Tree trunks swell in synchrony with tides

Trees bloat and then shrink with the rhythm of the tides, Swiss and Italian researchers report.

Stem diameters of young spruces show this tidal pattern even when growing in separate containers in darkness and at constant temperature and humidity, says Ernst Zürcher of the Swiss Federal Institute of Technology in Zurich. He and colleagues from three other institutions describe their observations in the April 16 NATURE.

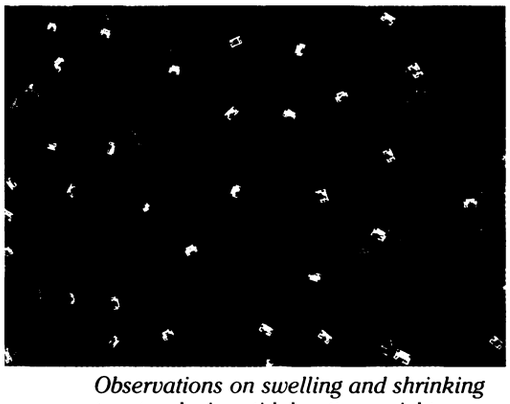
The researchers measured stem diameter changes of several hundredths of a millimeter. The changes follow roughly a 25-hour cycle with two peaks, one higher than the other.

According to the measurements, this pattern shows up even in isolated chunks of stem that have been sealed to prevent water from going in or out. The pattern can persist for months, as long as the most actively growing layer, the cambium, survives. The rhythm also shows up in trees that are dormant or are grown in continuous light or reversed day-night cycles.

Such patterns had previously been reported by coauthor Maria-Giulia Cantiani of the University of Trento in Italy and her colleagues on the basis of data collected over 14 years. Recently, Zürcher noticed the curves' similarity to tidal patterns, prompting the tree-measuring team to superimpose tidal records on some of their data. "It was amazing to build up these curves," Zürcher says. "It was absolute synchronicity."

The curves from the two spruces presented in NATURE haven't yet convinced plant physiologist Steve Pallardy of the University of Missouri in Columbia. "I would have to see more data," he says. He points out that the trees seemed to lead the tides slightly at one point and trail slightly at another.

Despite his hesitation, Pallardy notes that weirder correlations have survived scrutiny. Tree ring width, for example, really does vary with fish scale size, he says. Disturbances on land can stunt tree growth as well as affect bass in a stream.



Observations on swelling and shrinking tree trunks in a tidal pattern might explain folklore about wood drying faster if cut during a new moon.

Trees do thicken and then slim down, Pallardy says. In one well-known cycle, trees shrink a little from water loss during the day, when air holes in the leaves open and water evaporates. When the sun goes down, these holes swell shut, and the tree plumps up again, as water flowing in through the roots makes up for the day's losses.

Just how the tide correlation works is not clear, according to Zürcher. He suggests that some kind of miniature tidal sloshing moves water between the cytoplasm in living cells and the trunk's structural framework of dead cell walls.

Such a pattern might explain widespread folklore about cutting trees before a new moon to get the wood to dry faster, he says. He has heard this tree-cutting wisdom from India to South America. New moons, and their weaker coastal tides, may signal that less water flows into the hard-to-dry cell wall framework, he speculates. A full moon might indicate stronger tree "tides."

Zürcher sees the stem diameter correlation as fitting in with his earlier work showing that tree seeds germinate and grow at different rates, depending on the phase of the moon. However, not all the curves swooped up or down at the same point in the lunar cycles. "It is very complex," Zürcher cautions. —*S. Milius*

When lava and ice clashed on Mount Rainier

During prehistoric eruptions of Mount Rainier, rivers of lava poured out over the glacier-shrouded volcano, leading to epic battles of fire against ice. In most of those contests, the ice won, according to new geologic research on the mountain.

Unable to burn its way through the thickest part of the glaciers, the lava was forced to skirt the edges of the ice fields, leaving behind unusual rock formations that have deceived geologists for decades, report David T. Lescinsky of Arizona State University in Tempe and Thomas W. Sisson of the U.S. Geological Survey in Menlo Park, Calif.

The new understanding "very much changes how you think about the history of the volcano," says Sisson.

Lescinsky and Sisson made their discovery by studying the Washington volcano's large lava flows, many of which sit on top of ridges separating major valleys. These formations have intrigued geologists because lava, like any other fluid, should flow through a valley rather than along the top of a ridge.

When researchers first mapped Mount Rainier in the late 1950s, they tried to explain the unusual deposits by suggesting that the current topography represents the reverse of the former landscape. According to this theory, the molten rock originally flowed through low-lying valleys, shifting the rivers that had occupied them. Over time, the hardened lava resisted erosion, and the displaced rivers ate away at the softer rock on either side of the deposits. Eventually, the ancient lava flows ended up high on the ridge tops.

Lescinsky and Sisson abandoned this explanation when recent dating of the lava flows revealed that they are much younger than previously supposed—in some cases only 40,000 years old. Erosion could not have formed major valleys on either side of the lava deposits in so short a time, say the researchers in the April GEOLOGY.

When they examined the deposits in detail, evidence of an icy past emerged. Along the sides of the flows, the lava has a glassy texture and breaks into telltale hexagonal columns—twin indications that the flows cooled rapidly.

Lescinsky and Sisson hypothesize that the lava erupted at a time when glaciers covered more of the mountain than they do now. As the lava crept down the slope, its front hardened where it hit thick, glacier-filled valleys, forcing the lava to flow along the line of least resistance, usually the ridges between the valleys. There, where the ice layer was thinnest, the lava cut steep-sided channels.

As it flowed along the ridge top, the ice-cooled lava hardened in place. When the glaciers retreated, the lava deposits remained perched on top of the ridges, say Lescinsky and Sisson. They think the same process has occurred on many other glaciated volcanoes.

Their explanation has won over Richard S. Fiske, one of the researchers who proposed the original river valley hypothesis almost 40 years ago. Fiske and his coworkers had assumed that the lava flows were extremely old, but modern dating techniques were not widely available then. "With these new ages, I don't see how our earlier interpretation can be sustained," says Fiske, a geologist with the Smithsonian Institution in Washington, D.C.

The new hypothesis forces geologists to revise their ideas about past eruptions. "What it says to me is that a lot has happened on Mount Rainier just in the last 100,000 years rather than being stretched out over a long period of time," says Fiske.

Geologists consider Mount Rainier one of the greatest volcanic hazards in the United States (SN: 5/28/94, p. 341). Water from its glaciers has seeped into the mountain and corroded much of the rock, making it prone to collapse. During large landslides, glacial ice and rock combine to form massive mudflows. Future slides could sweep over nearby towns. —*R. Monastersky*