

Researcher develops new model to accurately date historic earthquakes

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Three earthquakes in the Monterey Bay Area, occurring in 1838, 1890 and 1906, happened without a doubt on the San Andreas Fault, according to a new paper by a Portland State University researcher.

The paper, "New Insights into Paleoseismic Age Models on the Northern San Andreas Fault: Charcoal In-built ages and Updated Earthquake Correlations," was recently published in the *Bulletin of the Seismological Society of America*.

Assistant Professor of Geology at PSU Ashley Streig said the new research confirms what her team first discovered in 2014: three earthquakes occurred within a 68-year period in the Bay Area on the San Andreas Fault.

"This is the first time there's been geologic evidence of a surface rupture from the historic 1838 and 1890 earthquakes that we knew about from newspapers and other [historical documents](#)," Streig said. "It basically meant that the 1800s were a century of doom."

Building on the 2014 study, Streig said they were able to excavate a redwood slab from a tree felled by early Europeans, from one meter below the surface in the Bay Area. The tree was toppled before the three earthquakes in question occurred. That slab was used to determine the precise date logging first occurred in the area, and pinpointed the historic dates of the earthquakes. Further, they were able use the slab to develop a new model for determining recurrence intervals and more exact dating.

Streig used the dating technique wiggle matching for several measured carbon 14 samples from the tree slab and compared them with fluctuations in atmospheric carbon 14 concentrations over time to fingerprint the exact death of the tree and confirm the timing of the earthquakes. Because the researchers had an exact age from the slab, they were able to test how well the most commonly used material, [charcoal](#), works in [earthquake](#) age models.

Charcoal is commonly used for dating and to constrain the ages of prehistoric earthquakes and develop an earthquake recurrence interval, but Streig said the charcoal can be hundreds of years older than the stratigraphic layer containing it, yielding an offset between what has been dated and the actual age of the earthquake. The new technique accounts for inbuilt charcoal ages—which account for the difference in time between the wood's formation and the fire that generated said charcoal—and can better estimate the age of the event being studied.

"We were able to evaluate the inbuilt age of the charcoal incorporated in the deposits and find that charcoal ages are approximately 322 years older than the actual age of the deposit—so previous earthquake age models in this area using detrital charcoal would be offset roughly by this amount," she said.

New earthquake age modeling using a method to correct for this charcoal inbuilt age, and age results from the tree stump are what give Streig absolute certainty that the 1838 and 1890 earthquakes in question occurred on the San Andreas Fault and during those years.

"We put the nail in the coffin," she added.

More information: New Insights into Paleoseismic Age Models on the Northern San Andreas Fault: Charcoal Inbuilt Ages and Updated Earthquake Correlations, *Bulletin of the Seismological Society of America*

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