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What the Muck of Walden Pond Tells Us About Our Planet

By CURT STAGER JAN. 7, 2017

In 1845, Henry David Thoreau repaired to a cabin in the woods beside Walden Pond “to front only the essential facts of life, and see if I could not learn what it had to teach.” During the last two years, my students and I have come to that same pond to see what we could learn from the sediments beneath it.

In “Walden,” Thoreau wished for a fanciful “realometer” to cut through the “slush of opinion, and prejudice and tradition ... to a hard bottom.” My own realometers are made of soft lake mud. One of the things I’ve reaffirmed for myself in this endeavor is that there is no such thing as a post-truth world, despite recent declarations to the contrary. Empirical facts are true whether people accept them or not, and science offers our clearest view of them.

Walden is a kettle pond, a 62-acre dimple in sand and gravel that formed around a block of melting glacial ice about 15,000 years ago. It was here that Thoreau produced one of the first maps of an American lake bed by lowering a weighted line through winter ice. He measured a depth of 102 feet in the western basin, demonstrating that the pond was not bottomless, as local residents had claimed. (In fact, it is one of the deepest in Massachusetts.) Thoreau also recognized that Walden could be both a window and a mirror. He called it “Earth’s eye,” in which we can see ourselves and our world reflected.

When I stand on the water’s edge, I look past the ripples and reflections and consider what lies beneath them. The bottom is a time capsule. Within its sediments are layer upon layer of fine silt washed in from the shore, golden pollen grains from flowers and trees, charcoal from forest fires, insect wings, fungus spores and the remains of microscopic algae. Echo soundings of the deep basin by the Salem State University geologist Brad Hubeny and

colleagues recently revealed about 30 feet of mud dating from the birth of the pond.

In 2015, two students and I lowered weighted plastic tubes through 45 feet of water near the center of the pond and hauled up several sediment cores. The longest measured two feet, enough to capture 1,500 years of environmental history. I can now read the pond's story in the muck as if I were reading pages in a book.

Several months ago, I mounted dozens of smears of mud from the longest core on glass microscope slides for closer analysis. But I felt a special connection to one in particular. It came from a layer nine inches down in the stack that was deposited during Thoreau's residency. Tiny shells of diatom algae glittered like frost under the lens. Some of those once-living cells floated in the plankton during Thoreau's stay, harvesting the sunlight of the 19th century like miniature plants. Perhaps they brushed his flanks as he swam in the cove or swirled like snowflakes in the wake of his canoe paddle.

Those diatoms lived in a cool, clean lake. The layers now being deposited on the floor of Walden Pond reflect a different setting. Scientists still debate whether to label our present slice of earth history the "Anthropocene epoch" (the Age of Humans), but signs that we have become a force of nature are being written into sediments worldwide. At Walden Pond, the ecological changes revealed in the sediments of the last century were more extreme than anything in the previous 1,400 years, and some were unique in the history of the pond.

Layers laid down after the 1920s are full of *Asterionella formosa* and *Synedra nana*, diatoms that thrive in nutrient-polluted lakes. For decades, soil erosion following the development of a public beach, bath house, boat launch and access trails had released tons of nutrient-rich sediment into the water. In addition, the beach draws thousands of bathers in summer, enough that surreptitious releases of swimmer urine could account for as much as half of the annual input of algae-stimulating phosphorus. The Massachusetts Department of Conservation and Recreation, which manages the Walden Pond State Reservation, is doing what it can to manage those problems.

This phosphorus enrichment is not the only telltale sign of our presence. If you were to dive to the bottom of the pond and thrust your hand wrist-deep into the mud, your fingertips would brush a layer that emits radiation. It is laced with cesium-137, a memento of the early 1960s, when humankind flirted with Armageddon. So many thermonuclear weapons were tested in the atmosphere then that the fallout contaminated every body of water on earth, and every person, too.

Just above the cesium layer lies another testament to the power of life and death we

hold over ourselves and other species. That layer was deposited during 1968, when the lake was poisoned with rotenone, a fish-killing pesticide. County officials had hoped to “improve” fishing by killing non-sport species and stocking the pond with nonnative rainbow and brown trout.

One day in December, I walked out on a sand bar that had been exposed by a recent drought. The pond normally froze in December during Thoreau’s time, but the ice often forms later now. And when the ice does arrive, it doesn’t last as long. The Boston University ecologist Richard Primack compared dates of spring ice melt recorded in Thoreau’s diaries to more recent data and found that, on average, Walden’s ice now vanishes about two weeks earlier.

I sieve a plankton sample from the shallows. Under a microscope, that green liquid is full of *Mallomonas*, an alga that has become common in recent layers of Walden sediments and in the sediments of many other lakes around the world. The reasons for the increase have yet to be determined, but for some experts its wide distribution suggests climate change as a cause. I worry that, like the earth as a whole, Walden Pond teeters near an ecological tipping point.

Further warming in New England could amplify the pond’s phosphorus problems. Hotter weather caps the surface with warmer water for longer periods, which depletes oxygen below and allows buried nutrients to leak more easily into the water. Hotter summers also draw more swimmers whose urine stimulates algal growth, which can further deplete oxygen as the algae decay. Floating algae also reduce sunlight on the bottom, where weedy meadows of *Nitella* absorb phosphorus from the water and trap it in the sediment. Anglers dislike the lure-snagging *Nitella*, but losing it to shading by overabundant plankton could let even more phosphorus leak from the mud, a cycle that could lead to a nutrient apocalypse in the pond.

Modern science has given us a much deeper understanding of our place in the natural world than Thoreau had. We ignore its lessons at our peril, because we are not separate from nature or immune to its laws. We *are* nature, a truth that I see most clearly through the eye of a pond.

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