AUGUST 7, 2014

THE WORLD TRADE CENTER SHIP GETS ITS BIRTH DATE

BY JERRY BEILINSON

Volunteers and curators from the Maryland Archeological Conservation Laboratory clean timbers from the ship that was unearthed at the World Trade Center construction site.

PHOTOGRAPH BY MARVIN JOSEPH/THE WASHINGTON POST VIA GETTY IMAGES.

Last Thursday, Neil Pederson, one of the dendrochronologists credited with dating the Revolutionary War-era sailing ship found buried at the site of the World Trade Center, was finding it hard to focus on his work. During the previous two days, he had answered approximately seventy-five e-mails with questions from the media. A television crew from WNBC had interviewed him at the Tree-Ring Lab at Columbia University's Lamont-Doherty Earth Observatory, where Pederson is a research scientist. And when I spoke with him, Pederson had just ended a call with a producer from "Fox & Friends" who was trying to convince him to come into the studio over the weekend. (He declined.)

Pederson was in demand because of a paper that had just appeared in the journal *Tree-Ring Research* that detailed how he and other scientists had dated the timbers of the ship found at the World Trade Center grounds. The vessel had been discovered in 2010 and the paper was submitted in 2012, but things move slowly in academic publishing. (The study's lead author, Dario Martin-Benito, was out of the country, so Pederson fielded most of the media requests.) The team had dated the outermost rings in the youngest of the ship's timbers to 1773, and the evidence pointed to the ship being built in the mid-1770s, probably in a small shipyard, and probably in the greater Philadelphia region.

The method they used to do this sleuthing is called dendrochronology—the study of tree rings to understand the past. The remarkable power of dendrochronology lies in the fact that each ring is dated to a specific year, even in samples that are hundreds or thousands of years old. This is in sharp contrast with the approximate ages yielded by techniques such as carbon dating. The precision derives from obsessive pattern recognition. When faced with a living tree or intact structure, researchers will bore long, narrow samples from the trunk—biopsies, essentially. In other situations, they cut cross-sections. Then, they examine many samples of the same species taken from the same location, noting the sequence of wide and narrow rings, year-by-year, decade-by-decade. Distinctly narrow

rings seen in multiple samples are of particular interest because they indicate that a single factor limiting the growth of the trees—a drought, for instance—was in existence across the site.

This process is harder than it may sound. In one sample, a ring may be missing altogether. In the next, a tree may have secondary "false" rings that can fool the researcher. Rings curve and wander more than you'd expect, and the ring boundaries can be ambiguous, especially in the damp-loving deciduous trees that thrive in the Eastern United States. After peering through the microscope at a number of samples and trying to reconcile the dates, researchers will measure each ring to the nearest micron using a desktop device called a Velmex measuring stage. The data is fed into specialized software that's used to catch possible dating errors, quantify the correlations between samples, and adjust for the factors aren't being studied in a particular project. Cross-dating, as the process is called, is a painstaking, persnickety process that requires high-grit sandpaper, fine-point pencils, and—this is critical—an ample supply of erasers.

To date the World Trade Center ship, the dendrochronology team examined cross-sections of the timber and created a two-hundred-and-eighty-year "floating" chronology of the rings, meaning that it was internally consistent but not anchored to specific calendar dates. They used a program called COFECHA to compare their work with established master chronologies of eastern oak populations and found strong statistical correlations with sites in and near Philadelphia. Dendrochronology has been used to date Navajo hogans and Viking ships. A dendrochronologist from the University of Tennessee helped authenticate the Messiah Stradivari violin, considered one of the word's best-preserved Stradivaris, by dating its most recent spruce rings to 1687.

Photograph: Lamont-Doherty Earth Observatory/Columbia University.

Dendrochronology studies rarely garner much attention, but this is the second time that one of Pederson's projects has hit a media jackpot. In 2012, he and a small team of scientists announced that analysis of Siberian pines in Mongolia showed that the rapid conquest of Asia by Genghis Khan was preceded by a warm, wet period that started in 1211. That could have helped fuel Genghis Khan's conquest of much of Asia—rain meant bumper crops and ideal conditions for breeding horses, which were the technological juggernaut of his military. That story was picked up around the world.

This time around, the online flurry took Pederson and his colleagues by surprise, although the university's public-relations team had predicted that it would be a hit. "For us, the basic analysis in the paper is rather simple," Pederson said. "It isn't anything you'd call home about." He is much more excited about another paper, coming out soon, that

describes past forest disturbances occurring all at once across a wide swath of the Eastern United States, a phenomenon that hadn't been documented before in living forests. That's the kind of thing you might expect to see in an arid landscape out West, but Eastern forests were thought to live in such stable, lush conditions that region-wide forest disturbances simply didn't happen.

As it turns out, the oak trees that formed the ribs of the World Trade Center sloop lived in hard times. Pederson's upcoming paper shows that a series of droughts in the middle of the eighteenth century dramatically weakened forests in the Eastern United States. The coup de grâce for many of the region's trees was a late frost in 1774. Pederson saw the evidence in damaged tree rings from that year, and, with the help of historians, he was able to pinpoint the dates. Members of a Moravian community near Winston-Salem, North Carolina, recorded a severe frost on May 4 and 5, 1774, that threatened crops and killed off many of the trees' new leaves. Residents of coastal South Carolina wrote about it. So did Thomas Jefferson.

If such a drought happened before, Pederson surmises, it could happen again. We are currently living through a "megapluvial," Pederson says. According to his tree-ring research, it is the rainiest period in at least five hundred years—and the rainiest period in several thousand years, according to a paper published this summer by a team of geologists. People remember the drought of the nineteen-sixties as a dramatic episode that strained water resources in the Northeast, but if an eighteenth-century-style drought occurred today, it would be devastating. On the other hand, if today's climate models prove prescient, and the upward trend accelerates, precipitation could increase as much in the next hundred years as it has in the past four thousand, affecting the landscape in hard-to-predict ways. "I'm grateful for the coverage of our work and I get the cultural appeal," Pederson said. "But sometimes, I wish the media would also write about the things we think are important."

By Friday afternoon, the interview requests had started to die down, and Pederson was able to enjoy the barbecue that his colleagues at the Tree-Ring Lab had organized as a going-away party. Pederson had just taken a new position at the Harvard Forest, in Massachusetts. As a going-away gift, Pederson's colleagues had polished and signed a cross-section of an old piling that was also dug up from Ground Zero. Pederson had been down in the pit after the ship was unearthed, which he said was an emotionally charged experience. "The ship was only found because the World Trade Center came down, and the ship does date from the Revolutionary War-era," he said. The eastern hemlock had been born before the settlement of New Amsterdam and ended its days at the mouth of the Hudson River.

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