

## **WTE Column of February 2, 2017: “Should Wyoming worry about earthquakes?”**

Ross Stein is a consulting professor of geophysics at Stanford University and a scientist emeritus of the US Geological Service. He has lectured on earthquake seismology and collaborated with scientists on projects connected to Japan, Algeria, and Turkey. He is also the co-founder of Temblor, a website and app that allows individuals to determine the risk of an earthquake in their region.

I happened to be in the area when Dr. Stein presented a talk on the geologic beauty and the seismic risks of Northern California. The presence of the San Andreas Fault System has created places of great natural beauty, he said, reminding listeners of the Santa Cruz mountains, the redwood trees, the bay, and the coastline. The system has also made the region, including the Tri-Valley (where I have family), a place of considerable risk.

All bay area faults interact in ways we don't yet fully understand, he said. Scientists cannot predict earthquakes; they only know afterwards that the Northridge 1994 quake, to give an example, was caused by plates pushing against each other.

“Our knowledge is inadequate,” he said.

The San Andreas fault happened when two tectonic plates began to converge. Some 28 million years ago, the Pacific Plate first rubbed against the North American Plate. Back then the western edge of North America's Pacific ocean lapped at the shores of what is today central Utah and Arizona, while most of today's California was in the process of being created, under the ocean or in the volcanic islands of the eastern Pacific.

“In your lifetime you should expect a 6.5 earthquake,” he warned his audience. “That said, there are things you can do to lower the risk to your home. Typically, your home is your most important investment.”

When we enjoy the beauty of the area we must ensure that we live in houses that can survive its quakes. It is our responsibility to ensure our homes are earthquake-proof. This means reinforcing with braces every corner of every room.

Unfortunately, most construction companies, even in the bay area, don't reinforce corners unless told to do so, even though it would add less than 2% to the initial construction cost. However, people can retrofit their homes. It's expensive but will considerably lower earthquake-insurance payments.

“In your lifetime you should expect a 6.5 earthquake,” he warned. “That said, you can—and should—take steps to lower the risk to your home and family.”

To make his point, Stein showed pictures of the 1906 San Francisco earthquake. Its aftermath of ruptured gas lines created an inferno of flames. No fire engines came to the rescue: the horses that pulled them were crushed in the rubble of collapsing buildings.

He cited Jack London, who with his wife rushed to the scene on horseback. As London stepped inside a lovely home, the unfortunate owner told him, “Yesterday morning I was worth six hundred thousand dollars. This morning this house is all I have left. It will go in fifteen minutes. . . . my wife's collection of china. . . . this rug upon which we stand . . . Try that piano; listen to its tone. . . . There are no horses. The flames will be here in fifteen minutes.”

Discovering tectonic movements began with the gold rush, Stein said. Countless ships steamed in San Francisco’s Yerba Buena Cove. Eventually a total of sixty thousand adventurers, many of them arriving by sea, trekked to the gold mines.

The Golden Gate entrance was treacherous and navigation maps were crude. In 1856, the federal government sent its surveyors to California, but their measurements remained rudimentary. Only with the advent of the laser were scientists able to accurately pinpoint the faults that run through the state, often parallel to each other.

At the reception I mentioned Wyoming. “Yes, Wyoming,” Stein said, growing animated. “Quite bit of seismic activity in the greater Yellowstone area.”

“I live in the southeast corner of the state,” I told him. “We don’t worry about an earthquake there.”

“Maybe you should,” he said. Then he launched into an exposition of human-induced seismic activity, adding that, “Nowadays Oklahoma has three times the tremors of California. Three times!”

“Ah, yes, the fracking,” someone interjected.

“It’s not fracking that causes the problem,” corrected the geologist. “It’s the injection of its waste fluids. Ironically, the liquid serves to lubricate the plates.”

Fracking fluid is injected deep into the earth so as—it is hoped—not to contaminate our groundwater and aquifers. Because they reach so deep, the injections produce countless tremors. Many of these are tiny, but some cause a great deal of damage to homes, roads, parks, etc.

“The Oklahoma legislature ordered its extraction companies to reduce their injections by one-third,” added Stein. “Since then, the state’s earthquakes have been reduced by one-third. So you see, there’s a direct correlation.”

Today fracking is banned in most of California. Hereabouts, we should wonder: Is Wyoming the next Oklahoma?