The Earth is Moving!

The earth moved along a fault during the 1906 earthquake

Scientists making measurements after the 1906 earthquake saw clear evidence that the earth moved during the earthquake.

This fence was torn apart when the two sides of the fault moved relative to one another.

Surveyors measure earth movement.

Plate motions cause earthquakes.

After 1906, scientists recognized that the motion that continued after the earthquake would cause stress to build up. Releasing that stress and strain is what causes earthquakes.

Continued measurements showed the Earth continued to move – even in the years after the quake.

Unlike during the earthquake, however, this later motion was not along the fault – the entire region was deforming. What were these scientists seeing?

What does this motion tell us about the way the Earth works?

Early evidence for plate tectonics

The words “plate tectonics” did not come along for sixty more years, but we now know that the 1906 scientists discovered some of the first evidence of constant plate motions.

The white portions of the map above are parts that move along as a big piece called a “plate.” When plates collide, the areas in red act like crumple zones in a car accident. We live right in the middle of one of these zones!

San Francisco Bay Area in Motion

Scientists have been measuring the constant plate motion in the time between earthquakes so that they can determine the amount of strain that must be released in future Bay Area earthquakes.

Average motion, 1993 - 2003, measured using high precision GPS.

Arrows show the amount of motion relative to San Francisco. There have been no major earthquakes during this time period, so almost all of the motion represents strain that has built up.

How far has it moved since you were born?

How much closer does Santa Cruz get to San Francisco each year?

How would you measure the slow movement of the Earth’s crust?

Trying to measure this slow motion is like watching your fingernails grow. Scientists make the measurements using GPS (Global Positioning System) equipment -- the same technology used by hikers and rental car navigation units, but even more precise.

**Step 1:** Set up GPS antenna exactly over center of benchmark

**Step 2:** Record the precise position using GPS instrument

**Step 3:** Repeat the process a few years later

**Step 4:** The position of the benchmark changed because the Earth’s crust has moved!

<table>
<thead>
<tr>
<th>Year</th>
<th>Latitude</th>
<th>Longitude</th>
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<tbody>
<tr>
<td>1998</td>
<td>37°34′59.377″N</td>
<td>122°34′02.995″W</td>
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<tr>
<td>2003</td>
<td>37°34′59.387″N</td>
<td>122°34′02.935″W</td>
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Which direction is this benchmark moving?