Scientists: Silent tremors may foretell next Big One

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The seismometer is snugged in its hole and tamped over with dirt. Now it's time for the stomp test.

"This is the fun part," says University of Washington researcher Ken Creager, pounding his foot on the ground three times.

Graduate student Amanda Klaus consults a handheld screen.

"We've got three nice peaks," she says.

That means the instrument is working.

Creager and Klaus had four more sensors to install before dark on this chilly spring day. Several other teams were fanned out across this swath of forest, doing the same thing.

When the scientists' work is finished in July, 200 seismometers will blanket the Olympic Peninsula. The array is designed to zero in on tiny tremors that someday may provide a warning of mega-quakes like the one that devastated Indonesia in 2004 -- and which threaten the Pacific Northwest.

"This is the most exciting thing in seismology today," says Klaus, a Californian who left the earthquake state to be part of the UW team chasing the phenomenon some call silent quakes.

Research on what more properly is known as "episodic tremor and slip" (ETS) has mushroomed in the scant decade since its discovery by Japanese and Northwest scientists. The UW's $3 million array of specialized seismic equipment, on loan from the National Science Foundation, is the most ambitious attempt yet to figure out where the mysterious rumblings originate and what they might reveal about the risk of major earthquakes.

Some of the tremor data already hint the next "big one" might strike closer than expected to Seattle and the region's other population centers.

"That's an unknown everybody is worrying about," said Tim Melbourne, of Central Washington University.

Melbourne was among the first in the region to document the "slip" part of episodic tremor and slip. Normally, Western Washington is shoved an inch or two northeast each year by the force of the offshore Juan de Fuca Plate colliding with and diving under the North American Plate at the Cascadia subduction zone. But every 14 months or so, GPS measurements show the land starts creeping in the opposite direction.

Herb Dragert and his colleagues at the Geological Survey of Canada in Sidney, B.C., soon linked these turnarounds to swarms of tremors so slight scientists long mistook them for wind or other background noise.

It was as if doctors, who have been listening to people's chests for centuries, stumbled across an entirely new type of heart rhythm.

"There's just a sheer joy of discovery," Melbourne said.

After a couple of years of confusion and competing theories, scientists have patched together a basic picture of what they think must be going on: Deep under Vancouver Island and the Olympic Peninsula, where

pressure and heat turn rock to taffy, the geologic plates that grind together at the subduction zone occasionally slip past each other. These silent quakes, which last for weeks, release as much energy as the magnitude-6.8 Nisqually earthquake that rocked Seattle in 2001 _ but they happen so slowly, no one notices.

"We can detect it instrumentally, but it doesn't shake the ground so that any person can feel it," UW seismologist John Vidale said.

But when the deep, malleable portion of the plates slips, that cranks up pressure on the most dangerous part of the subduction zone _ the segment near the surface where rocks are brittle and the plates are locked together. When the locked zone breaks loose, the result is a megathrust earthquake of magnitude 9 or more.

"If I could go to Las Vegas and bet on it, I would say the next megathrust earthquake will be triggered by one of these ETS events," said Melbourne, who is reluctant to even visit Seattle during a silent quake.

Canada's Geological Survey issues an alert when the slip and tremors begin. The U.S. Geological Survey does not, because experts say the link is far too uncertain. The Canadians are reconsidering their policy after a 2007 notice led to blaring headlines and alarm.

"We don't want to cause panic," Dragert said. Megathrust earthquakes off the coast occur every 500 years or so, and the last one was in 1700. That means tremor and slip events most likely have been happening regularly for more than 300 years without setting off a disaster, Dragert said.

"We don't really understand these things well enough yet to use them as a predictor."

But that may be possible in the future as scientists learn more about the events, which have been detected in most of the world's subduction zones. Changes in the normal patterns, such as stronger shaking or more extensive slip, could be the clue to pending earthquakes, Dragert said.

Unfortunately, the best experiment will be to analyze the tremor and slip that precede a massive quake _ but that hasn't happened. The 2004 subduction-zone quake in Sumatra provided little insight because too few sensors to detect tremor and slip were in the area.

A dense network of stations, such as the UW's, will be better able to pick up the weak signals and pinpoint their origins. "You can use it like a telescope to focus in," Creager said.

Tremor location could be a key to understanding how destructive future megathrust earthquakes will be. Creager and his colleagues are trying to find the boundary between the shallow, locked portion of the subduction zone, which generates the big quakes, and the deep portion where rocks slide past each other in harmless tremor-and-slip events.

So far, it looks like that boundary might run under the Olympic Peninsula from Port Angeles, Wash., to Shelton, Wash. If that's true, the locked zone extends much closer to Seattle, Portland and other cities than previously believed. And the closer the quake, the worse the damage.

"It's a huge difference if the earthquake is 70-plus kilometers closer to where most of the people live," Melbourne said.

Others, including Dragert, say there's not enough evidence to conclude the danger zone is any closer than the Pacific Coast.

One of the most puzzling aspects of the silent earthquakes is their

regularity. Recurrence times vary around the world, from roughly six months to a couple of years.

Creager and his team installed most of their instruments this month so they could monitor the next event, due in August.

But the tremors started in April and petered out by the end of May.

So the scientists will have to leave the temporary network of sensors in the field longer than expected and power them down to conserve batteries.

"It's just going to make some more work for us," Vidale said. "We'll be waiting for a tremor episode, and when it comes we'll rush back out there and put the batteries in."

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