Saint Patterson and his Duck Soup

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Clair C. Patterson, 1922–1995

In the far reaches of our galaxy, former asteroid #2511 now soars as "Asteroid Patterson" in a dark, eternal, and silent tribute. On Earth, in a remote part of the Antarctic's Queen Maude Mountains, one peak now bears the Patterson name as well. Both are equally symbolic of the greatness—and the obscurity—of Clair Patterson, a man some consider the most influential geologist of the 20th century.

There are individuals in the history of science whose efforts have touched nearly all of us: Lister, Pasteur, Fleming, and Salk. Those luminaries can claim to have benefited millions; Clair Patterson's work benefited the health of every person now breathing on this planet—an amazing feat for a boy whose first science lab was on the banks of the Skunk River.

Patterson's early intellectual sparks were ignited and nurtured with a chemistry set in the basement of his family's home in Mitchellville, Iowa, a town, he later said, where "creativity is not to be trampled on just because it's divergent from ordinary views."

Patterson's ascent was meteoric. He graduated from Grinnell College in 1943, after blowing up part of the chemistry lab, and then earned a master's degree in nine months at the University of Iowa. During World War II, he did atomic-emission spectroscopy for the Manhattan Project. He received his Ph.D. in chemistry from the University of Chicago in 1950, and then received a most intriguing offer to work in a totally different discipline.

Patterson was invited to determine the age of our planet, a problem that had long befuddled geologists. The invitation came from a fellow scientist and master fundraiser, Harrison Brown. Brown had a rough idea of how this could be done and had secured grants to do it, but he needed a capable chemist familiar with spectroscopy. Patterson was young, capable, and on a very short list of people qualified to do such work. In 1950 "mass spectroscopy experience" wasn't on too many resumés. What Brown wanted Patterson to do was analyze the lead in ancient iron meteorites and rocks. He theorized that a dating system similar to what existed for carbon-14 could be created using lead. The carbon-14 dating system was only of use on objects less than 40,000 years old. Going from carbon to lead would be like trading in a ruler for a very long tape measure. Patterson proved to be the right choice even though he didn't know a thing about geology or mineral separations. "It'll be duck soup," Brown assured him. That soup took the better part of seven years to prepare.

The research was conducted at the University of Chicago and then Cal Tech. Fortunately, at both institutions Patterson was working in old, dirty buildings; he soon became aware that lead was omnipresent at substantial levels. He needed to measure incredibly minute amounts of lead to create his calculations, but massive amounts of environmental lead swamped the samples he wanted to analyze. It was like trying to hear someone whisper from ten rows away at a rock concert.

What Patterson did with this "problem" parallels what Sir Alexander Fleming did with the mold that appeared in his Petri dish, "ruining" his experiment by killing the bacteria. Patterson's observations later resulted in further research and eventually legislation that would be crucial to the air quality of the entire planet.

In pursuit of his duck soup, Patterson learned that most of the tens of thousands of statistics published about the lead content of common objects were wrong. Our atmosphere was far more contaminated than anyone knew. So before he could conduct his measurements, he first had to banish lead from his lab. No lead pipes, no water from lead pipes, no cans with solder, no food from cans with solder, no unfiltered air or lead paint. Patterson became obsessive in his efforts to eliminate every possible molecule of lead, including hitchhikers on skin, clothing, and every strand of hair. This process led to the creation of a state-of-the-art "clean" lab. The Patterson lab and his field procedures for procuring samples became the standard for all environmental efforts. The final step was a measurement taken at the Argonne National Laboratory in Illinois. Plugged into Patterson's formula, test results indicated that the earth

and thus the solar system were 4.55 billion years old.

Patterson's euphoria resulted in heart palpitations. He was so overwhelmed that he drove to Iowa and then checked into a hospital. Over the last half century this estimate has been scrutinized and has withstood the test of continued verification.

Patterson then turned his full attention to the lead that had pestered his initial studies. He calculated how much lead ancient Romans generated with their coin-manufacturing process. At one point he brewed a batch of sapa, the grape juice concentrate used by the ancients to control the fermentation of wine. The Roman recipe called for simmering the juice, herbs, and spices in a lead cauldron for days; the sweet taste of lead sweetened the sapa. He traveled to Antarctica to pioneer capturing clean core samples. Through all this Patterson collected more and more data on a clear, oily liquid called tetraethyl lead.

When it had been discovered in the 1920s that the tetraethyl lead additive could eliminate engine knock, there was a stampede to add it to gasoline. General Motors, Du Pont, and Standard Oil of New Jersey formed a joint enterprise called the Ethyl Corporation, which quickly became the tetraethyl lead provider to the world. What followed was an advertising campaign that spent millions linking lead with baseball, apple pie, and "the American Way of Life."

Although lead was widely known to be dangerous in the first half of the last century, it was still widely used. It was even sprayed onto fruit as a pesticide. Lead was easy to extract and work, and immensely profitable especially since it did stop engines from knocking. Until this time environmental lead was almost ubiquitous. After the Ethyl Corporation was launched in 1923, lead was ubiquitous.

Scientists knew that the tretraethyl lead additive was a neurotoxin and could damage the brain and central nervous system. Most conceded that overexposure could cause insomnia, blindness, cancer, kidney failure, hearing loss, palsies, and convulsions, and lead to death. But what wasn't clear was how much lead was getting into the ecosystem and at what point it would be dangerous. From the start, the Ethyl Corporation's own employees demonstrated symptoms associated with being poisoned. The corporation responded by embarking on a campaign that could easily be called a cover up to protect profits that grew from $36 million to $300 million in a decade. The resulting seven million tons of lead consumed in internal combustion engines increased human exposure by a factor of 300 to 500. The industry maintained that lead was a natural part of our environment and any elevated levels were natural and not related to exhaust.

The ethyl conglomerate funded almost all the research about tetraethyl lead's effect on human health, research that conveniently focused on efficient production rather than on public health. Ironically, after Patterson had established the age of the solar system, the petroleum industry funded Patterson's research on lead, thinking it might help them locate oil fields.

That hope was to end soon, as Patterson's studies started to contradict the rosy picture drawn by corporate executives. He studied the bones of 1,600-year-old Peruvian Indians to establish preindustrial levels of lead. The tests highlighted the impact of lead manufacturing. He meticulously built a case focusing on two very significant facts. The first was that lead concentrations in humans had risen to between 500 and 1,000 times preindustrial levels. The second was that no threshold concentration for lead toxicity in humans had been established. Beyond compromise or corruption, Patterson was attacked and belittled by corporation spokespeople and house scientists. However, all of Patterson's research has now been corroborated, and his methods have revolutionized environmental and medical research.

Patterson had his allies. Novelist Saul Bellow created a scientist (Sam Beech) in *The Dean's December* who was a paragon of virtue and meticulousness. Bellow let it be known that the character was not modeled after Patterson—it was Patterson. Bellow also was extremely vocal in promoting Patterson for the Nobel Prize.

A crucial ally was Senator Edmund S. Muskie of Maine, who chaired the Senate Special Subcommittee on Air and Water and was in charge of public hearings. Patterson's testimony, combined with one of his research articles ("Contaminated and natural lead environments of man") created a turning point and led to passage of the Clean Air Act in 1970.

Preeminent geochemist Gunter Faure was once asked his opinion of Patterson. "Patterson's a saint," he responded. "The fact that we stopped using leaded gasoline is largely his doing, and he showed you can't study lead contamination in humans because there are no uncontaminated people anymore. I think he was a very brave man. As a man, he ranks right alongside Newton and Galileo." ❖

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