

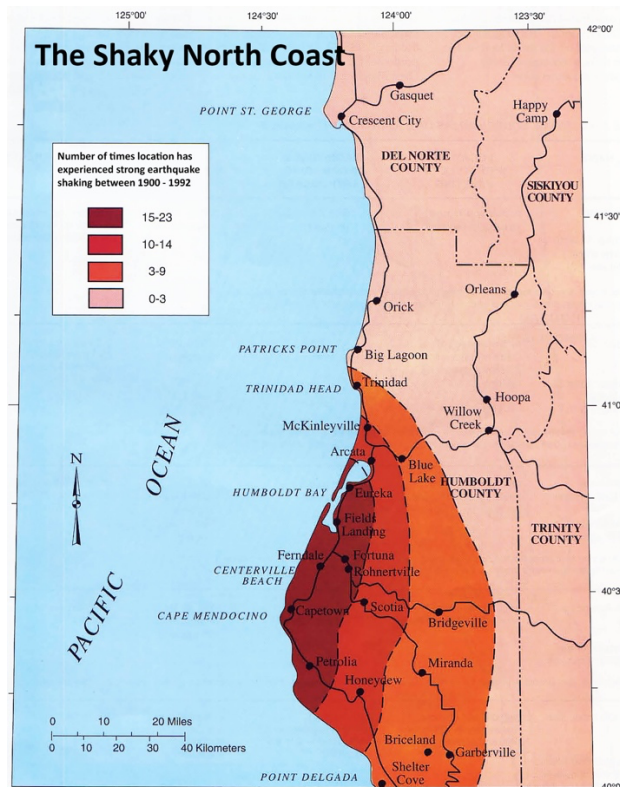
Times Standard

Not My Fault: A Shaky History of the North Coast

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Cumulative number of times strong earthquake shaking experienced between 1900 and 1992.

It didn't take long for earthquakes to make it into the written history of Humboldt County. The first people of European ancestry stumbled into the Humboldt Bay region in the winter of 1849, after a poorly planned overland trek from a mining camp near Weaverville. When the eight members of the Josiah Gregg party reached Humboldt Bay (Wigi in the Wiyot tongue), the Wiyot warmly welcomed them, prepared a feast and, in describing the area, explained that a great earthquake had created the Bay in a single day (<https://littlelostforest.com/2023/05/31/wigi-a-history-of-humboldt-bay/>).

A rush soon followed the Gregg party, some driven by better access to Trinity gold rush sites and others seeing opportunity in supplying the miners and settling in the Humboldt Bay area. Within a year, numerous settlements were established near the Bay. Along with the settlers came newspapers. Some lasted for only a short while. The Humboldt Times was an exception. Founded in 1854, it would merge with the Humboldt Standard (founded 1875) to become this paper in 1967 and California's oldest paper in continuous publication north of Sacramento.

I mention newspapers because they are an important tool for studying earthquakes in the pre-instrumental era. Reports of felt and damaging earthquakes help seismologists reconstruct the pattern of shaking and, by comparing with more recent earthquakes, estimate the epicenter location and magnitude.

In 1992, Gary Carver, Bob McPherson and I wrote a paper on historic North Coast earthquakes. We found 38 earthquakes between 1853 and 1932 where newspaper reports are the primary source of information on location and size. We relied heavily on work done at what is now the California Geological Survey (CGS). But also spent hours sorting through newspaper microfiche files.

The first earthquake to make it into our paper occurred on October 23, 1853, 170 years ago. Based on the felt reports, Tousson Toppazada, the seismologist at CGS put the epicenter on the Samoa Peninsula and gave it a magnitude of 5.7. My guess is that it was further offshore where most of our earthquakes are centered and a bit larger in size but felt reports can't pinpoint offshore quakes. It caused damage to a wharf in the Eureka area and one drunken reveler on the wharf allegedly drowned.

I found it fascinating to experience past earthquakes not through a table of numbers, but from descriptions such as: fissure near Fort Humboldt, knocked down all chimneys in Petrolia, or damaged mill in Eureka. It's quite clear from the reports that the frequency of strong North Coast earthquakes was very similar to what we've seen in more recent times.

It was no surprise to find that Petrolia on Cape Mendocino featured prominently in the felt reports. Masons must have had a steady source of income as "chimneys down in Petrolia" featured prominently. The first seismic instruments on the North Coast were installed in Ferndale in 1932. Once part of Berkeley's array, they done service for two decades at Mare Island in the Bay Area when Ferndale resident Joseph Bognuda convinced the Berkeley Seismology Laboratory to send them to the North Coast.

The two massive Bosh-Omori horizontal instruments recorded ground motion on smoked drums as part of the Northern California seismic network until 1962 when they were deemed obsolete. Donated to the Ferndale museum, they continue to operate to the present, among the oldest seismic instruments still in continuous operation.

Berkeley established more instruments on the North Coast in the following decades, but the biggest advance came in 1974, when concerns about the seismic safety of the Humboldt Bay Nuclear Power Plant resulted in the establishment of Tera Corporation's Humboldt Bay Seismic Network, an array of 16 stations that operated until 1986 when PG&E opted to no longer pursue re-licensing the plant.

My first graduate student Bob McPherson ran the Tera array, and his thesis gave a comprehensive look at the details of our earthquake activity. At first glance, a North Coast epicenter map looks like a great cloud centered on Cape Mendocino, gradually diminishing to the north, west, and east. An epicenter map only shows locations relative to the earth's surface and understanding our earthquake activity requires a 3-D perspective.

The Tera data showed that most of our earthquakes were offshore in the Gorda plate. The Gorda plate is the southern section of the Cascadia subduction zone that is slowly pulled by gravity beneath the land. It forms the seafloor surface of much of offshore Humboldt and Del Norte counties. At the continental shelf roughly 30 miles offshore of Eureka, it begins to dive beneath the land. The top of the Gorda plate is about 8 miles below Eureka and 12 miles beneath Willow Creek and continues to deepen to the east. It is a very important interface, delineating the world of North American faults above it and Gorda faults below.

The dominance of the Gorda plate in terms of earthquake activity continues even as it sinks beneath the edge of North America. Bob's work showed that most of our onshore activity is relatively deep, beneath the subduction zone interface. We have experienced seven earthquake of magnitude 5 or larger near or beneath the Humboldt county coast since December 2021. Five were in the Gorda plate below the interface.

Earthquake activity since December 2021 has renewed interest in the complex pattern of North Coast seismicity. The earthquake early warning program brought new seismic stations to the region and advances in seismic analysis has improved abilities to locate and analyze fault motion. Where we used to see a great cloud of earthquakes, we can now pick out individual faults within the Gorda plate buried deep below the overlying surface rocks. Seismologist can identify the patches that slipped, how much they moved, and the direction of rupture. And just like surface faults, these deeper ones produce repeat earthquakes.

The interface between the North American plate and the deeper Gorda plate below doesn't only delineate two different source areas for earthquakes. The interface itself is a fault and is part of the largest fault system in the lower 48 states, the Cascadia subduction zone.

The Cascadia subduction zone has not produced a major earthquake in the short written history of the North Coast. It has been essentially quiet for over 300 years. We know about its activity from the geologic record, written records in Japan, and the oral history of the many peoples who experienced repeated Cascadia earthquakes from California to Vancouver Island.

View my Cal-Poly Humboldt Osher Lifelong Learning Institute free lunchtime talk about the North Coast's shaky history at <https://extended.humboldt.edu/olli/events/brown-bag-lunch-presentations/brown-bag-lunch-presentations-video-archive> .

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