

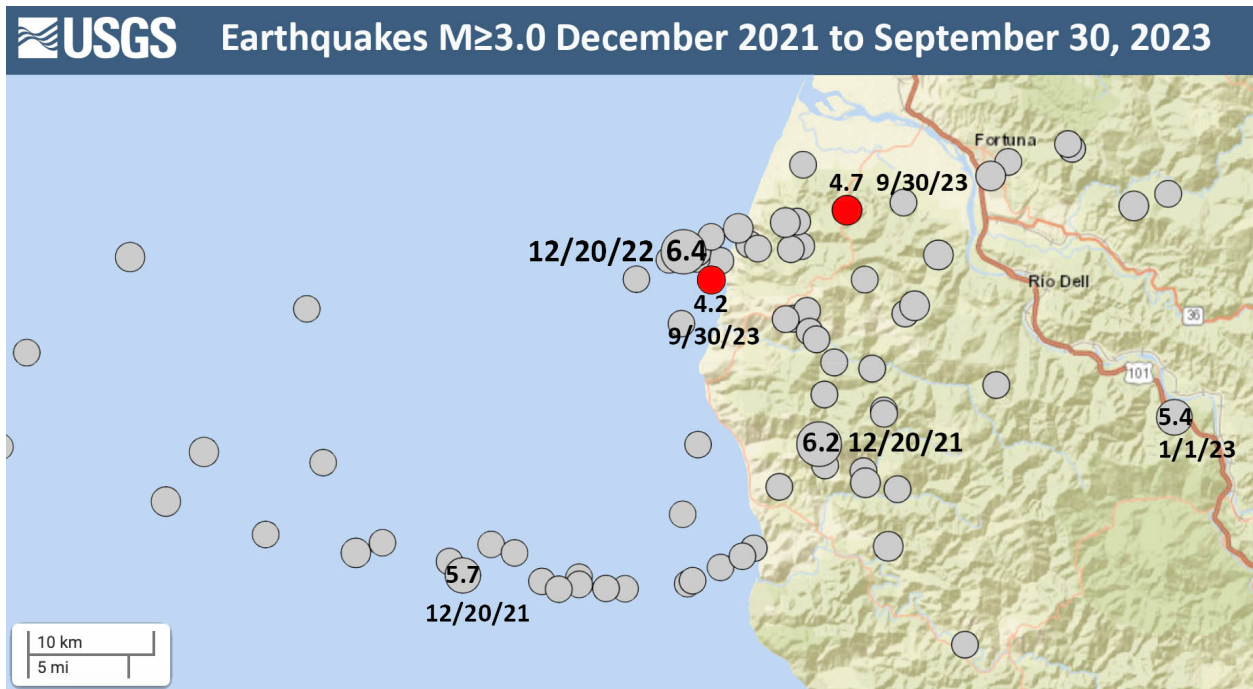
Times Standard

Not My Fault: An earthquake ate my homework

Lori Dengler for the Times-Standard

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USGS epicenters from December 2021 through September 2023. Red circles show the recent magnitude 4.7 and 4.2 earthquakes.

Saturday morning September 30th and I am nearly finished with this column. At 8:26 AM, my phone buzzes. It's a MyShake audible message: Earthquake, Earthquake. Expect Shaking. Drop Cover and Hold On. I have two metal knees and dropping to the ground is not in the cards for me. I bend over in my chair and put my arm over my head and neck. About three seconds later, the house began to sway and rattle. It lasts no more than five seconds.

Drat. I know that my morning plans have changed. So much for the nearly finished column. It's into response mode. First find out about the earthquake. The magnitude is 4.8 near Ferndale. Six minutes after the earthquake a National Tsunami Warning Center text announces no tsunami threat. I already knew this – local earthquakes need to be well over 6 to cause a tsunami, but I like to get the official confirmation.

Next update the Humboldt Earthquake Hotline, (707) 826-6020. It's usually my first step to getting out information to the community. Then post an update on the Redwood Coast Tsunami Work Group Facebook page (www.facebook.com/rctwg). It's the easiest place for me to quickly post information and you can access it even if you don't use Facebook.

By the time I finish the post, the magnitude has been revised to 4.7. It's common for the initial magnitude to change by a few decimal points. The first posting is always an automated location and magnitude calculation. For earthquakes of magnitude 3 or larger that are likely to be felt, a seismologist will review the data and often make some changes. If you visit the USGS Recent Earthquakes, there is a notation midway down the page on the earthquake's review status. If it says REVIEWED, you know that human eyes have looked at it.

Next to put the earthquake in context. It is located near the zone that ruptured in last December's M6.4 Ferndale earthquake, and after conferring with a few colleagues, we agree that it is an aftershock. I get busy making a new figure showing the locations of magnitude 3 and larger earthquakes over the past two years.

I've just finished the figure when another earthquake notification hits my phone - a 4.2 at 10:16 AM, centered just offshore of False Cape, 9 miles SW of Ferndale and 7 miles SW of the 4.7. No MyShake alert this time, I'm too far away to feel any shaking and the earthquake magnitude is below 4.5. This earthquake is very near the M6.4 Ferndale epicenter and confirms my feeling that both quakes are aftershocks.

How unusual is all of this activity? Does it mean another bigger quake is imminent? Earthquake sequences can last for many months or even years. The larger the magnitude of the main earthquake and the more complicated the tectonics of the region, the more likely aftershocks will continue for a long time.

I often get questions about what causes aftershocks and how long they might last. Aftershocks are earthquakes in their own right. If looked at by themselves, they look like any other earthquake of a particular magnitude and size. They involve fault rupture, they produce seismic waves, and they are capable of producing damage. We call them aftershocks because they occur after a bigger quake and are on the same fault or a closely related one.

Faults and big earthquakes are messy things. The December 20th Ferndale earthquake was on a buried fault miles beneath the surface. The rupture started just offshore of False Cape, 7 miles SW of Ferndale and then grew to the east, continuing to rupture the ground for at least 10 miles. This buried fault plane was by no means smooth. Some patches slipped as much as a foot and others only a few inches. The stress on nearby rocks miles away changed as well. Aftershocks are nature's way of resettling the region into a new equilibrium.

Most aftershocks occur in the first few weeks after the largest earthquake. The largest magnitude aftershock of the Ferndale earthquake was a 5.4 on January 1. Since then, aftershock activity has varied but is still above what was typical before the 6.4. Most of the aftershocks have been in the magnitude 1 to 2 range, too small to be felt. Today was different, but not entirely unexpected.

Might there be more? Absolutely. Whenever a somewhat larger aftershock occurs, it changes the stresses nearby and often results in a slight uptick in activity. I would expect to see a few more M3s in the area over the next few days and there is always a chance of something larger. But I don't think we are likely to see an earthquake as large as last December's on this same fault anytime soon.

That doesn't mean we are off the hook. We live in a very complex geologic area, and I consider last December's quake and the activity since then to be part of a sequence that began a year earlier. On December 20th, 2021, the Cape Mendocino area was struck by twin earthquakes 11 seconds apart. The first (currently listed as M5.7 by the USGS) was on the Mendocino fault 18 miles west of Petrolia. The second (M6.2) was onshore 4 miles north of Petrolia.

For the past several months I've been working with a group of seismologists trying to understand the activity of the past two years. Between the M6.5 offshore Eureka earthquake and the 2021 quakes, earthquake activity was relatively steady with a smattering of 4s and 5s and an average depth of around 12 miles. Between 2019 and December 2021, seismic activity nearly stopped. Since then, we've had more earthquakes, both larger and deeper than typical of the previous decade.

I'm going to stick my neck out and consider all of the earthquake activity in the vicinity of Cape Mendocino, Ferndale, and Rio Dell to be part of a very complex sequence that began on December 20, 2021. The sequence so far includes three main quakes (roughly 5.7, 6.2 and 6.4) and numerous aftershocks. We've seen at least four different faults be involved so far.

I hope the area quiets down, but I wouldn't be surprised to see yet another fault in the complex region decide to enter this sequence. And of course, we have other more distant faults that could give us a jolt at any time. Last week I urged you to participate in the ShakeOut (<https://www.shakeout.org/>), a national earthquake preparedness drill. Mother Nature has just seconded my suggestion.

Lori Dengler is an emeritus professor of geology at Humboldt State University, an expert in tsunami and earthquake hazards. The opinions expressed are hers and not the Times-Standard's. All Not My Fault columns are archived online at <https://kamome.humboldt.edu/taxonomy/term/5> and may be reused for educational purposes. Leave a message at (707) 826-6019 or email Kamome@humboldt.edu for questions and comments about this column. Downloadable copies of the North Coast preparedness magazine "Living on Shaky Ground" are posted at <https://rctwg.humboldt.edu/prepare/shaky-ground>.