

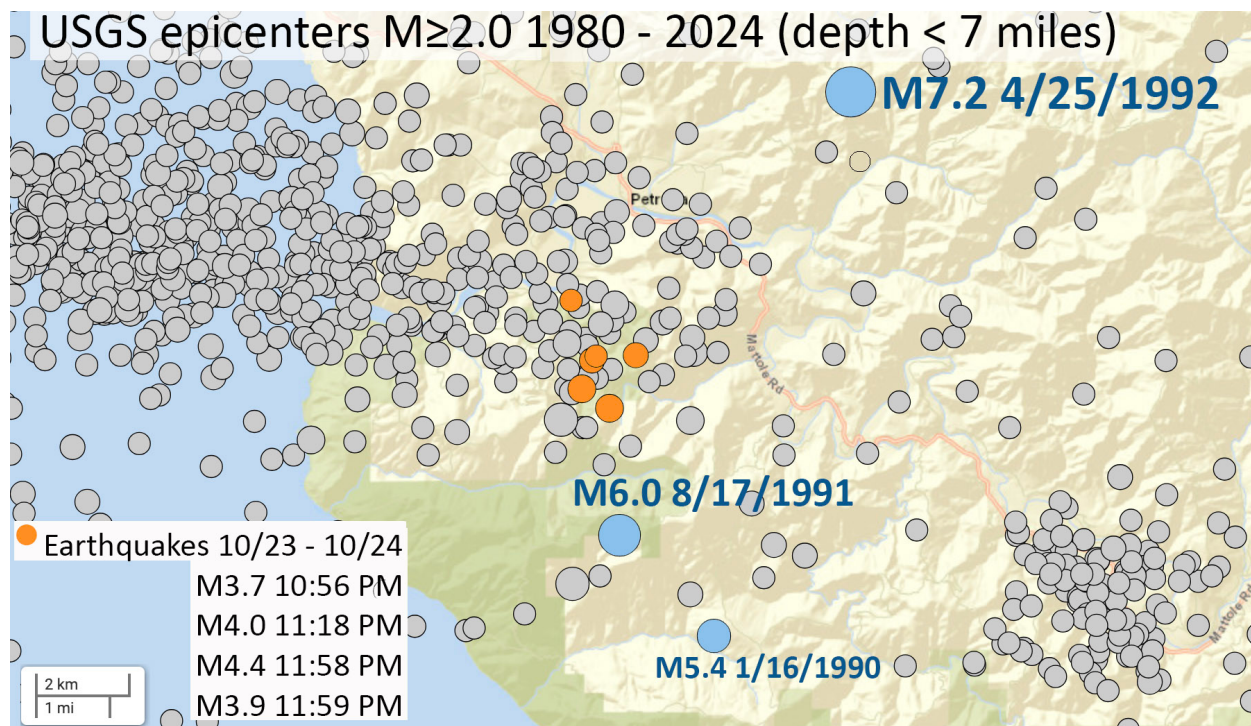
Times Standard

Not My Fault: A tickle from the triple junction

Lori Dengler for the times-Standard

Posted October 27, 2024

<https://www.times-standard.com/2024/10/26/lori-dengler-a-tickle-from-the-triple-junction-area-this-week/>



USGS epicenter map of magnitude 2 and larger earthquakes in the Cape Mendocino area since 1980 with depths of less than 7 miles. Locations of this week's earthquake sequence shown in orange, the 1992 M7.2 mainshock, the 1991 M6.0 Honeydew earthquake foreshock and another possible foreshock in 1990 shown in blue. Another foreshock in March 1992 just off the map area.

Wednesday night just before 11 PM my phone issued a weak buzz. I put it on silent mode in the night and figure if something warrants my attention I will hear multiple buzzes. I ignored this one and was able to fall asleep soon after. Good thing I did because I would have heard another buzz 22 minutes later and a couple more just before midnight.

I get alerts whenever earthquakes of magnitude 3 or larger occur on the North Coast. The next morning there were four on my phone and a text message from geologist and good friend Thomas Dunklin who lives in Petrolia. It was short and to the point, "Dang. Going wild tonight. All very close." Close indeed - four earthquakes about two miles from Thomas' home and all considered shallow.

For Thomas, living right above the foci, shaking was sharp indeed. But the vibrations from each one lasted only a few seconds and Thomas knew they weren't major quakes. The final USGS

assessment of the sequence was a 3.7 at 10:56 PM., 4.0 at 11:18, 4.4 at 11:58, 3.9 at 11:59, and six smaller quakes in the magnitude 1 – 2 range. The larger quakes were felt by many in the Cape Mendocino and Eel River Valley area and by a few from Mendocino to McKinleyville. No damage was reported, and the sequence appeared over by early Thursday morning.

These earthquakes not only got Thomas' attention, but others as well. I have been barraged with questions. What do they mean? Are they aftershocks of the December 2022 quakes? Could they be foreshocks of something bigger? Are they just giving off "steam" and helping to reduce the likelihood of a much bigger quake? Why didn't I get a phone ShakeAlert before I felt the shaking?

Putting these earthquakes in a geologic context answers some of these questions. The first one is easy. They are not aftershocks of the M6.4 December 20, 2022, Ferndale earthquake. That earthquake was centered roughly 18 miles away offshore of False Cape. Distance is not the most important factor – it was in a different tectonic regime. Depth, that third dimension, is important on the North Coast where the surface doesn't reflect what is going on far below.

The Cascadia subduction zone makes for a complex layered structure. The Gorda plate is a giant slab of earth material slowly being pulled to the east. It has created two different geologic worlds – a thin wedge of material above it where we live (the North American plate), and the deeper Gorda plate slab below. The Cascadia megathrust fault separates these two worlds. In McKinleyville where I live, that interface is about 8 miles beneath our house. Going east it deepens, hitting 12 miles at Willow Creek and roughly 20 miles beneath Weaverville.

The North American plate and the subducted Gorda plate beneath it both have faults within them that reflect their different histories and stress regimes. The North American fabric is reflected in the north-northwest orientation of rivers and mountain ridges and mapped fault zones. The deeper Gorda plate faults beneath the Cascadia interface run more easterly. The December 2022 Ferndale earthquake occurred on one of these buried Gorda faults, rupturing ten miles extending from offshore of False Cape to south of Ferndale.

The earthquakes of last Wednesday night were relatively shallow at depths of about six miles beneath the surface and in the world of the North American plate. The Ferndale earthquake in 2022 was nearly twice as deep, in the Gorda plate below the subduction zone interface. The 2022 earthquake did produce a vigorous aftershock sequence, but all of these aftershocks were likewise in the Gorda plate.

Whenever an earthquake occurs, there is always a very small chance that it could be a foreshock of something larger. The USGS calculates that likelihood whenever a U.S. earthquake of magnitude 5 or larger occurs. It is possible for smaller earthquakes to be foreshocks, but it is very rare for them to precede earthquake in the magnitude 6 and larger range.

I took a deeper dive into the Cape Mendocino seismic history to look for possible foreshock precedents. This is the Mendocino triple junction area, an extremely complex zone affected not only by the subduction zone layering but the stresses imposed by the abutment of the Pacific plate to the south. It's not a point, but a diffuse region of elevated seismicity that extends both onshore and offshore.

Looking only at the relatively shallow North American plate earthquakes, the most notable event is the April 25, 1992, M7.2 Cape Mendocino earthquake, the largest on-land temblor in instrumented North Coast history. It was preceded by several foreshocks, a 5.3 a month beforehand, the M6.0 Honeydew quake eight months earlier, and possibly a 5.4 in January 1990. This two-year period of shallow magnitude 5 to 6 earthquakes was unusual. There were no clear foreshocks in the hours or days immediately before the 7.2.

Last Wednesday's earthquakes were located in between the Honeydew and Cape Mendocino earthquakes and were caused by the same stresses that triggered those larger temblors. There have been a number of earthquake in the M4 range and several sequences not unlike Wednesday's. None of them led to major earthquakes. I might raise an eyebrow if a shallow M5 occurs.

When it comes to "giving off steam" and reducing our big quake threat, the answer is an emphatic NO. These small quakes were not on the subduction zone interface where strain is accumulating and will eventually produce next great subduction zone earthquake. Even if they were, they released a trivial amount of that strain. It would take roughly five M5 earthquakes every day for 500 years to equal the strain release of a single M9.

No one who felt any of Wednesday's earthquakes received notification of the shaking ahead of time. That's not because the system didn't work. The earthquakes were all below the M5 threshold for ShakeAlert and Wireless Emergency Alert (WEA) messaging. The calculations were made, the initial magnitude estimate was 4.6 and notifications sent to those on the ShakeAlert team 5 seconds after the earthquake. There is no reason to alert the public for such modest events unlikely to produce injuries and when the only people to feel a sharp jolt are too close to the epicenter to get the alert before the shaking arrives.

Magnitude 4 earthquakes are relatively common in the North Coast area. A 4.0 was reported early Saturday morning offshore of Petrolia, bringing the 2024 tally of magnitude 4 and larger earthquakes in North Coast California and the adjacent offshore area to 21. Fortunately, most of these earthquakes are offshore and too far from population centers to be felt or make the news.

Wednesday night may have only been a tickle from the triple junction and unlikely to mean something bigger will soon follow. Only time will tell. But there are many fault systems in our area quite capable of producing bigger quakes at any time and there's a pretty good chance no foreshocks will precede them.

Note: learn more about the dynamic Mendocino triple junction area in Thomas Dunklin's virtual field trip at <https://rctwg.humboldt.edu/capemendo92>.

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 or to request copies of the preparedness magazine "Living on Shaky Ground."