Times Standard

Not My Fault: April's 1906, 1992 earthquakes and triple-junction connections

Lori Dengler for the Times-Standard
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A tale of two earthquakes 86 years apart. The left shows Ferndale's General Mercantile in the early morning hours of April 18, 1906, after the San Francisco earthquake (photo by Edna Garret from the Peter Palmquist collection). Right is the same brick building, renamed the Valley Grocery, on April 25, 1992, when it experienced similar damage in the Cape Mendocino earthquake (Kevin Bayless photo). It was torn down after 1992 and replaced with a wooden structure.

Our last three significant North Coast earthquakes all occurred in December. This was mere coincidence and there is nothing about any particular time of year that is more earthquake prone. The two most damaging North Coast earthquakes in the era of instrumental records happened in April. This weekend is the anniversary of one of them and last weekend marked the other. They deserve a closer look.

I write about the April 25 – 26 1992 Cape Mendocino earthquake sequence almost every year to mark its anniversary. The only earthquake to merit a Presidential Disaster declaration, it caused more than $60 million in damages and injuring over 400. The April 1992 mainshock also caused a modest tsunami and was one of the driving forces behind the creation of the National Tsunami Hazard Mitigation Program.

Anyone who was on the North Coast in April '92 remembers what they were doing when the first earthquake struck at 11:06 AM on Saturday. It was a sunny day, and I was upstairs making final preparations for a family picnic. No cell phone alerts in those days, and the rumble and the shaking caught me by surprise. I gathered my wits and remembered to start counting. After years of recommending that others do so in earthquakes, this was this first time I succeeded in doing the same. The effect was instantaneous, slowing the adrenalin rush and allowing me to observe what was happening. My count lasted 45 seconds, only the first 20 or so strong, the last part barely discernable. I guessed at least a mid-6 but too rolling to be right underneath me.

Afterwards, I headed downstairs and we gathered outside. I lay down on the lawn to better feel any aftershocks and was rewarded with several tickles - an earth massage. Neighbors were outside too, all discussing what had just happened. One item had tipped over on a counter, but our home was spared damage, and we smelled no gas so we could safely leave the gas line open. It's important to know how to turn off your gas line but doing so means only trained PG&E service personnel can turn it back on and probably several days delay. No smell means no leak so just leave it be.

No picnic for me that day. Internet was in its infancy and communicating with colleagues meant lots of phone calls. Fortunately, land lines and power stayed on in most of the county. A number of Humboldt Geology faculty and students headed into the field to look for signs of liquefaction, landslides, and fault rupture. I played coordinator with field groups and other researchers planning instrument deployments.

There was no tsunami alert that morning. The preliminary magnitude was 6.9, just under the M7 threshold in place at the time, and none of us thought about tsunamis in those days. It took our very sharp State Geologist at that time Jim Davis to query NOAA and the tsunami warning centers to see if a tsunami had been triggered. We had the same number of tide gauge stations on the California coast as we do now, but none were online, and it took several days for the records to be retrieved. We were all surprised to see the 8-inch-high squiggle from the Humboldt Bay tide gauge and an almost two-foot tsunami in Crescent City. It was low tide and only a few people reported seeing anything unusual.

We take it for granted that a preliminary magnitude and location for any felt earthquake will be available within a minute or two and a tsunami assessment soon after. In 1992, it took about three hours to get accurate earthquake information. But like today, the best source of information on the impacts was the radio and I would channel surf to get updates on what eyes on the ground were seeing. I also had a student Kevin Bayless with emergency response contacts, and I sent him off to photograph as much of the epicentral region as he could.

There would be no sleep for me that night or for many other North coast residents. Two large "aftershocks" would cause additional damage at 12:48 AM and 4:18 AM. My counting (35 and 40 seconds respectively) suggested they weren't quite as large as the earlier earthquake but still packed a major punch. I put aftershock in quotations because they were both on different faults and nearly as large as the first quake. Some seismologists prefer to call them 'triggered' earthquakes, but I use aftershock to mean any quake clearly related in time and space.

It would take months for seismologists to analyze these earthquakes. The April 25 quake ended up as a magnitude 7.2 and the early morning quakes a 6.5 and 6.6 respectively. The mainshock was shallow by North Coast standards, only 6 miles deep and centered on a north-south thrust fault closely associated with the Cascadia subduction zone. The latter quakes were about 18 miles away offshore, more than twice as deep with horizontal movement (strike-slip) within the Gorda plate. The third largest aftershock occurred ten days later, centered just south of Cooksie Mountain and seven miles south of the mainshock. It was a shallow strike-slip quake and probably in the North American plate. There were plenty of smaller aftershocks on the Mendocino fault too. This was truly a triple junction sequence with faults within and bordering all three plates (Pacific, Gorda, North America) that abut near Cape Mendocino participating.

Last Sunday's paper featured a page on the second notable April quake, the April 18th, 1906 "San Francisco" earthquake. I put San Francisco in quotations because it is misleading. It is protocol to name earthquakes after a city, town, or geographic feature closest to the epicenter. While the 1906 epicenter was just offshore of San Francisco, the rupture was very long, extending 200 miles north to Cape Mendocino and 60 miles south to Santa Cruz. This entire fault rupture was the source of seismic waves and the Eel River Valley experienced shaking just as strong as San Francisco.

From a Humboldt County perspective, last Sunday's overview of the 1906 earthquake omitted the most interesting part of the story – the devastation it caused here. I spent much time in the early 2000s pouring through newspaper archives and reports on the 1906 earthquake to map out the shaking strength in more detail. My research led me to photo historian Peter Palmquist who had collected historic photos with a particular emphasis on early women artists. He introduced me to the work of Edna Garrett, a photographer who with her husband had a studio in Ferndale in the early 20th century.

Like everyone in Ferndale, Edna was rudely awakened at 5:12 AM on April 18th. Unlike her husband or the other two men who had Ferndale photography studios, Edna immediately grabbed her camera and equipment and set about documenting the impacts in Ferndale. Because of her work, we have a detailed record of what happened to nearly every building on Main Street and the earliest imagery of liquefaction on the banks of the Eel River. See links below for more on the Humboldt County 1906 story.

Seismology was in its infancy in 1906 and there were no instruments on the North Coast. But the geology community was active and three days after the earthquake, Governor Pardee commissioned a detailed study of the geology, seismology, and impacts of the earthquake. Led by Berkeley Professor Andrew Lawson, 25 principal scientists and nearly 300 other professionals contributed to the study which is still considered the most thorough post-earthquake examination ever published. It took two years for field teams to map fault rupture, landslides, and document intensity from Humboldt to Santa Cruz counties. The elastic rebound theory of earthquake genesis was one of the results.

There is no question that the 1906 earthquake caused a much larger swath of damage in Humboldt County than any more recent temblor. I used reports of chimneys fallen to map out the intensity VII and stronger zone of shaking and compared it to what happened in 1992. The 1906 zone was about twice as large, extending as far north as Blue Lake and east to Bridgeville. Not only was the area of 1906 damage larger, liquefaction was far more pronounced in 1906 with surface water expelled from the shaking making it difficult to travel from Eureka to the Eel River Valley for many days.

The largest 1906 aftershock occurred on April 23, five days after the mainshock. It was offshore of Trinidad, likely in the Gorda plate, roughly 50 miles north of the northern termination of the 1906 rupture. Like 1992, this was another "triggered" earthquake. Models of 1906 suggest that some of the largest slip occurred at the northern end of the rupture zone with the western or Pacific side of the San Andreas moving 18 feet north relative to the eastern North American side. This instantaneous ramrod affected stresses in the Gorda plate.

New quakes and old ones both tell us more about connections within and across the triple junction region. When one side gets tweaked, expect another piece to adjust. !992 and 1906 were very different earthquakes in scale and impacts but both reveal earthquake vulnerabilities and the necessity of planning for not just one type of event but many, possibly only minutes apart.

My paper on the 1906 earthquake on the North Coast is posted at https://kamome.humboldt.edu/sites/default/files/The_1906_Earthquake_on_Californias_North_Coast.pdf, a virtual field trip of the 1906 earthquake in Ferndale is at http://ebeltz.net/fieldtrips/1906quake-fdale.html

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