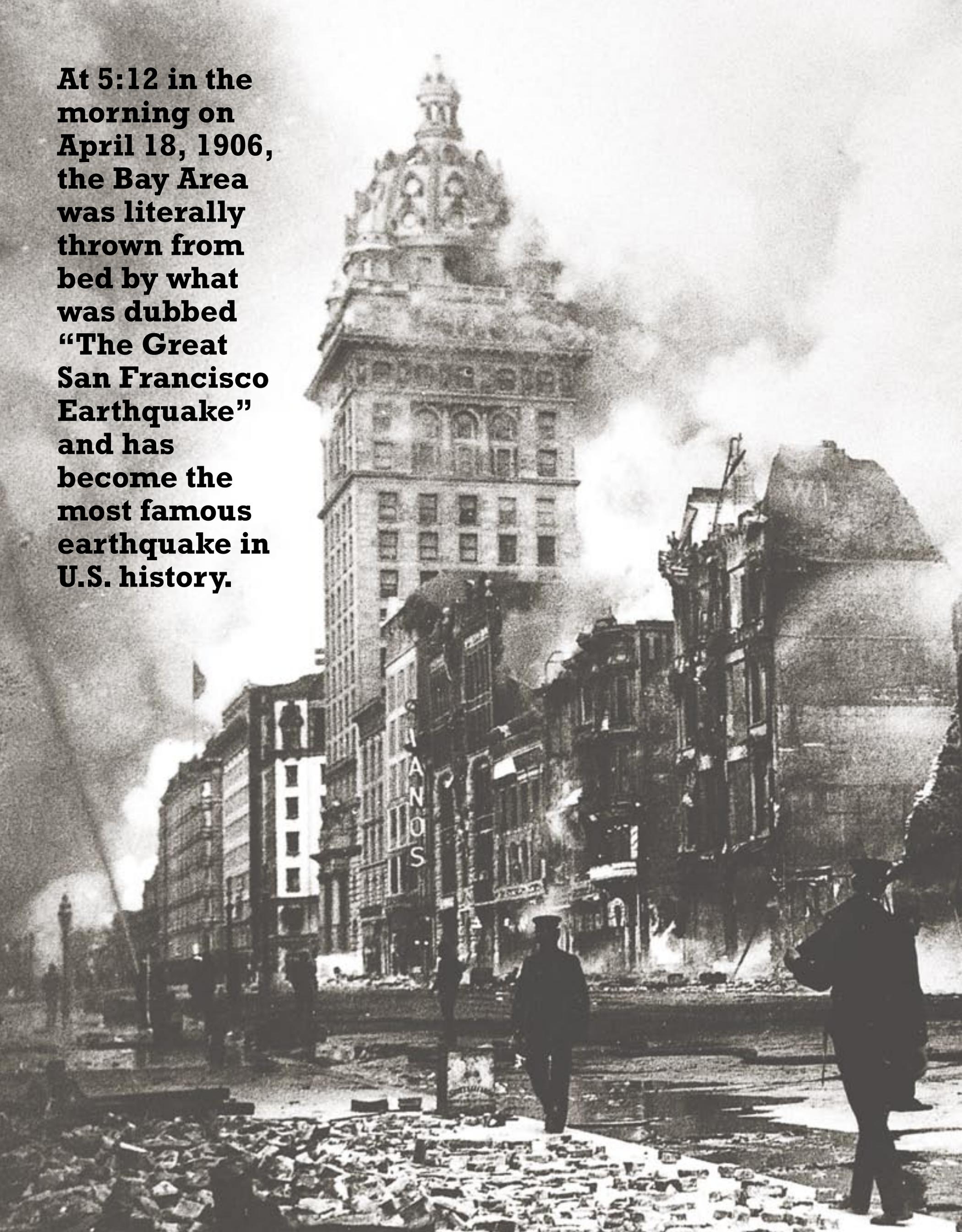


At 5:12 in the morning on April 18, 1906, the Bay Area was literally thrown from bed by what was dubbed “The Great San Francisco Earthquake” and has become the most famous earthquake in U.S. history.



A Moment of Magnitude for America and for Science

By David Hebert

In December 1904, a University of California at Berkeley geology professor named Andrew Lawson wrote the following in the university's newspaper: "History and records show that earthquakes in this locality have never been of a violent nature, as so far as I can judge from the nature of recent disturbances and from accounts of past occurrences there is not occasion for alarm at present."

Less than two years later, he might have considered a retraction.

At 5:12 in the morning on April 18, 1906, the Bay Area was literally thrown from bed by what was dubbed "The Great San Francisco Earthquake" and has become the most famous earthquake in U.S. history.

Starting under the Pacific, just off the coast of the San Francisco peninsula, the magnitude-7.9 temblor grew until it had caused shaking and damage along nearly 300 miles of the then-unknown San Andreas Fault in Northern California. Strong shaking lasted for nearly a minute, and in some places along the fault, the earth moved more than 25 feet.

For those who were there, it was surely a singular experience.

"My sensations ... were of being on ship in a gale pounding against the rocks, being thrown this way and that, then up in the air, and dropped with a sickening thud that took away my breath," said Melissa Stewart McKee Carnahan in her 1908 book documenting her personal experiences of the earthquake. "It lasted twenty-eight seconds. Had it lasted ten seconds longer, I fear every building in San Francisco would have gone down."

As it was, 28,000 buildings were destroyed in San Francisco by both the earthquake and the subsequent fire, which blazed for three days — the shaking had damaged the city's water lines, rendering the fire department ineffective.

Throughout Northern California, at least 3,000 people were killed (most in San Francisco and many in the fire); and of San Francisco's some 400,000 residents, about 225,000 lost their homes. Damage losses have been estimated at more than \$500 million (1906 dollars).

A repeat of this quake today would likely lead to thousands of deaths and possible economic losses in the hundreds of billions of dollars.

"This bombardment of nature caused greater destruction in the number of seconds it lasted than the most modern engines of war could accomplish in the same number of weeks," Carnahan said. "From whence did this tremendous force originate?"

For all the horror of this earthquake's destruction, it's this last question that might lend the disaster its lasting significance.

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Photo courtesy California Historical Society

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Before April 18, 1906, knowledge of earthquakes — how and where they occur and the hazards they pose — was relatively little. However, that was about to change.

“While the 1906 earthquake marked a seminal event in the history of California, it can also be remembered as the birth of modern earthquake science in the United States,” said Mary Lou Zoback, a senior research geologist with the U.S. Geological Survey (USGS), in an April 2006 article for *GSA Today*. “It was the first time that an earthquake was recognized and documented as the result of a recurring tectonic process of strain accumulation and release.”

Much of that recognition and documentation was the work of Professor Lawson, whose ironic statement in 1904 about the relative lack of seismic hazards in the Bay Area underscored the need for scientific study and understanding.

With Lawson as its leader, a group of scientists and engineers documented the physical characteristics of the 1906 earthquake’s faulting throughout California and published *The Report of the State Earthquake Investigation Committee, volume I*, in 1908. This report also included reports on shaking intensity and an atlas of 40 maps and folios.

A second volume of the report was published in 1910 under the editing of Harry Fielding Reid. This volume focused on the earthquake’s seismological and mechanical traits, and it was from this research that Reid created the elastic-rebound theory of earthquake sources — the primary model of the earthquake cycle even today.

“H.F. Reid’s work is one of the seminal studies of earthquake science in the 20th century,” said Ross Stein, a USGS geophysicist.

“Their exhaustive data and thoughtful conclusions led to a number of new discoveries about the cause and effects of earthquakes,” said Zoback of both volumes as

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well as a complementary report published by the USGS in 1907.

And these discoveries and observations still fuel seismic science nearly 100 years later.

“There is still much to be gained from study of the 1906 report, in spite of the fact that it is nearly a century old and in spite of the great increases in our understanding of the San Andreas Fault since the time of its publication,” said USGS geologist Carol Prentice in a 1999 paper. “The 1906 report continues to supply information for modern studies in geology, geodesy and seismology.”

The importance of continuing seismic research becomes apparent when one considers that a powerful earthquake is bound to happen again — a USGS-led study published in 2003 places a 62-percent probability on an earthquake of magnitude 6.7 or larger occurring in the Bay Area before 2032.

With that sort of likelihood looming, earthquake hazard science and mitigation by the USGS and its partners are vital to the safety and welfare of those living in the Bay Area as well as the United States’ other seismically active places.

To ponder future possibilities, however, one should also peer into America’s shaky past. In the relatively short time since its colonization and independence, the nation has seen many moments of major magnitude, including April 18, 1906.

Over the next several pages, you can find a narration of how USGS scientists in and near the Bay Area responded to the earthquake as well as firsthand accounts from others who were there.

A brief but significant seismic history of the United States can also be found along the bottom of the next several pages in the accounts of 18 such earthquake events, beginning in 1700.

For more information on the 1906 earthquake, visit <http://quake.usgs.gov/info/1906/index.html>.

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