

Laser flashes expose Oregon earthquake faults

Scientists using lidar, a system that bounces laser flashes off the ground, have found hidden seismic faults in Oregon, including one on the northern flank of Mount Hood that appears to be active — and dangerous.

Joe Rojas-Burke, Portland Oregonian, 9-4-11

PORLAND — On the northern flank of Mount Hood, a scar in the earth's crust stretches for several miles beneath the fir trees that hide it from airborne observers.

It is the mark of a previously undetected seismic fault that appears to be active — and dangerous. The last time the fault ruptured, opposing sections of the earth's crust jolted 6 feet apart horizontally, leaving a miles-long raised edge, or scarp.

"It was probably a magnitude 6 or 7 earthquake," says Ian Madin, chief scientist with the Oregon Department of Geology and Mineral Industries. "That would be felt in Hood River. It might be damaging in Hood River valley communities."

The fault went unnoticed until its recent discovery by Madin's team, which is using aircraft equipped with lidar, a system that bounces laser flashes off the ground, to search for hidden seismic faults. The ongoing search has revealed dozens of shallow crustal faults, including others near Mount Hood and several in Deschutes County, Klamath County, and near the coast between Bandon and Coos Bay.

Figuring hazards

Now Madin's team is trying to figure out how great a hazard the faults pose to people, buildings and infrastructure such as bridges, dams and electric power lines.

"We don't know where all the seismic faults exist in Oregon. We don't know how often they cause earthquakes," says Michael Olsen, an assistant professor of engineering at Oregon State University. "That leads to a lot of uncertainty when we try to design buildings," he says, that are sufficiently resistant to earthquake damage.

Disaster preparedness in Oregon has largely focused on massive earthquakes on the Cascadia Subduction Zone, where an ocean-spanning slab called the Juan de Fuca Plate is plunging beneath the North American plate along the coast. A subduction-zone earthquake could cause magnitude-9 ground-shaking that persists for several minutes across Oregon and Washington.

At shallow crustal faults, earthquakes last for seconds rather than minutes and the ground-shaking is more limited in reach than from a subduction quake. But shallow faults can be deadly and massively destructive to nearby cities. The magnitude 6.3 earthquake in February on a shallow fault beneath Christchurch, New Zealand, killed more than 180 people and collapsed modern, seismically reinforced buildings.

Tales from the trench

The recently discovered Blue Ridge Fault at Mount Hood is about 10 miles west of Parkdale. Geologists don't know how often the fault unleashes earthquakes, or how big and damaging an earthquake it could produce. But this month they expect to find out using one of geology's most trustworthy techniques: digging a trench.

In an earthquake, the opposing sides of a fault jolt past each other. Digging through layers of soil and sediment above a fault line, geologists can read the story of past earthquakes in the pattern of displaced dirt and gravel. At the Blue Ridge Fault, volcanic eruptions also left regular layers of ash that might help geologists assign rough dates to past earthquakes and figure out how often quakes recur.

Oregon State scientists will scan the trench and build a three-dimensional computer model of the exposed layers of earth. Researchers will then be able to revisit a virtual replica of the site with views accurate to within a millimeter or two, Olsen says.

But until the dig, it's impossible to know how revealing the earth will be.

"About half the time you get a really good story and half the time you get an ambiguous story," Madin says. His team plans to excavate trenches at the Blue Ridge Fault this month. The team includes Portland State University geologist Scott Burns and U.S. Geological Survey scientist Brian Sherrod.

Geologists know that the fault caused a substantial quake sometime in the last 12,000 years because it shifted a deposit of rock and debris, called a moraine, dropped by a receding ice sheet.

"That also tell us it's a relatively young fault," Madin says.

Lidar imaging revealed another fault near Mount Hood that runs to within a mile or two of the Columbia River Gorge, which raises questions about the earthquake resistance of hydropower dams.

"None of the dams were designed with this kind of fault in the analysis," Madin says. "If we find evidence that these faults produce large earthquakes, it might be worth re-examining dam safety."

He points out that dam operators have repeatedly adjusted to evolving knowledge about earthquake risks. Existing analysis by the U.S. Army Corps of Engineers suggest the dams are strong enough to avoid catastrophic failure in a large earthquake. But shaking could topple high-voltage transmission towers, especially near the river where water-saturated ground is likely to sink, tilt and collapse foundations. The Bonneville Power Administration is spending millions to secure transformers and other links in the power system.

Uncertain connections

Connections between the faults and volcanic activity at Mount Hood are uncertain. At Mount St. Helens, a shallow crustal fault played a major role in the 1980 eruption. A magnitude 5.1 earthquake on the fault triggered a landslide that collapsed the north side of the mountain.

Nearly all of the recently disclosed faults in Oregon remain a complete mystery. Progress on defining the risks has been slow because the state has invested little in the field work required.

"There is no money, really," Burns says.

With no budget for field work, Madin is relying on universities and other state and federal agencies to help trench the Blue Ridge Fault.