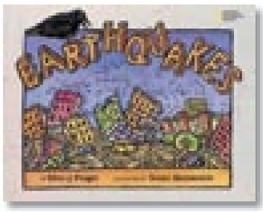
The Great Quake of 1906

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.

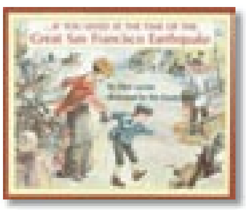
This Month's Trade Books



Earthquakes
By Ellen Prager.
National Geographic Society. 2002.
ISBN 0-792-28202-7.
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.
Scholastic. 1987.
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 classrooms—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.).

Connecting to the Standards

This article relates to the following *National Science Education Standards* (NRC 1996):

Content Standards

Standard D: Earth and Space Science
- Changes in Earth and sky (K–4)
- Structure of the Earth system (5–8)

Standard F: Science in Personal and Social Perspectives
- Natural hazards (5–8)

Standard G: History and Nature of Science
- History of science (5–8)

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

National Research Council (NRC). 1996. *National science education standards.* Washington, DC: National Academy Press.

Internet

U.S. Geological Survey: The Great 1906 San Francisco Earthquake
http://quake.wr.usgs.gov/info/1906

The Virtual Museum of the City of San Francisco: The Great 1906 Earthquake and Fire
www.sfmuseum.org/1906/06.html

Modified Mercalli Intensity Maps for the 1906 San Francisco Earthquake
http://pubs.usgs.gov/of/2005/1135

ABAG Earthquake Shaking Hazard Maps
www.abag.ca.gov/cgi-bin/pickmapx.pl