

# Science: Geology

## Earthquakes and Plate Tectonics

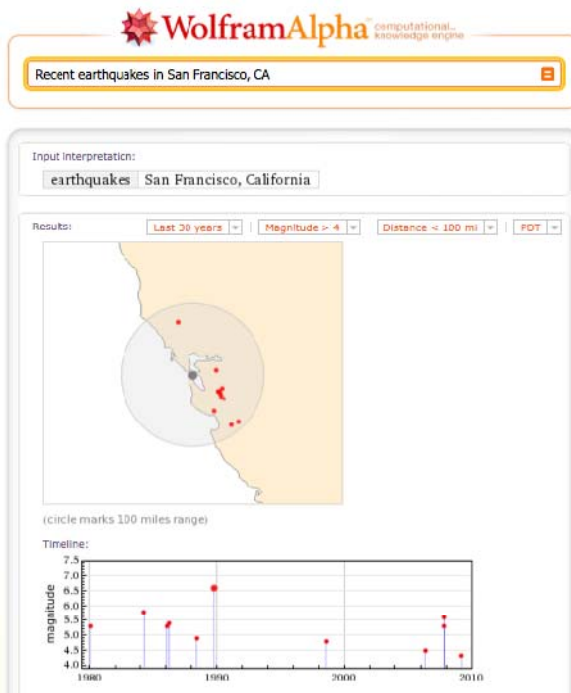
### Objectives

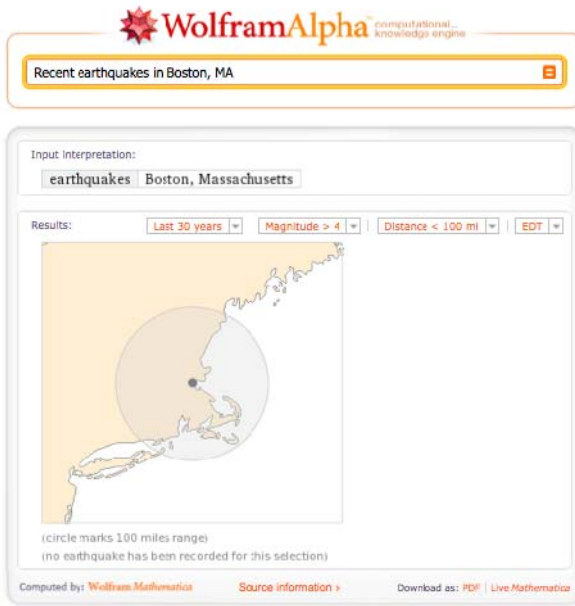
Students will be able to:

- Research quantitative information about recent earthquakes.
- Understand the concept of selection effects in science.
- Recognize patterns of earthquake activity as evidence for plate tectonics.

### Warm-Up

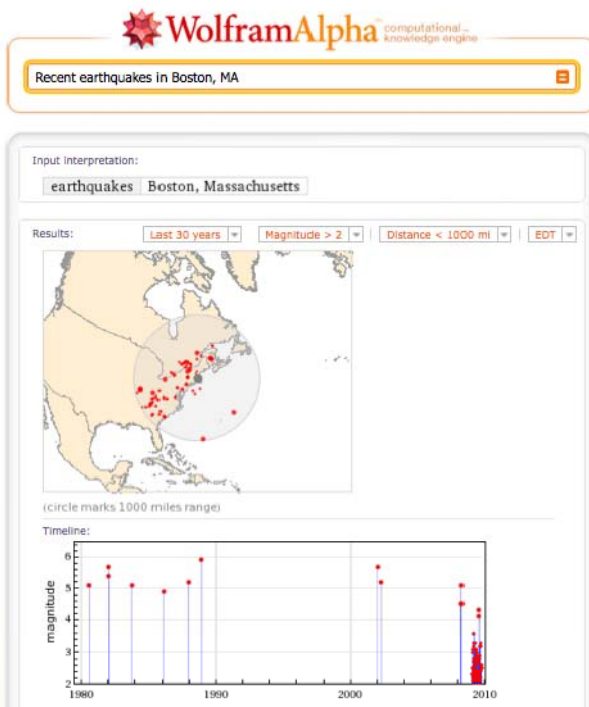
Ask students to identify a part of the world that experiences frequent earthquakes (San Francisco, for example). Look up earthquake statistics for this location with W|A. Then look up earthquake statistics for the location of your school, and compare the results.



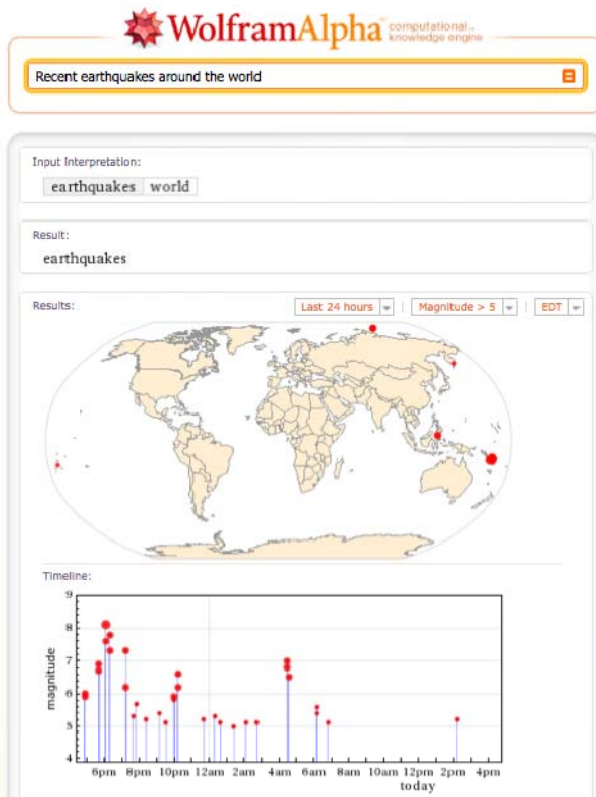


## Lesson

- Ask students to experiment with the different information fields on their recent earthquakes page: try looking within a 500- or 1000-mile radius of the cities, try looking for earthquakes occurring within the last year or last month, and try looking for smaller-magnitude quakes. This last query should yield some interesting results.



- In the example above, the number of earthquakes during or after the year 2009 is vastly larger than the number of earthquakes during previous years. Ask students what they think this information means: did small quakes only begin recently? Is your city approaching a geological catastrophe? Or is it possible that online recordkeeping for small-magnitude quakes only began recently? Point this out to students as an illustration of a selection effect and the need for caution in scientific hypothesizing.
- Ask students what they know about the causes of earthquakes. Explain the theory of plate tectonics, how it was based in part upon the shapes of the continents and the distribution of fossil remains, and how it posits an explanation for the cause of earthquakes and makes testable predictions about the geographic patterns in which earthquakes occur. Then use W|A to look for these patterns by inputting "recent earthquakes" and broadening the parameters to include smaller quakes and a longer period of time.





Recent earthquakes around the world

Input Interpretation:

earthquakes world

Result:

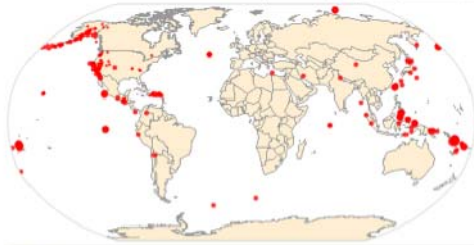
earthquakes

Results:

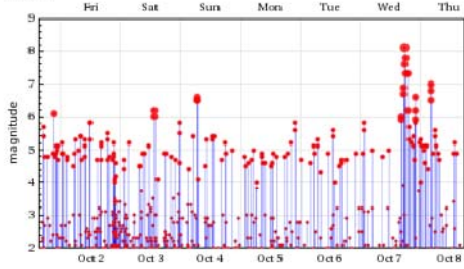
Last 7 days

Magnitude > 2

EDT



Timeline:





Recent earthquakes around the world

Input Interpretation:

earthquakes world

Result:

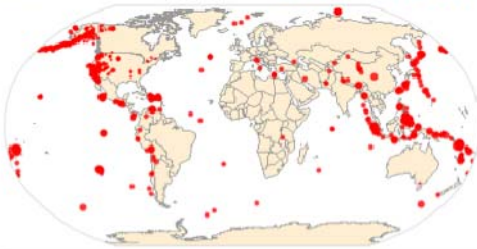
earthquakes

Results:

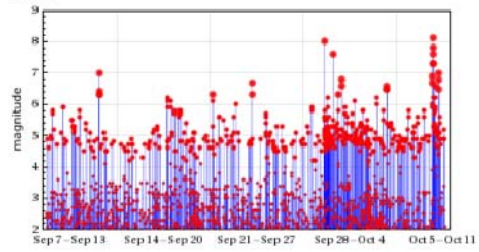
Last month

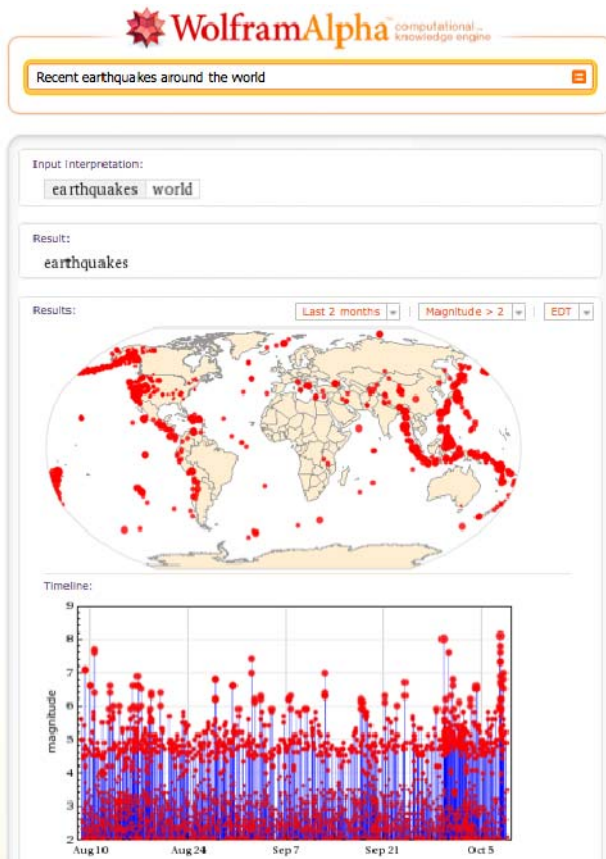
Magnitude > 2

EDT



Timeline:





- Point out how looking at more and more historical earthquake data generates more and more clearly defined lines—patterns of earthquake activity at the edges of tectonic plates.
- If students are scientifically minded, they may ask whether the outlines seen in the image above are "real" patterns or simply a selection effect. Discuss this possibility. For example, does it seem likely that there are fewer seismographic measuring devices in the eastern United States than in Indonesia? If this were the case, could it explain the differences in measured earthquakes between these locations? Use these questions as examples of the critical thinking skills necessary for good science.

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## Closing

- Give students a chance to investigate earthquake activity and peruse lists of earthquakes sorted by magnitude, date, and epicenter location. Suggested input: "Japan earthquakes", "Okinawa earthquakes", "Tonga earthquakes", "Indonesia earthquakes", "Samoa earthquakes", "Russia earthquakes", "United Kingdom earthquakes". Ask students to use the knowledge learned during class to hypothesize why some countries are more prone to earthquakes than others.

## **Demonstrations**

Seismicity of Germany

Seismoscope