The Great Quake of 1906

By Stephen Mattox and Colleen Zeeff

Natural disasters such as the 1906 San Francisco earthquake serve as reminders of the need for geologic research and investment in disaster preparedness of all types. Although young students may view their world as a rather localized area, natural disasters such as earthquakes are brought into their homes—whether it’s through television, internet, or print media. Today’s students are more globally aware than their counterparts of yesteryear and teachers can capitalize on this.

This Month’s Trade Books

*Earthquakes*
By Ellen Prager.
National Geographic Society. 2002.
Grades K–5

**Synopsis**
This short, engaging book provides a complete examination of earthquakes for elementary students. Key topics are covered in a manner that introduces the appropriate vocabulary needed while keeping jargon to a minimum. Throughout its text and illustrations, it presents the key aspects of earthquakes: cause, distribution, effects, mitigation of effects, and safety. It is a great start to any earthquake lesson and supports diversity by presenting a female scientist.

*…If You Lived at the Time of the Great San Francisco Earthquake*
By Ellen Levine.
ISBN 0-590-45157-X.
Grades 3–8

**Synopsis**
In this book, questions and answers provide a complete description of events before, during, and after the 1906 earthquake. Information about this particular quake is well presented and serves as a connecting point between history and science. Key concepts including magnitude, intensity, effects, response, and recovery are presented.

**Curricular Connections**
In addition to the obvious Earth and Space Science connection, the trade books selected for this month’s column help to demonstrate and promote two areas of the National Science Education Standards that often go to the wayside in class-rooms—Science in Personal and Social Perspectives and the History and Nature of Science. These topics help students connect science concepts to their life and what is happening in the world, as well as showing a historical perspective.

Each book, *Earthquakes* and *…If You Lived at the Time of the Great San Francisco Earthquake*, examines this type of natural disaster from a different vantage point. The first book presents scientific concepts associated with earthquakes and important terminology that is developmentally appropriate for younger students, whereas the later book provides the connection to the societal and historical perspectives of science. As the class reads either book, there are opportunities for students to make observations and spend some time discussing their prior knowledge of earthquakes. Opportunities such as these allow the students to make the important connections between what they already know, what they are hearing about in the everyday world, and the science concepts associated with the topic.

The first activity presented allows students to investigate earthquake waves from a kinesthetic perspective. In mimicking the movement along a fault line, students see how rock can shift during an earthquake when they see that where they started is not where they ended up. This simple simulation provides a concrete representation of what happens during an earthquake similar to the one in 1906.

The second activity involves students examining pictures that were taken during the 1906 earthquake, making inferences, and then applying an accepted scientific scale to them. Often, as a natural disaster is happening, information is gathered but final results are not reported until later—take for example the final determination of the category of Hurricane Katrina.

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For Grades K–3: Fault in Motion

Purpose:
Students mimic the duration, displacement, and type of movement along the fault that produced the 1906 earthquake.

Materials: A rope at least 20 m long

Procedure:
1. Show students a photograph of damages caused by the 1906 earthquake (see Internet resources). Ask what force in nature might cause such destruction. Students may respond with many of the recent disasters that have been in the news. If needed, read *Earthquakes* to refresh students’ memories about key aspects of earthquakes and to provide maps of the location of the San Andreas fault.

2. Next, while reading *If You Lived at the Time of the Great San Francisco Earthquake* aloud, ask students to focus on pictures where the ground seems to have moved.

3. Introduce the students to the process of movement on a *fault*, a crack in Earth’s crust along which blocks of rock move against each other. It should be noted that there are many types of faults—the movement isn’t always the same. Explain to the students that in this activity they will simulate the movement of rocks along a fault similar to what occurred during the 1906 earthquake.

4. Divide your class into two equal-size groups. Have each group form a single-file line, representing a block of rock. Place each line of students parallel to the fault (the rope stretched in a straight line) with one line of students on each side of the fault. Have the students in each line stand shoulder to shoulder facing their classmates across the fault. Students need to place the palms of their hands outward, in front of them, touching their peers’ palms across the fault. This represents the ground before the earthquake.

5. The students shout “earthquake” and release their energy by moving. Where the two “blocks” slide past each other, they make an earthquake. The students need to make two motions simultaneously: jumping up and down while each line moves to the left (so the two lines are moving in opposite directions). Walk the students through this process in slow motion first so that they understand what they are doing before allowing them to demonstrate their “full force.”

6. Students should remain in motion for 50 seconds (the duration of the 1906 earthquake) and move laterally until students that were once facing each other are now 6 m apart (the displacement of objects across the fault in 1906).

7. After participating in the activity, discuss the key points: blocks of rock—students slide past each other along a fault line (rope); as the blocks move they release energy (demonstrated as motion) in the form of an earthquake; and during great earthquakes the ground might shake many tens of seconds and move 10–20 m.

8. Return to the pictures that show clear examples of ground on each side of a fault line moving. Ask the students to make observations about what types of human-made things were also moved when the ground along the fault line shifted as well. Discuss the changes that occur as a result of such disasters (building codes, etc.).
For Grades 4 – 6: Estimating Intensity

**Purpose:**
Students will collect their own data based on observations of pictures and then assign an intensity rating to the 1906 earthquake.

**Materials:**
- Access to the internet or photographs of the 1906 earthquake (see Internet resources)
- Copies of the intensity scale (Modified Mercalli Intensity Maps for the 1906 San Francisco Earthquake, see Internet resources)

**Procedure:**
1. Unlike magnitude, which is a measure of the amount of energy released during an earthquake, earthquake intensity is a measure of effects felt and reported by anyone that experiences an earthquake. For example, a rating of II on the Modified Mercalli Intensity Scale means that the earthquake is felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. Intensity can also be estimated after the earthquake by carefully examining photographs. Reading *Earthquakes* will refresh students’ memories about the felt effects of earthquakes and factors that influence intensity.
2. While reading *If You Lived at the Time of the Great San Francisco Earthquake*, ask students to develop a list that describes the effects of the 1906 earthquake (fire, buildings knocked down, etc.).
3. Pose the question, “What do we mean by the term intensity?” Some students may define the word with the word—it’s intense! Work with the students to develop a class definition of intensity—how something felt, the level at which something occurs, etc. Once students have an understanding of intensity, present them with the intensity scale and ask them to explain it.
4. Using some of the pictures in either book, model evaluating the pictures and comparing them to the intensity scale.
5. Provide students (working in groups of 2 – 3 students or individually) with a series of pictures from the 1906 earthquake that should be labeled with either a title or letter so that students will be able to compare their descriptions. Ask the students to spend some time closely examining the effects shown in each picture and then to assign a specific intensity value to the pictures and support their answers.
6. Discuss the students’ observations and assign a maximum intensity for the 1906 earthquake. Was there a range in the values? Discuss what might cause a single event to produce different intensities across an area (e.g., distance from epicenter, construction practices, and types of geologic materials). *Earthquakes* introduces some of these factors.
7. After the group discussion, review the intensity map for the 1906 earthquake. Maximum intensity, X-XII, occurred along the length of the fault. Intensity decreased with increasing distance away from the fault. Areas underlain by soft material, such as fill or sediment, shake more than areas that are constructed on bedrock.

In the 100 years since the Great San Francisco Quake, technology has improved and the science of seismology has advanced. However, it should be noted that we would not be where we are today without remembering, examining, and understanding the historical events of the past.

**Resources**

**Internet**
- U.S. Geological Survey: The Great 1906 San Francisco Earthquake
- The Virtual Museum of the City of San Francisco: The Great 1906 Earthquake and Fire
  [www.sfmuseum.org/1906/06.html](http://www.sfmuseum.org/1906/06.html)
- Modified Mercalli Intensity Maps for the 1906
  San Francisco Earthquake
- ABAG Earthquake Shaking Hazard Maps
  [www.abag.ca.gov/cgi-bin/pickmapx.pl](http://www.abag.ca.gov/cgi-bin/pickmapx.pl)
On April 18, 1906, an earthquake and subsequent fires devastated San Francisco, California, leaving more than 3,000 people dead and destroying more than 28,000 buildings. The quake ruptured the San Andreas fault to the north and south of the city, for a total of 296 miles, and could be felt from southern Oregon to Los Angeles and inland to central Nevada. San Francisco Earthquake: April 18, 1906. The greatest devastation resulted from the fires that quickly followed the quake. The initial tremors destroyed the city’s water mains, leaving firefighters with no means of combating the growing blaze, which burned for several days and consumed much of the city. More than 3,000 people perished and more than 28,000 buildings were destroyed in the disaster. A great-great grandfather on her mother’s side worked on U.S. railroads in the late 1800s and sent money back to his village in southern China until he died here. His son, Guan's great-grandfather, attempted to immigrate in the 1930s but he was rejected. Guan immigrated from southern China with her parents in 1997. Now a freshman at UC Davis, she is learning about the laws targeting Chinese and their way of life, and how Chinese Americans appealed to the U.S. Supreme Court for their rights, easing the way for other immigrants. The 1906 earthquake in San Francisco spawned fires that nearly destroyed the city, and defied all scientific theories of the day. You know the broad story; now here's the science to fill in the details. Blended image of 1906 post-quake damage, and present-day San Francisco. Photography credit: Shawn Clover. The 1906 earthquake isn't one of the Top Ten largest earthquakes in the world. It isn't even the largest earthquake in Californian history. Yet it is one of the most significant earthquakes in history, shaping both cultural and scientific understanding of the devastation an earthquake can wreak. The Earthquake. G/O Media may get a commission. And 30 years after the great quake of 1906 destroyed much of San Francisco, Hollywood produced a romantic drama about the catastrophic event. When MGM released director W.S. Van Dyke's San Francisco in 1936, the City had been completely rebuilt. It was the crown jewel of the West Coast, a city who's skyline was beginning to rival that of New York. Van Dyke's film ends with a shot of the devastated city in 1906. The 1906 quake was an unimaginably horrific tragedy that only those who endured could fully comprehend. San Francisco the film does not attempt to sugar coat the events of that terrible day. The love triangle which leads up to the film’s devastating climax ultimately puts a human face on tragedies such as these. "We call the 1906 earthquake the Great Earthquake," said Dr. David Schwartz, a research geologist with the United States Geological Survey's office in Menlo Park, Calif. "We call this one a large earthquake." Indeed, the magnitude of the 1906 quake justifies its listing in what Dr. Schwartz terms an “elite group of major earthquakes” that have struck the United States. Most seismologists place the 1906 quake at 8.3 on the Richter scale of ground motion, although some have estimated it at 7.9. The Richter scale was devised years after the San Francisco quake; thus, certifying its magnitude is educated guesswork, scientists say. On the Richter scale, every increase of one number means a tenfold increase in magnitude.