# Understanding Earthquake

BY AMY PALLANT

GEOLOGISTS COLLECT DATA about Earth and its tectonic plates. Indeed, we live on shaky ground. In 2004, the Indian Ocean earthquake triggered a series of devastating tsunamis, killing large numbers of people and inundating coastal communities across South and Southeast Asia. While geologists know that earthquakes cannot be predicted, they continue to explore the patterns of earthquake activity around the world.

The following activity was developed for the *Information Technology in Science Instruction* (ITSI) project, whose goal is to help middle and high school teachers prepare diverse students for careers in IT by engaging them in exciting, inquiry-based science projects that use computational models and real-time data acquisition.

In this earth science activity your students will study data—the same data geologists use—and look at patterns of earthquake magnitude, depth, location, and frequency in order to discover the patterns of distribution associated with different types of plate boundaries.
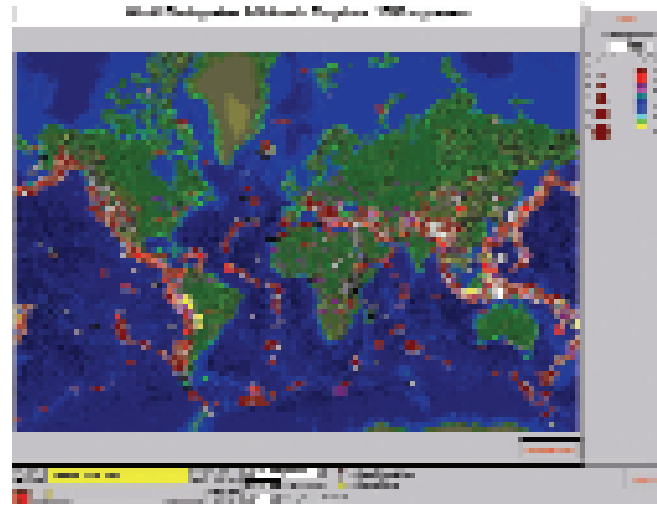
Figure 1: Seismic Eruption software as it begins to plot earthquakes greater than 5.0 in magnitude. The size of circles represents earthquake magnitude; depth is represented by different colors.

Current earthquakes

Software called Seismic Eruption plots all the earthquakes and volcanic eruptions that have occurred around the world since 1960. These data are linked directly to the most current data collected by the U.S. Geological Survey (USGS).

Observing data

The goal of this introductory activity is for students to take note of the patterns of earthquakes around the world. It is best not to focus on individual earthquakes, but rather to look at the overall pattern of the earthquakes.

1. Have students observe the earthquakes as they are plotted around the world. Click the **PLATES** button in the lower right to view the Earth's plates and the **KEY** button in the upper right for a description of the boundaries.

Launching the Seismic Eruption Software

- Download Seismic Eruption from http://www.geol.binghamton.edu/faculty/jones/

- After the opening screens disappear, click the **WORLD** button in the center of the screen to watch all earthquakes that have occurred in the world from January 1, 1960, until the present time.

- Set the program to display **6 MONTHS/SEC** by clicking the up arrows on the speed control below the map.

- Go to the Control Menu, select **TIME TO PAUSE AT END...** A dialog box will appear. Type as many 9s in the box as you can. Click **OK**

Note: Seismic Eruption software runs on Windows 95/98/NT/2000/XP. Seismic Eruption was developed by Alan L. Jones, Ph.D. We gratefully acknowledge his assistance.

LINKS *Monday's Lesson*

ITSI
http://itsi.concord.org

Activity Along Plate Boundaries

2. Students should look for characteristic patterns of earthquakes along each type of boundary. For example, which boundaries have the most frequent earthquakes? Which have the deepest earthquakes? Do the earthquakes occur in wide bands or narrow bands along the boundaries?

3. In pairs, have students brainstorm different ways to describe what they see.

Creating cross-sections

Challenge students to go deeper—literally! Have them create cross-sections along each type of boundary. Students should take notes about a) the relationship between *magnitude* of earthquake and *depth* of earthquake to plate boundaries, b) the frequency of earthquakes along each type of boundary, and c) the location of earthquakes relative to each type of plate boundary.

1. Go to the Control Menu and select **SET-UP CROSS-SECTION VIEW.** (See Figure 2.)

2. Click anywhere on the map. This will cause an icon like the one below to appear. (Move the icon to any location by clicking and dragging it.)
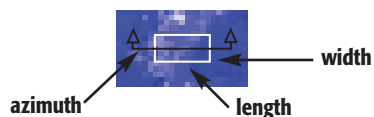
3. Increase the length to 1500 and width to 500 by using the arrows or typing in numbers.

4. Click the **REDRAW** button and watch what happens to the icon.

5. The azimuth changes how the red line is drawn in comparison to the bottom of the screen. Change the azimuth to 20, 0 and -20 and click **REDRAW** each time.

Table 1

	Latitude	Longitude	Depth (km)	Magnitude
1/1/2006	35.13	-117.56	3	2.9
1/3/2006	37.44	-117.08	5	3.1
1/7/2006	32.49	-115.44	5	3.7
1/7/2006	32.49	-115.44	5	3.7
1/9/2006	44.92	-112.36	10	3.1
1/9/2006	32.17	-115.80	9	3.2
1/12/2006	33.93	-117.80	9	2.7
1/13/2006	37.47	-118.78	11	3.1
1/15/2006	37.32	-118.31	8	2.8

6. Place the cross-section tool anywhere along a plate boundary. Be sure to place the azimuth so that it is perpendicular to the plate boundary and crosses over the plate boundary. The boundary should be in the center of the icon. Then click **OK.**

7. View the cross-section by going to the Control Menu, selecting **MAP VIEW/ 3-D/CROSS-SECTION** and clicking **CROSS-SECTION VIEW.**

Analyzing

Students are now prepared to evaluate their descriptions. Have students summarize what they have learned about the occurrence of earthquakes along different plate boundaries. What do the depth, magnitude, location and frequency tell about the dynamic movement along each boundary?

Hold a discussion about the certainty of their descriptions. Is each description good enough to cover data collected by other students? Have students look at data from other students along each boundary. Do students recognize that the distribution patterns provide evidence for the different types of movement along plate boundaries?

Applying understanding

The earthquake data you've been studying was collected by the USGS and imported into the Seismic Eruption software. The USGS also provides numerical information about each earthquake, including magnitude, date and time, location (latitude and longitude), and the depth in kilometers.

Table 1 includes a small subset of data from the USGS Earthquake Database.

1. Examine the data and determine what type of plate boundary the data represents.

2. List three ways the data confirms your conclusions.

Ask students to think about the depth, magnitude, and frequency of earthquakes that occur along the different boundaries.

The key here is to look at all the data. Only then can students make sense of the patterns of earthquake activity and better understand the shaky ground on which we live.

Amy Pallant (apallant@concord.org) is Senior Science Education Researcher at the Concord Consortium.

Figure 2: Cross-section view.