago. The*

amount of lead in the atmosphere also continues to grow, quite legally, by about a hundred thousand metric tons a year, mostly from mining, smelting, and industrial activities. The United States also banned lead in indoor paint, "forty-four years after most of Europe," as McGrayne notes. Remarkably, considering its startling toxicity, lead solder was not removed from American food containers until 1993.

16. *As for the Ethyl Corporation, it's still going strong, though GM, Standard Oil, and Du Pont no longer have stakes in the company. (They sold out to a company called Albemarle Paper in 1962.) According to McGrayne, as late as February 2001 Ethyl continued to contend "that research has failed to show that leaded gasoline poses a threat to human health or the environment." On its website, a history of the company makes no mention of lead-or indeed of Thomas Midgley-but simply refers to the original product as containing "a certain combination of chemicals."*
17. *Ethyl no longer makes leaded gasoline, although, according to its 2001 company accounts, tetraethyl lead (or TEL as it calls it) still accounted for $25.1 million in sales in 2000 (out of overall sales of $795 million), up from $24.1 million in 1999, but down from $117 million in 1998. In its report the company stated its determination to "maximize the cash generated by TEL as its usage continues to phase down around the world." Ethyl markets TEL through an agreement with Associated Octel of England.*
18. *As for the other scourge left to us by Thomas Midgley, chlorofluorocarbons, they were banned in 1974 in the United States, but they are tenacious little devils and any that you loosed into the atmosphere before then (in your deodorants or hair sprays, for instance) will almost certainly be around and devouring ozone long after you have shuffled off. Worse, we are still introducing huge amounts of CFCs into the atmosphere every year. According to Wayne Biddle, 60 million pounds of the stuff, worth $1.5 billion, still finds its way onto the market every year. So who is making it? We are-that is to say, many of our large corporations are still making it at their plants overseas. It will not be banned in Third World countries until 2010.*
19. Clair Patterson died in 1995. He didn't win a Nobel Prize for his work. Geologists never do. Nor, more puzzlingly, did he gain any fame or even much attention from half a century of consistent and increasingly selfless achievement. A good case could be made that he was the most influential geologist of the twentieth century. Yet who has ever heard of Clair Patterson? Most geology textbooks don't mention him. Two recent popular books on the history of the dating of Earth actually manage to misspell his name. In early 2001, a reviewer of one of these books in the journal *Nature* made the additional, rather astounding error of thinking Patterson was a woman.
20. *At all events, thanks to the work of Clair Patterson by 1953 the Earth at last had an age everyone could agree on. The only problem now was it was older than the universe that contained it.*

1. What do you feel about Clair Patterson's work? Should he be more famous?

2. How can we get more people to be a bit more like Clair Patterson?

3. How can we protect people from immoral companies that try to make money at the expense of people's health? How should the companies be punished?

4. Does money make people do bad things? Is money a bad thing?

5. How can we make a more healthy environment here in this country?

Clair Patterson

Herb Needleman
(another campaigner against lead in the environment)

Pictures taken from: Oceanriver.org

The Ethyl Corporation logo
http://splash.corunna.ca/

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