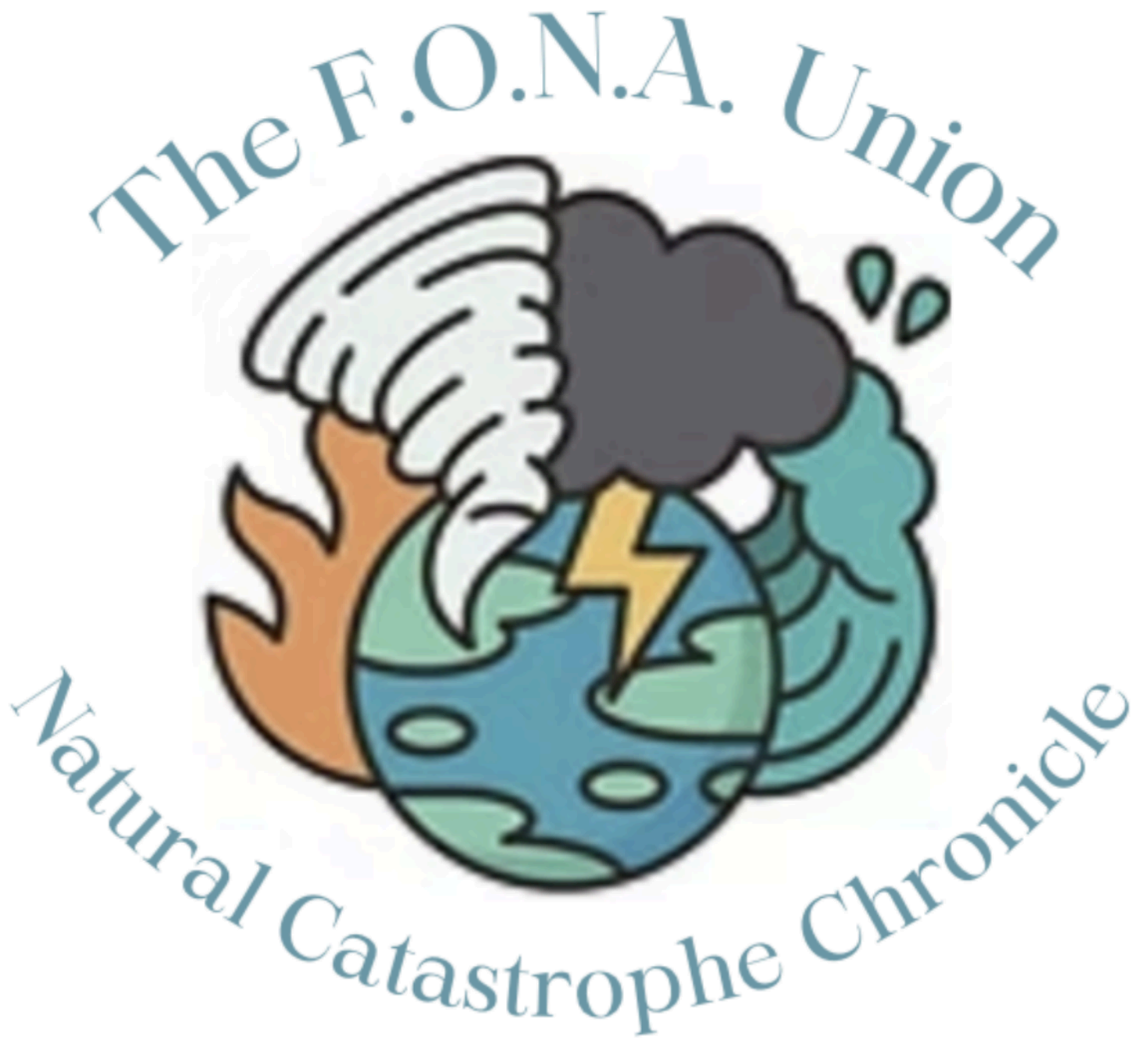




Issue 2: Earthquakes

The Science Behind Earthquakes and How to react if you find yourself in one:

Earthquakes are natural occurrences that occur when stress on the Earth's crust causes an abrupt release of energy, creating ground shaking. Such stress builds up because the tectonic plates, enormous slabs in the outer layer of the Earth, move continuously. Although these plates move constantly, friction usually keeps them from sliding effortlessly. When the stress becomes too big, it overcomes the friction, and the plates suddenly jump and release energy in the form of seismic waves.

There are several types of earthquakes. The most common are tectonic earthquakes, which take place on plate boundaries. Volcanic earthquakes occur as magma moves under a volcano, and collapse earthquakes result from cave-ins or underground explosions. Induced earthquakes are man made through such processes as mining or the injection of large reservoirs.

Different plate boundaries form different earthquake patterns. Converging boundaries, where plates are colliding, are likely to form intense quakes. Diverging boundaries, where plates are spreading apart, are likely to form small quakes. Transform boundaries, where plates are sliding past each other, tend to form brief but highly destructive earthquakes, such as those along California's San Andreas Fault.

Seismic waves are the vibrations which travel from the earthquake's focal point. P-waves move in the quickest manner and pass through solids and liquids, while S-waves move slower and travel only through solids. Surface waves, traveling along the Earth's surface, do the most damage.

Earthquakes are measured on different scales. The Richter Scale measures magnitude or energy emitted. The Moment Magnitude Scale (Mw) is more appropriate for big quakes. The Modified Mercalli Scale measures intensity based on damage observed and human judgment.

The effects of an earthquake can be devastating. Ground shaking is greatest at midpoints near the epicenter. Liquefaction may result in grounds acting like liquids, collapsing buildings. Underwater earthquakes can cause tsunamis, and landslides in hilly regions. The destruction caused by an earthquake is enormous and far-reaching.

Preparation can reduce the impact of earthquakes. Heavy objects must be fastened so that they will not fall and injure a person. Emergency supplies—such as water, food, flashlights, batteries, and a first-aid kit—must be gathered in advance. Safety drills must be rehearsed so that all persons will be aware of what to do during an earthquake. If you are indoors when an earthquake occurs, get under a sturdy table, hold onto the table legs, and protect your neck and head to shield yourself from falling debris. Stay away from windows and heavy furniture that may fall or shatter. If you are outside, avoid buildings, trees, streetlights, and power lines. Move to an open area and crouch to avoid being knocked over. If you are driving, safely pull over to the side of the road, try not to stop under bridges or overpasses, and go inside the car until the shaking is over. Once the shaking has stopped, look for injuries or damage, watch out for aftershocks (smaller quakes that happen after the

initial one) and tune into the radio or phone for emergency messages with information and instructions.

In brief, earthquakes are giant natural forces sustained by tectonic activity. Being aware of the causes and effects of earthquakes—and properly preparing for them—can help in ensuring the safety of you and others when they arrive.

Historical Incidents:

Living in California means living with earthquakes—it's just part of the deal. The state sits right on the boundary between the Pacific and North American tectonic plates, making it one of the most seismically active areas in the U.S. Over the years, California has been shaken by some major quakes, each leaving behind not just destruction, but also important lessons that helped improve safety and preparedness. Here's a look at some of the most significant earthquakes in California's history and what they taught us.

The San Francisco Earthquake of 1906 was one of the most catastrophic in American history. With a magnitude of 7.9, it destroyed over 80% of the city. But the fires that broke out afterward—fueled by broken gas lines and a lack of water—ended up doing even more damage than the quake itself. Around 3,000 people died. One clear takeaway: buildings made from brick and wood just couldn't hold up. This disaster pushed city officials and engineers to rethink how structures should be built in earthquake-prone areas, eventually leading to stronger building codes.

Next came the Long Beach Earthquake in 1933, which had a magnitude of 6.4. It wasn't as strong as the San Francisco quake, but it hit a vulnerable area—schools. Many collapsed, which led to a major wake-up call: kids needed to be protected. That's when California passed the Field Act, a law that required schools to be built to stricter safety standards. It was a huge step forward in making sure classrooms were safe for students and teachers alike.

The San Fernando Earthquake of 1971 was another major earthquake. It measured 6.6 and hit hard—damaging hospitals, cracking freeways, and nearly causing a major flood when the Van Norman Dam was pushed to the brink of failure. This quake made it clear that emergency facilities, especially hospitals, needed to be able to withstand powerful shaking. As a result, new rules were put in place to make sure critical infrastructure could stay standing when it mattered most.

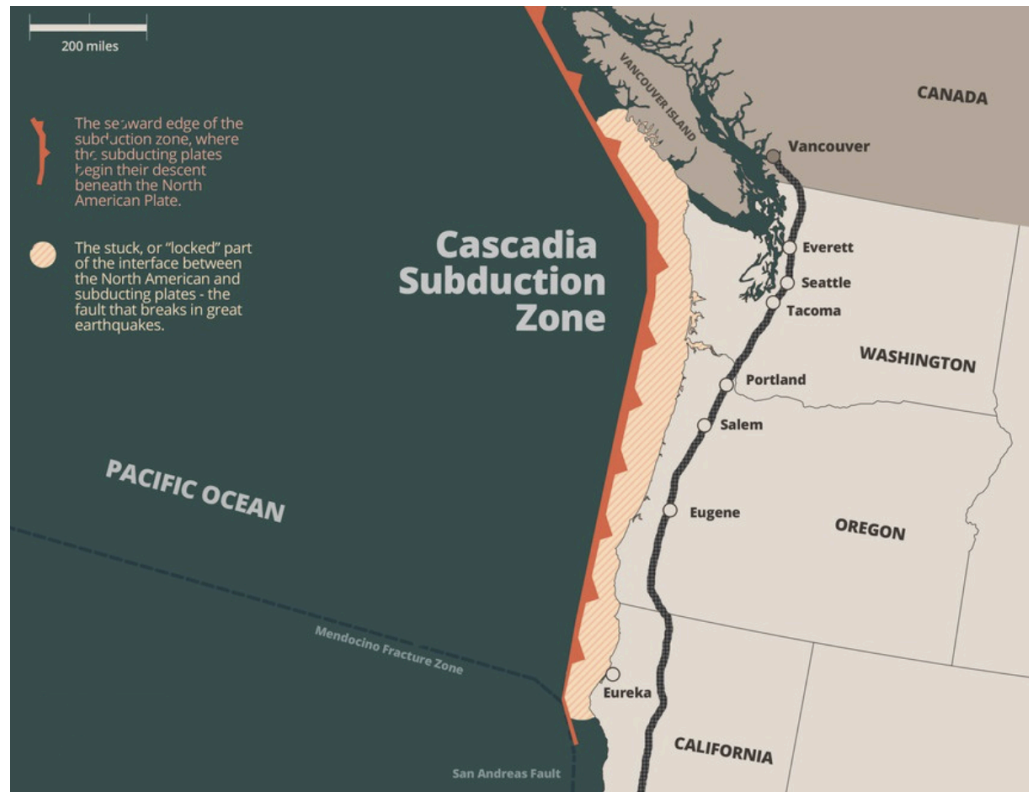
In 1989, the Loma Prieta Earthquake struck during the World Series, which meant millions of people were watching when it happened. With a magnitude of 6.9, it caused the collapse of the Cypress Freeway and a section of the Bay Bridge. It was a reminder that California's older roads and bridges weren't built to handle modern earthquakes. In the years that followed, massive retrofitting projects were launched to upgrade the state's transportation systems.

Then came the Northridge Earthquake in 1994—a 6.7 magnitude quake that caused an estimated \$44 billion in damages. Over 60 people lost their lives. Apartment buildings, commercial centers, and freeways all crumbled, pointing out serious flaws in construction practices. The lesson here was clear: even newer buildings needed better designs and enforcement of building codes to truly be considered earthquake-safe.

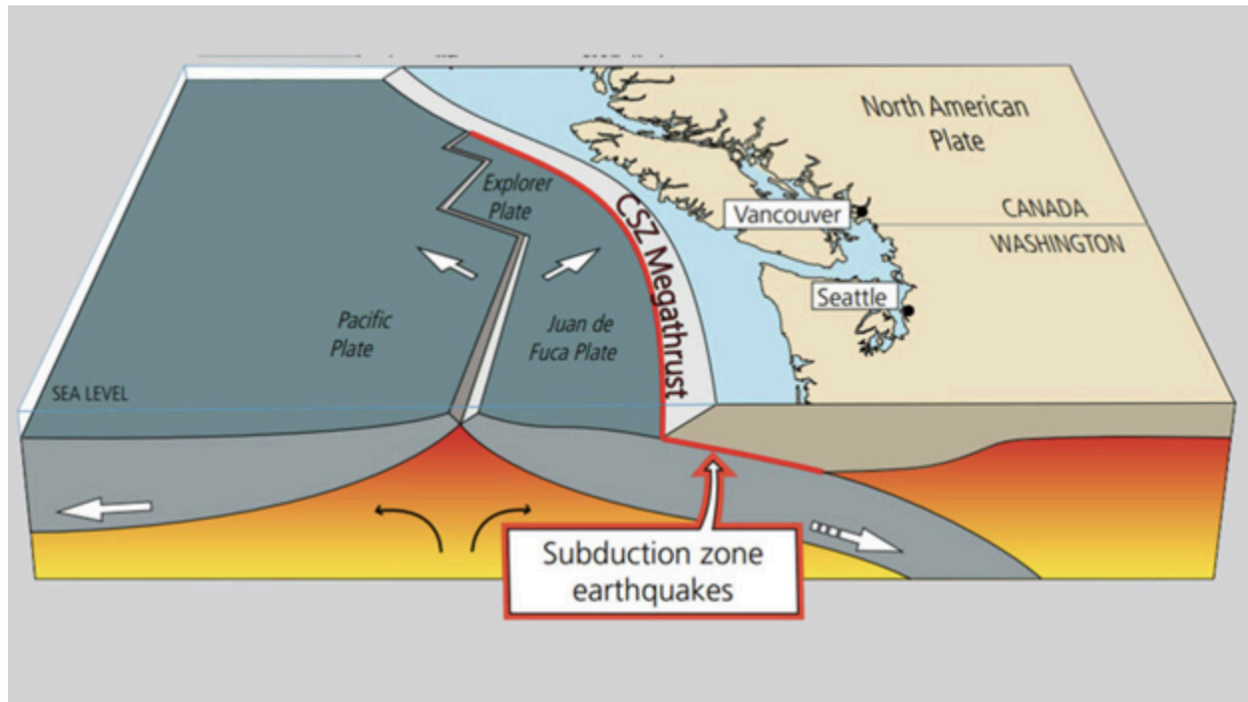
Most recently, the Ridgecrest Earthquakes in 2019—two big ones back-to-back, at 6.4 and 7.1—shook Southern California. Luckily, the area wasn't heavily populated, so damage was limited. Still, the tremors were felt far and wide, and they served as a reminder that California is still very much at risk for "The Big One." It reinforced how important it is to stay prepared—through emergency kits, evacuation plans, and ongoing improvements to infrastructure. Each of these earthquakes left scars, but they also taught valuable lessons. California's approach to building safety, emergency response, and public awareness has improved dramatically thanks to what we've learned from these past events. And while we can't prevent earthquakes, we can definitely get smarter about how we prepare for them.

The Big One:

California is on the brink of a cataclysmic disaster predicted to strike within the next eight years - a megathrust earthquake along the Cascadia Subduction Zone, the same zone that had once caused a magnitude (number) earthquake on January 26, 1700. Subsequently, a catastrophic tsunami struck the west coast of North America and the coast of Japan where it drowned out entire forests. Now, over three hundred years later, we are about to tip over into facing the same danger once again. However, this time, the consequences are bound to worsen exponentially, as the tsunami would likely flood the coastline, trigger landslides, collapse bridges many miles inland, and damage infrastructures across the Northwest for months to years afterward.



The next Big One is predicted to run along the Cascadia Subduction Zone in Washington, a fault that runs from northern California to Vancouver Island in Canada, where a tectonic plate slides beneath another. Earthquakes transpire when tectonic plates touch and scrape against each other. In terms of the Cascadia Subduction Zone, the two plates, the North American and Juan de Fuca, are going to collide, with the North American plate pushing down on the Juan de Fuca and sliding over it until it can no longer be pushed down. The result will be a disastrous earthquake that will leave aftershocks for months and years to come, with an estimated death toll in the thousands. Due to the location, areas of Seattle, Tacoma, Portland, and Vancouver would be badly hit, and the dreadful vibrations would send a tsunami crashing down the Puget Sound. Civilians near the Puget Sound will no doubt face extensive damages and will likely try to escape east based on the condition of roads and bridges in the face of the disaster. However, numerous highways and bridges are likely to collapse from the damage, and help must come from the outside to secure the safety of the civilians.



The Cascadia Subduction Zone is not the only area that might be impacted. Scientists conclude there is also a possibility for the big one to strike at the San Andreas fault - a strike-slip fault where tectonic plates slide past each other, known to generate disastrous earthquakes. An example of such would be the quake that occurred on April 18, 1906, an event so severe it caused a 296 miles rupture in the land with an estimated magnitude of 8.3. San Andreas is broken up into many segments instead of acting as one significant fault. In southern California, the main strands are the San Andreas Fault, the San Jacinto Fault, and the Elsinore Fault. In northern California, there are the San Andreas, the Hayward-Calaveras fault system, and the Greenville and Green Valley faults farther east. What's even more dangerous is that the Bay Area and LA have many active faults underneath that have not yet been discovered. Geologists have hinted at a massive earthquake of a magnitude of 7.8 or higher that is overdue for the southern portion of the San Andreas fault that's going to devastate cities like Los Angeles, San Diego, and San Bernardino. According to the 2014 Working Group on California Earthquake Probabilities, the big one is predicted to have a 72% probability of hitting the San Francisco Bay area with a magnitude of 6.7 or larger by 2043 - but only a 22% chance of hitting the northern portion of the San Andreas. Researchers also predicted a 19% chance of an earthquake of 6.7 or greater magnitude hitting the southern part of the fault, closer to LA. An earthquake of this size would cause colossal damage to highways, bridges, and water supplies, which countless civilians rely on for sustainability and survival. Millions would be impacted, with thousands displaced and injured, overwhelming the state's emergency response system. While improvements have been made regarding building codes, emergency preparedness, and public awareness campaigns, many areas remain vulnerable to disastrous earthquakes of such a high magnitude, including houses, old buildings, and crucial infrastructure. Due to the fact that the fault runs through

the Bay Area, the damage to our environment would be disastrous and will no doubt throw our systems into a panic.