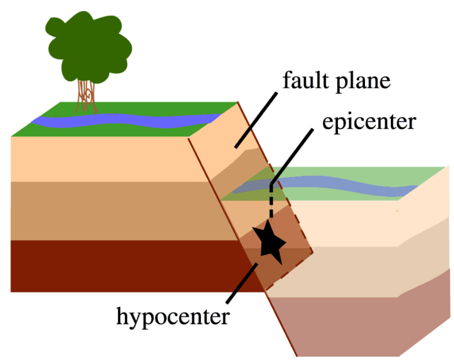
Earthquakes

In the mid-1960s A global network of sensors designed to detect hydroacoustic signals was installed to monitor compliance with the Nuclear Test-Ban Treaty of 1963. Hydroacoustic monitoring can differentiate sound wave signals that are generated from different sources such as: nuclear explosions, human activity (ie oil exploration), or natural events (e.g. volcanic eruptions, and underwater earthquakes). This sensor network's ability to monitor seismic activity provided scientists with much more information on the patterns of earthquakes that occur under Earth's oceans.[1]

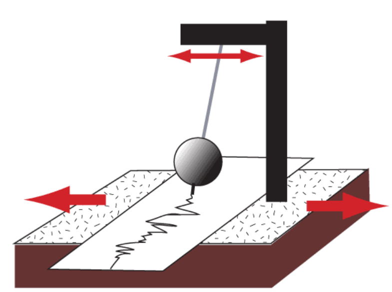
What & How?



An **earthquake** occurs when two blocks of the earth suddenly slip past one another. The surface where they slip is called the **fault** or **fault plane**. The location below the earth's surface where the earthquake starts is called the **hypocenter**, and the location directly above it on the surface of the earth is called the **epicenter**.

Sometimes an earthquake has **foreshocks**. These are smaller earthquakes that happen in the same place as the larger earthquake that follows. Scientists can't tell that an earthquake is a foreshock until the larger earthquake happens. The largest, main earthquake is called the **mainshock**. Mainshocks always have **aftershocks** that follow. These are smaller earthquakes that occur afterwards in the same place as the mainshock. Depending on the size of the mainshock, aftershocks can continue for weeks, months, and even years after the mainshock!

While the edges of faults are stuck together, and the rest of the block is moving, the energy that would normally cause the blocks to slide past one another is being stored up. When the force of the moving blocks finally overcomes the **friction** of the jagged edges of the fault and it unsticks, all that stored up energy is released. The energy radiates outward from the fault in all directions in the form of **seismic waves** like ripples on a pond. The seismic waves shake the earth as they move through it, and when the waves reach the earth's surface, they shake the ground and anything on it, like our houses and us!



The size of an earthquake depends on the size of the fault and the amount of slip on the fault. Scientists use **seismogram** recordings made on the **seismographs** at the surface of the earth to determine how large the earthquake was. The cartoon sketch on the right of an old-school seismograph shows how the instrument shakes with the earth below it, but the recording device remains stationary. A short wiggly line that doesn't wiggle very much means a small earthquake, and a long wiggly line that wiggles a lot means a large earthquake. The length of the wiggle depends on the size of the fault, and the size of the wiggle depends on the amount of slip.

The size of the earthquake is called its **magnitude**. There is one magnitude for each earthquake. **Intensity** is another category used for describing earthquakes-- i.e. the *intensity* of shaking from an earthquake, which varies depending on where you are during the earthquake. [3]

Where?

Earthquakes can strike any location at any time, but history shows they occur in the same general patterns year after year, principally in **three large zones** of the earth:

- The world's greatest earthquake belt, the **circum-Pacific seismic belt**, is found along the rim of the Pacific Ocean, where about 81 percent of our planet's largest earthquakes occur (with the earned nickname: "Ring of Fire"). Earthquakes in the circum-Pacific seismic belt include the M9.5 Chilean Earthquake [Valdivia Earthquake] (1960) and the M9.2 Alaska Earthquake (1964).
- The **Alpide earthquake belt** extends from Java to Sumatra through the Himalayas, the Mediterranean, and out into the Atlantic. This belt accounts for about 17 percent of the world's largest earthquakes, including some of the most destructive, such as the 2005 M7.6 shock in Pakistan that killed over 80,000 and the 2004 M9.1 Indonesia earthquake, which generated a tsunami that killed over 230,000 people.
- The third prominent belt follows the submerged **mid-Atlantic Ridge**. Most of the mid-Atlantic Ridge is deep underwater and far from human development, but Iceland, which sits directly over the mid-Atlantic Ridge, has experienced earthquakes as large as at least M6.9.

The remaining shocks are scattered in various areas of the world. Earthquakes in these three prominent seismic zones are taken for granted, but damaging shocks can occur outside these zones. Examples in the United States include New Madrid, Missouri (1811-1812) and Charleston, South Carolina (1886). However, many years usually elapse between such shocks.[2]

References

[1] https://www.ctbto.org/?id=290 accessed Aug. 1, 2020
[2]https://www.usgs.gov/faqs/where-do-earthquakes-occur?qt-news_science_products=0#qt-news_science_products accessed Aug. 1, 2020
[3]
https://www.usgs.gov/natural-hazards/earthquake-hazards/science/science-earthquakes?qt-science_center_objects=0#qt-science_center_objects accessed Aug. 1, 2020