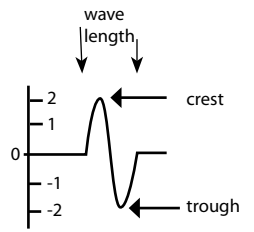


# Vocabulary

To accompany Background files for [IRIS' Animation page](#). (Definitions from [usgs.gov](#); [nasa.gov](#); and [fema.gov](#))

**Amplitude**—the maximum disturbance or distance from the constant point. On a seismogram the horizontal time line is flat until there is a ground disturbance which is recorded as wave, or *seismogram*. The amplitude of a seismic wave is the amount the ground moves up or down. Amplitude is one-half the distance between the crest and trough of one wave length. In drawing at right, maximum displacement is  $2 + 2 = 4$ , so Amplitude =  $0.5 * 4 = 2$ .



**Asperity**—literally “roughness. It is an area on a fault that is stuck or locked. A type of surface roughness appearing along the interface of 2 faults. Physics the elastically compressed region of contact between two surfaces caused by the normal force.

**Asthenosphere**—the ductile part of the earth just below the lithosphere is about 180 km thick and is found 100–250 km (60–150 mi) below the Earth’s surface. The asthenosphere yields to persistent stresses more than the rigid crust or the core.

**Body Waves**—waves that move within the Earth’s interior or within a body of rock. P and S waves are body waves.

**Compression**—fractional decrease of volume due to pressure.

**Continental rifting**—The process by which a continent stretches and splits apart; if successful, this process separates a larger continent into two smaller continents separated by an expanding ocean. See [Basin & Range](#) and [Plate Boundaries](#).

**Convergence**—coming together or joining at a common point. At convergent boundaries tectonic plates are moving toward each other. (See *divergence*. See Convergence in [Plate Boundaries](#))

**Crust**—the outermost major layer of the earth, ranging from about 10 to 65 km in thickness worldwide. The uppermost 15-35 km of crust is brittle enough to produce earthquakes. Oceanic crust is thinnest; continental crust is thickest.

**Deformation**—process where rocks are folded, faulted, sheared or compressed by Earth stresses.

**Dip**—the angle by which a rock layer or fault plane deviates from the horizontal.

**Divergence**—moving apart from a common point. At divergent boundaries plates are moving apart. (See *convergence*. See also Divergent Boundaries in [Plate Boundaries](#).)

**Earthquake**—shaking or trembling of the earth that accompanies rock movements extending anywhere from the crust to 680 km below the Earth’s surface. It is the release of stored elastic energy caused by sudden fracture and movement of rocks inside the Earth. Part of the energy released produces seismic waves, like P, S, and surface waves, that travel outward in all directions from the point of initial rupture. These waves shake the ground as they pass by. An earthquake is felt if the shaking is strong enough to cause ground accelerations exceeding approximately 1.0 centimeter/second squared. *Types of earthquakes* include:

- A) **Tectonic Earthquake:** earthquake that occurs when the earth’s crust breaks due to geological forces on rocks and adjoining plates that cause physical and chemical changes.
- B) **Volcanic Earthquakes:** earthquakes that result from tectonic forces which occur in conjunction with volcanic activity.
- C) **Collapse Earthquakes:** small earthquakes in underground caverns and mines that are caused by seismic waves produced from the explosion of rock on the surface.
- D) **Explosion Earthquakes:** earthquakes which are the result of the detonation of nuclear and chemical devices

**Elastic Properties**—the measure of an objects ability to change shape when a force is applied to it, and return to its original shape when the force on it is released.

**Elastic Rebound**—an objects ability to return to its original shape after being broken apart. See [Strike Slip](#) and [Subduction](#)

**Elastic strain**—Earthquakes are caused by the sudden release of energy within some limited region of the rocks of the Earth. The energy can be released by elastic strain, gravity, chemical reactions, or even the motion of massive bodies. Of all these the release of elastic strain is the most important cause, because this form of energy is the only kind...

**Epicenter**—the point on the Earth’s surface directly above the *focus* of an earthquake.

**Fault**—a fracture or zone of fractures in rock along which the two sides have been displaced relative to each other. If the main sense of movement on the fault plane is up (compressional; reverse) or down (extensional; normal), it is called a dip-slip fault. Where the main sense of slip is horizontal the fault is known as a strike-slip fault. Oblique-slip faults have both strike and dip slip.

**Fault plane**—The plane along which the break or shear of a fault occurs. It is a plane of differential movement, that can be vertical as in a strike slip fault or inclined like a subduction zone fault.

**Fault zone**—Since faults do not usually consist of a single, clean fracture, the term fault zone is used when referring to the zone of complex deformation that is associated with the fault plane.

**Focus**—the point on the fault at which the first movement or break occurred. Directly beneath the *epicenter* at 1–50 km depth.

**Hazard**—a source of unpredictable, unplanned danger.

**Intensity**—The intensity is a number (written as a Roman numeral) describing the severity of an earthquake in terms of its effects on the earth's surface and on humans and their structures. See *magnitude*.

**Lithosphere**—solid, rocky, outer part of the Earth, ~100 km thick (50 miles) comprised of the crust and the solid portion of the mantle. **The** thickness is age dependent with older lithosphere is thicker than younger oceanic lithosphere. The lithosphere below the crust is brittle enough at some locations to produce earthquakes by faulting, such as within a subducted oceanic plate.

**Locked fault**—a fault that is not slipping because frictional resistance on the fault is greater than the shear stress across the fault (it is stuck). Such faults may store strain for extended periods that is eventually released in an earthquake when frictional resistance is overcome.

**Love Waves**—surface waves that move parallel to the Earth's surface and perpendicular to the direction of wave propagation..

**Magma**—molten rock material that is liquid or pasty which originated within the earth. Molten rock below the surface of the Earth. Lava is molten rock on the surface of the Earth.

**Magnitude**—The magnitude is a number that characterizes the relative size of an earthquake. Magnitude is based on measurement of the maximum motion recorded by a seismograph. Several scales have been defined, but the most commonly used are (1) local magnitude (ML), commonly referred to as “Richter magnitude,” (2) surface-wave magnitude (Ms), (3) body-wave magnitude (Mb), and (4) moment magnitude (Mw). Scales 1-3 have limited range and applicability and do not satisfactorily measure the size of the largest earthquakes. The moment magnitude (Mw) scale, based on the concept of seismic moment, is uniformly applicable to all sizes of earthquakes but is more difficult to compute than the other types. All magnitude scales should yield approximately the same value for any given earthquake..

**Mantle**— the layer in Earth's interior between the crust and the metallic core.

**Material Properties of the Earth**—the bulk character of the rock, such as composition, density, elastic moduli, mineralogy, and phase (ex. the presence of melt). Elastic waves may propagate through the earth in a manner which depends on the material properties of the earth. The elasticity of the material provides the restoring force of the wave.

**Moment Magnitude**—the preferred measure of earthquake size (magnitude) in which the stiffness of the rock, the average slip on the rupture plane, and the area of the rupture plane are taken into account (the “moment” of the earthquake). See magnitude.

**Plastic Deformation**—an object's ability to change shape under an additional amount of stress beyond its elastic limit before it breaks.

**Plate**—a large, relatively rigid segment of the Earth's lithosphere that moves in relation to other plates over the asthenosphere.

**Plate Tectonics**—the theory supported by a wide range of evidence that considers the earth's crust and upper mantle to be composed of several large, thin, relatively rigid plates that move relative to one another. Slip on faults that define the plate boundaries commonly results in earthquakes..

**P Wave**—the primary body wave; the first seismic wave detected by seismographs; able to move through both liquid and solid rock.. Also called compressional or longitudinal waves, they compress and expand (oscillate) the ground back and forth in the direction of travel, like sound waves that move back and forth as the waves travel from source to receiver. P wave is the fastest wave.

**Rate**—an expression that describes a change in position or velocity with respect to time.

**Rayleigh Waves**—surface waves that move in an elliptical motion, producing both a vertical and horizontal component of motion in the direction of wave propagation.

**Recurrence Interval**—the average period of time between earthquakes in a seismic region.

**Seismic Moment**—a parameter related to the angular leverage of the forces that produce slip on a fault; determined from the seismic waves and field measurements that describe the fault area.

**Seismic Wave**— an elastic wave generated by an impulse such as an earthquake or an explosion. Seismic waves may travel either through the earth's interior (P and S waves; the fastest waves) or along or near the earth's surface (Rayleigh and Love waves). Seismic waves travel at speeds of several kilometers per second.

**Seismicity**—the geographic and historical distribution (the “where?” and “how often?”) of earthquakes.

**Seismic Tomography**— Seismic tomography is an imaging technique that uses seismic waves generated by earthquakes and explosions to create computer-generated, three-dimensional images of Earth's interior. See [Seismic Tomography](#)

**Seismogram**—A real-time record of earthquake ground motion recorded by a *seismograph*. Seismograms are the records (paper copy or computer image) used to calculate the location and magnitude of an earthquake..

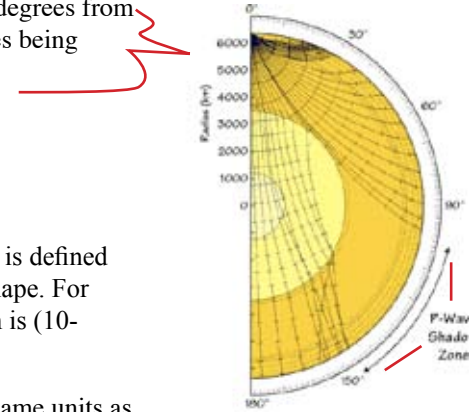


**Seismograph**—an instrument that records vibrations of the Earth, especially earthquakes. Seismograph generally refers to the *seismometer* and a recording device as a single unit. See [IRIS' Seismographs](#).

**Seismology**—science that deals with earthquakes and attendant phenomenon including the study of artificially produced elastic waves in the Earth's material.

**Seismometer**—a sensitive instrument that can detect waves emitted by even the smallest earthquakes. (See *seismograph*.)

**Shadow Zone**— The shadow zone is the area of the earth from angular distances of 104 to 140 degrees from a given earthquake that does not receive any direct P waves. This zone results from S waves being stopped entirely by the liquid core and P waves being bent (refracted) by the liquid core.



**Shear**—type of *strain* in which the shape of a material is displaced laterally with no corresponding change in volume.

**Slip Fault**—the relative motion of one face of a fault relative to the other.

**Strain**—change in the shape or volume of a material, often recorded in three-dimensions. Strain is defined as the amount of deformation an object experiences compared to its original size and shape. For example, if a block 10 cm on a side is deformed so that it becomes 9 cm long, the strain is  $(10-9)/10$  or 0.1 (sometimes expressed in percent, in this case 10 percent). [Learn more](#)

**Stress**—a measure of forces acting on a body. Stress is defined as force per unit area. It has the same units as pressure, and in fact pressure is one special variety of stress. However, stress is a much more complex quantity than pressure because it varies both with direction and with the surface it acts on. [Learn more](#)

**Subduction**— the process of the oceanic lithosphere colliding with and descending beneath the continental lithosphere.

**Subduction zone**—the place where two lithospheric plates come together, one riding over the other. Most volcanoes on land occur parallel to and inland from the boundary between the two plates. See [Convergent Boundary](#).

**Surface Wave**—waves that move close to or on the outside surface of the Earth rather than through the deep interior like the faster P or S waves. Two principal types of surface waves, Love and Rayleigh waves, are generated during an earthquakes. Rayleigh waves cause both vertical and horizontal ground motion, and Love waves cause horizontal motion only. They both produce ground shaking at the Earth's surface but very little motion deep in the Earth. Because the amplitude of surface waves diminishes less rapidly with distance than the amplitude of P or S waves, surface waves are often the most important component of ground shaking far from the earthquake source.

**S Waves**—secondary body waves that oscillate the ground perpendicular to the direction of wave travel. They travel about 1.7 times slower than P waves. Because liquids will not sustain shear stresses, S waves will not travel through liquids like water, molten rock, or the Earth's outer core. S waves produce vertical and horizontal motion in the ground surface.

**Tectonics**—large-scale deformation of the outer part of the Earth resulting from forces in the Earth.

**Tectonic earthquake**—an earthquake that is due to the movement of the tectonic plates. Tectonic earthquakes will occur anywhere within the earth where there is sufficient stored elastic strain energy to drive fracture propagation along a fault plane. Other earthquakes can be caused by blasts.

**Tectonic plates**— the large, thin, relatively rigid plates that move relative to one another on the outer surface of the Earth. Comprised of the solid section of the Earth's crust and outermost mantle that moves over the deeper mantle.

**Tension**—the stretching or extension of a material.

**Wave**—a disturbance that moves through a system. (See *seismic wave*.)

**Wave height**—the vertical distance from a wave's crest to its trough. (This measurement will be twice the amplitude measured for the same wave.)

**Wave crest**—the highest point a wave reaches. The lowest point is called its trough.

**Wavelength**—the horizontal distance between two successive crests, often measured in meters.