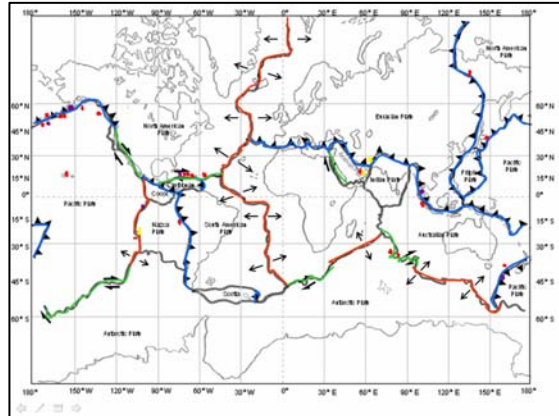


Teacher Notes- “Earthquakes-Plotting Recent Activity”

In this 2-day activity your students will first set up a World and U.S. map and then plot earthquakes that happened as recently as minutes ago on it.

On the surface it appears that students are just putting dots on a map. But because most of the dots end up near heavy black lines on the map, they’ll learn on their own that most earthquakes occur along tectonic boundaries. If they don’t yet understand why this is so, you’ll just have to do some explaining. That’s what makes this an ideal activity to do at the beginning of an earthquake chapter.



Materials per student:

- Two-sided map: World on front, U.S. on back (see last page)
- handout “How To Set Up Your Earthquake Map” (copy these 2 to a page; see last page)
- Colored pencils
- Student internet access (optional)

additionally...

- 1-large classroom map or globe, or both (optional)
- 1-copy of the World Map to put on class screen on day 2. This is helpful when explaining to students how to dot their maps.
- PowerPoint (see last page)

Beforehand:

1. Check the links to make sure they still work:
 - World Quakes, last 7 days:
http://earthquake.usgs.gov/eqcenter/recenteqsww/Quakes/quakes_all.php
 - USA Quakes, last 7 days:
http://earthquake.usgs.gov/eqcenter/recenteqsus/Quakes/quakes_big.php

If they don’t work, go back to <http://earthquake.usgs.gov> and work your way to the new links.

2. If your students aren’t using the internet, print the list of earthquakes from the website for them. If it’s a big deal to get internet access, go with copies on paper of recent earthquakes printed the morning of the activity. It is a ton easier this way, but you’ll miss out on earthquakes happening throughout the day.

3. Locate the page in your textbook that shows plate boundaries and their type (convergent, divergent, strike-slip). Write that page number in item 1 on the “How To Set Up...” sheet (shown to the right).



4. Set out colored pencils, if you’re providing them. Otherwise, have students to bring them.

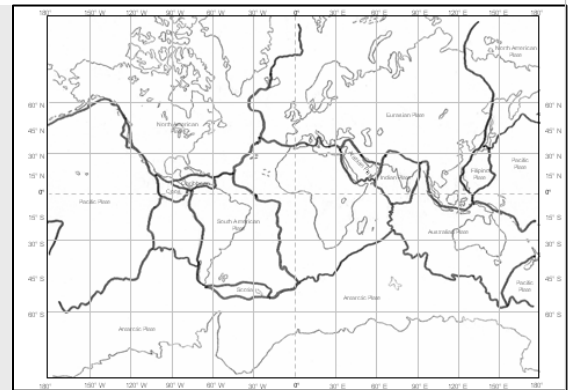
5. Take the time to do this activity yourself a day or two early. That will give you a student perspective (which helps everyone!).

Procedure: presented in 2-day format

DAY 1- Outline the project and set up the map

1. Start by flipping through the Earthquakes chapter while you do some out-loud thinking. Without going into too much detail, look at and respond to what you see. Just notice things. It’s a great focusing tool, sets the tone for the activity, and it gives you the opportunity to mention things you won’t be able to later. When you see the chapter title, ask “What causes an earthquake anyway?” If *focus* and *epicenter* are mentioned, ask what the difference is between them. (The website lists the focus as the depth.)
2. Make sure students have the handouts they need- the World/U.S. maps copied front and back and the half sheet “How To Set Up...”.
3. Take a long, slow first look at the world map. With all the information on it, ease through the information with your students:

“Students, the map I just gave you is very different from any other you’ve ever seen. Notice those continent lines aren’t very dark, because on this exercise they’re not the most important thing. The heavy black lines are. That’s where you’ll be doing most of your work. What do you suppose they represent? (plate boundaries).



Great. So we’ve got continents on the map. And plate boundaries. Oh, and something else. There’s longitude and latitude on the sides. Remind me what the zero latitude line is called? (the equator). Notice that it’s dotted, so it stands out.

Good. And how about zero longitude? (the prime meridian)
Well done. Now we know how to read the map, so we can begin.”

4. Now turn your attention to the half sheet “How To Set Up Your Earthquake Map”. Do just one item at a time at first. Explain item 1 (put symbols along boundaries), give them a few minutes to do it, then explain #2, and so



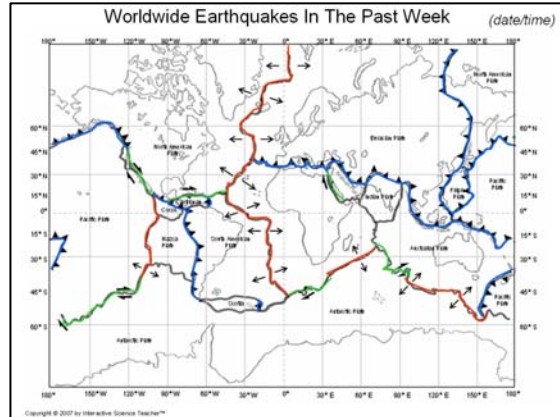
forth. The PowerPoint is will lead you through this.

Item 1-Label Boundaries with Symbols- Have students open their books and look at the map with them that they'll be referring to for plate boundary symbols.*¹

Point out that some plates may have more than one symbol along its boundary. This can occur when either the plate is slowly spinning or the plates bordering are moving differently.

Item 2-Color- Color the boundary as indicated by the symbols, *not* the symbols themselves.

Color really makes the boundaries stand out.*² Later, when dots start going on the map, they should realize on their own that most earthquakes occur along convergent and strike-slip boundaries.



Item 4-Date & Time- Put tomorrow's date and the time class begins in the upper-right hand corner. That's when they'll be accessing the website.

Item 5- Put "--" by South and West- Student need put a minus sign next to all south and west coordinates on their maps. That's because the website uses a negative symbol to distinguish north from south and east from west.*³

MAG	UTC DATE-TIME y/m/d h:m:s	LAT deg	Lon deg	DEPTH km	LOCATION
MAP 3.3	2009/02/25 11:09:21	19.098	-65.372	35.1	88 km (55 mi) N of
MAP 3.3	2009/02/25 06:16:43	19.046	-65.485	61.7	78 km (49 mi) NNE of
MAP 3.1	2009/02/25 05:14:13	63.452	-145.056	12.8	34 km (21 mi) SW of

Item 7-Color the key- Any 3 colors can be used other than the blue, red, and green already used to shade plate boundaries (so dots will be noticeable). The magnitude scale to be written by each dot is: 2.5-4.4 , 4.5-5.9 , 6.0-

Item 8-Label places- Have each student put each country/place listed on their map.*⁴ They are all tectonically active. If you have some few globes, put them out for students to use.

Item 9- U.S. Map- On the back of the world map is a U.S. map. When the front World side is completed, have them go through steps 1-8 again for the U.S. region shown. Most will have to finish this at home. Note that on this side the scale has changed: 2.5 – 4.4 is listed in bold, and 4.5 and above are in red.

This is the end of day 1. We now have our maps set up. Tomorrow we'll start plotting actual earthquakes!

DAY 2- Plot the earthquakes

1. Have students take out their maps. Briefly review each detail to get their minds back in gear and to correct any mistakes.
2. Put a copy of the world map on front screen.
3. Direct them to the website:
http://earthquake.usgs.gov/eqcenter/recenteqsww/Quakes/quakes_all.php .^{*5} Keep a close eye on students to make sure they arrive at and stay on the site specified. If students are sharing a computer screen and the print is too small, press the “Ctrl” and “+” keys together to enlarge the text.

The site links are also printed on the bottom of the World map, but that’s for students who don’t finish and need to access the site from home. The easiest and way to get students to the site is to leave a copy of the document “*Link-Worldwide Earthquakes...*” on a server that they can all access, which they open and then can click the link to get on the site. Doing a Google search for “world earthquake list” and “us earthquake list” also gets them to the site.

4. With all students motionless, read through the introductory paragraph on the website together. It explains how to read the list. Scroll down and note the time in red that the page was updated. To convert from UT to Eastern Standard, subtract 5 hours (for example, 13:43 UT would be 8:43 am EST). Scroll down a bit more until you come to the actual list of recent earthquakes.^{*6}
5. Look at the first earthquake on the list together. Go through the information deliberately in each column, discussing what it means. When you get to the latitude and longitude columns, ask them if the degrees are north or south, east or west.

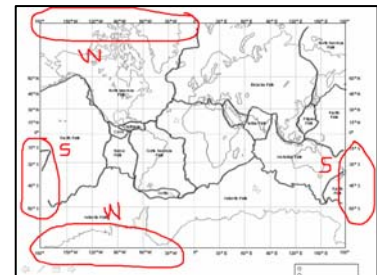
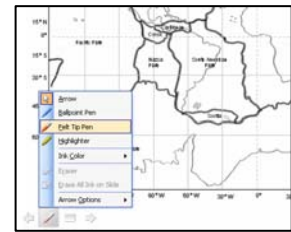
After you’ve all figured out where the first dot goes, go back to the PowerPoint map and put a dot there using the *Felt Tip Pen* tool (if you’re using the PowerPoint slide). A dot is all that’s needed- no numbers or words around it. Just the dot.

6. Do a few more together, then turn them loose. Have them do at least 25 earthquakes.^{*7} When they get tired of putting dots in the same place, you know that they’re going to understand where and why earthquakes occur.
7. Some dots will overlap, and that’s ok. When this happens, tell students to offset them a little. It’s really neat when they get to plot a huge quake with several aftershocks.
8. Don’t forget about the back side, with the U.S. map. If you want to get it in today, give them at least 10 minutes to get about of those dots. Send them to the U.S. earthquakes link
(http://earthquake.usgs.gov/eqcenter/recenteqsus/Quakes/quakes_big.php) and plot those the same way as with the world map.

9. When they're finished dotting the U.S. earthquakes, homework questions are at the bottom of page 2. Be ready to give students a page number to fill in on question 2. *8

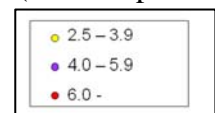
Accessories Other sub-topics you can add for more length and depth.

- *1 The symbol shape gives a clue to what happens at that boundary: convergent, being a triangle, resembles mountains; divergent, 2 arrows pulling away, does just that, and strike-slip, resembling the 2 sides on a pair of scissors, also move that way.
- *2 When students are done coloring, have them notice that's there's about as much red as there is blue, which is what we want. If everything was red, then all boundaries would be diverging, and the earth would be expanding. But it's not. For every divergent boundary there's a convergent one somewhere else, keeping the earth the same size.
- *3 Since this is confusing, put slide 1 from the PowerPoint "Setting Up..." on the screen and use the *Pen* tool to circle the coordinates to do this to. To mark on a PowerPoint slide (that's running) notice a set of 4 faded buttons near the lower-left corner. Click the one second one, and then go up to *Felt Tip Pen*. You can even choose the color. Make your marks-circle the South and West coordinates (and anything else you feel is helpful). There was also an *Erase* tool in there, if needed. When you're done it will ask if you want to *Keep* or *Discard* the marks. You'll want to *Discard*.



If all of this work just doesn't seem worth it, you can always choose to put the minuses on the original yourself before photocopying.

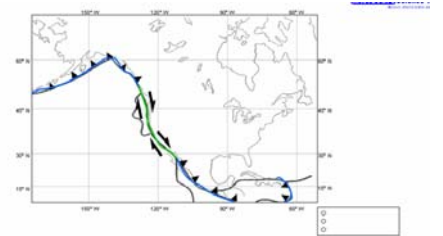
- *4 Have them bring their social studies book or student planner (some have a decent world map in them).
- *5 When going back and forth between PowerPoint and the internet browser, you don't have to quit the slideshow. Of the 4 faded buttons in the lower-left corner, click the 3rd one (looks like a box), and select *Screen* and then *Switch Programs*. Pretty cool, huh?
- *6 You'll notice on the website that the entries are presented 3 ways (those in plain text, bold, and in red). They indicate strength, and reflect the same scale we used.
- *7 It's up to you which earthquakes from the list to do. You can simply go in order they come on the list until they have 25. You can have them only do the bold and red ones off the list. Or, just the ones that have occurred today and yesterday. 25 world dots and 25 U.S. dots will be a pretty full class period for most students.



- *8 There are many ways you could lengthen the activity. See if any of these ideas “move” you:
 - Further down link page is U.S. and then Top 10. Have students plot those quakes using a special 4th color.
 - Have students hand-draw their own maps. It would add another day or more to the project, but they’ll learn places in the world they never knew about (does anyone know where Madagascar is?). Give them a sheet of tracing paper and have them trace the continents off a map, add the plate boundaries, then the longitude and latitude lines. If it sounds interesting, try it yourself first and see what you think of it.
 - Give them a map without plate names, latitude/longitude, and plate boundaries, and have them add them in. The *Maps* folder has these in it.
 - Consider adding the locations of active volcanoes to your map, especially if that is the next chapter.

Come back and visit InteractiveScienceTeacher.com to upgrade this lesson with:

PowerPoint- lead your students through the lesson click-by-click



Earthquakes Homework

1. What percent of all earthquakes on your world map occurred along or near (within an inch of) a plate boundary?

2. What 3 key sentences or phrases from page _____ best explain what causes an earthquake?

Student Handout



QuickNotes

Teacher Quick Notes - "Earthquakes-Plotting Recent Activity"

Materials per student:

- Two-sided map: World on front, U.S. on back
- 1- handout: "How To Set Up Your Earthquake Map". (Copy these 2 to a page)
- Colored pencils
- Internet access (optional)

additionally...

- 1-large classroom map or globe, or both (optional)
- 1-copy of the World Map to put on class screen on day 2 when demonstrating how to dot earthquakes, using either multimedia projector or overhead transparency

Procedure:

DAY 1-Set Up Maps

1. Read/flip through Earthquakes chapter.
2. Give students handouts: the World/U.S. maps and the half page "How To Set Up..."
3. Clarify each item on the "How To Set Up Your Earthquake Map" sheet.
4. Allow students the rest of class to finish setting up their world and U.S. maps.

DAY 2-Plot

1. Review maps.
2. Go to website-
http://earthquake.usgs.gov/socenter/recenteqw/Quakes/Quakes_all.php
3. Look at the first earthquake on the list and explain what information is in each column.