Stumped

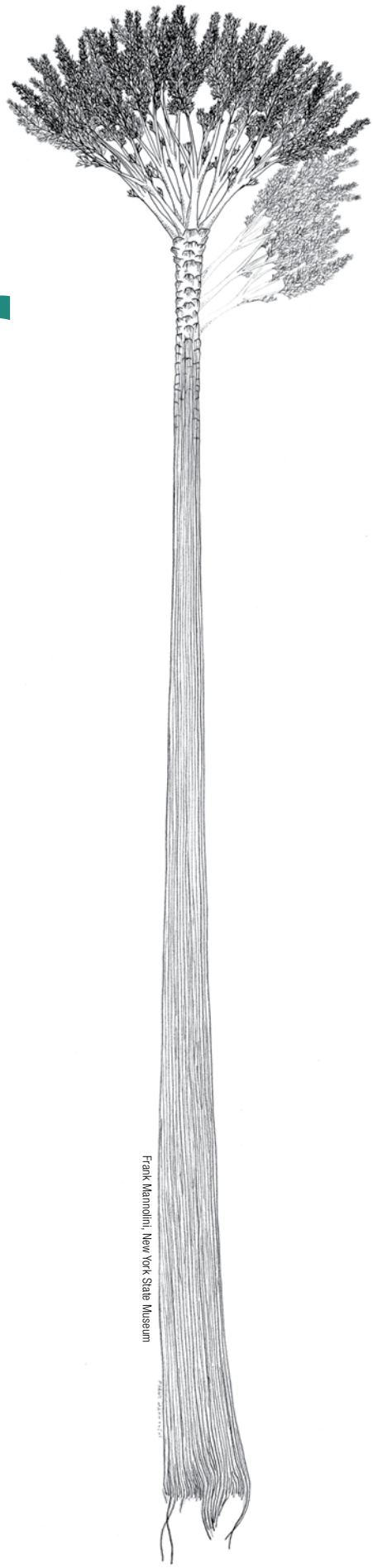
no longer

FOSSILS FROM EARTH'S OLDEST FOREST DIVULGE LONG-SOUGHT SECRET

For almost a century, researchers from around the world have flocked to an area near the Gilboa Dam in the Catskill Mountains of upstate New York to examine the fossilized stumps of tremendous trees that predate man and dinosaur.

The Devonian-era tree trunks were first uncovered in the 1920s when excavation for the Gilboa Dam, a New York City water project, began. They seized the imagination and piqued the curiosity of scholars and naturalists the world round because they represented the remains of "aforestation." That process — the original greening of the Earth — some 380 million years ago had a major impact on the planet's climate, weather, carbon cycling and, ultimately, what kinds of animals evolved in certain ecosystems.

Decade after decade, no matter how long or hard scientists studied the tree trunks, they could only guess at what the Earth's first treetops had looked like. Just as there was no solid proof of how tall the trees had stood in their prime, there was no way to corroborate or to disprove any conjectured "treetop" reconstructions.



Frank Mannolini, New York State Museum

Diogenes Agcaoili Jr.

"I COULD NOT BELIEVE WHAT I WAS SEEING. IT'S ASTONISHINGLY LARGE AND MORE COMPLETE THAN SEEN BEFORE."

— William Stein

A few ambitious drawings pictured the treetops as giant seed ferns or as closely resembling a modern palm tree. An early researcher, Winifred Goldring of the New York State Museum, gave the trees the name *Eospermatopteris* because she also guessed that the trees looked like tall seed ferns.

But like a root system tenaciously holding on long after the tree is felled, the mystery refused to be unearthed.

Then, a few years ago, a call from researchers at the New York State Museum in Albany to paleobotanist William Stein at Binghamton University changed all that. The call was to report the discovery of an "odd specimen," a fossil with an extensive trunk system and a crown attached.

"I just dropped my jaw," Stein, an associate professor of biological sciences, recalled about his first examination of the specimen. "I could not believe what I was seeing. It's astonishingly large and more complete than seen before."

The fossil, more than 12 feet long, offered the first evidence of how big and complex the Earth's first trees were and what their tops, or "aerial portions," looked like.

Last year, the prestigious British journal *Nature* published the findings of Stein and his colleagues, Frank Mannolini, Linda VanAller Hernick and Ed Landing of the New York State Museum as well as Christopher Berry of Cardiff University in the United Kingdom. The discovery created a stir, earning stories in *Discover, New Scientist* and newspapers around the world.

Stein and his colleagues now can credibly say that the trees, which predate the earliest dinosaurs by about 135 million years, were more than 26 feet tall, with a system of frond-like but leafless branches at their very tops. The trees were bigger and more complex than scientists had guessed, with a long trunk and small anchoring roots.

The crown belongs to a previously known plant taxon, the *cladoxylopsid Wattieza.* But the trunk and base match a different group, named *Eospermatopteris.* The *Cladoxylopsida* is a class of big vascular plants with spectacular morphology for their time.

"We now really have these trees nailed," Stein said. "We solved a mystery that's been around for 100 years. It looks remarkably tree fern-like."

The State Museum was able to collect the fossil the way dinosaur skeletons often are collected, which is unusual for this kind of work. Nearby, a second 19-foot-long fossil was recovered, reinforcing some of the data offered by the first.

THE FOSSIL, MORE THAN 12 FEET LONG, OFFERED THE FIRST EVIDENCE OF HOW BIG AND COMPLEX THE EARTH'S FIRST TREES WERE AND WHAT THEIR TOPS, OR "AERIAL PORTIONS," LOOKED LIKE.

Stein, who earned his bachelor's degree from Pomona College and master's and doctoral degrees at the University of Michigan, joined Binghamton University's faculty in 1988. His research interests include paleobotany (the study of fossilized plants) and plant evolution, which makes for a natural fit at Binghamton, which is home to a large and distinguished collection of fossils from the Devonian era.

Stein also has a talent for drawing and photographing the specimens with which he works. That artistic ability came in handy for the Gilboa project; images of the giant fossils are on display all over Stein's office and help provide a framework for the research going on in his lab.

Though these trees are now extinct, Stein can point to possible modern-day descendants — including ferns and horsetails — as he walks through the greenhouse on campus at Binghamton. "You go to Hawaii today, or the tropics, and you can find similar great trees with big, upright stems and fronds," he said. "*Eospermatopteris* was very much like this."

The plants in the greenhouse are like the fossils, but nevertheless impossibly remote in time and quite a bit more primitive in other aspects of their morphology, Stein notes.

Berry, who is also a paleobotanist, had been working on the group of plants that includes *Wattieza* since 1990. He said the discovery of the whole tree allows scientists to begin to understand the impact the plant group had on the terrestrial environment.

"In forming the first forests, they must have really changed the Earth system as a whole, creating new types of micro-environments for smaller plants and insects, storing large amounts of carbon and binding the soil together," he said.

Landing, a paleontologist, studied the geology of the area where the fossils were found. He believes that when the trees died they fell over and became waterlogged as they traveled down a small stream. The trees then sank to the bottom at the foot of a small delta that formed in standing water. Layers of fossilized trees were found intertwined like pickup sticks in an underwater log jam in the quarry.

"Science really is these kinds of discoveries," Stein said as he looked over photos of the new Gilboa site findings. Gazing at the images of trees that had been the very first on the planet, he concluded with discernible reverence:

"No one has ever seen this before." ■

— Rachel Coker