

MAR 110 Natural Hazards and the Oceans

Section #1 Glossary

OCEAN GEOPHYSICS

Abyssal Sea Floor. The of the deep ocean sea floor formed by thick sediments that are exceedingly flat because of the long sediment particle “rain” has buried the ancient basement rocks.

Avalanche (see Landslide). A flow of debris of different particle sizes that takes on catastrophic proportions. Volumes of 50-100 million cubic meters traveling at velocities of 300-400 km hr⁻¹ have been measured.

Basaltic Rocks. Fine-grained, dark -grey rock that is derived from magma (or lava).

Bathymetry. Ocean seafloor depths lying below sea level.

Benioff Zone. The zone at a depth of 700 km associated with earthquakes along a subduction zone.

Bombs. Boulder-sized pieces of liquid lava blown out of an erupting volcano.

Caldera. The round depression formed at the summit of a volcano caused by the collapse of the underlying magma chamber that has been emptied by an eruption.

Continental Drift. The movement of continents relative to each other over 100s of million years; caused by convection in the interior earth.

Continental Margins. An ocean geographic zone consisting of a continental shelf, continental slope, and continental rise.

Continental Shelf. That part of a continental margin that slopes gradually moving seaward from the coast (average slope of less than 0.1 degrees) and terminating at a depth of 100-150m.

Continental Slope. That part of a continental margin that slopes steeply (average slope about 15 degrees) to the continental rise portion of the deep ocean bottom.

Contour. A line on a chart, map, or section that connects equal values of a given dimension.

Convergent Plate Boundary. A zone, where ocean and continental plates collide, that is often characterized by a deep trench that is bordered by either (1) narrow continental shelves, backed by a coast-parallel line of volcanoes or (2) island arc line of volcanoes Earthquakes are common to great depths below the continental margin.

Crust. The outermost shell of the Earth, 20-70 km thick under continents, but only 5 km thick under the oceans. It consists of lighter, silica-rich rocks, which flow on denser liquid rock making up the mantle.

Deep Ocean Floor. A zone characterized by abyssal plains of depositional (sedimentation) origin, abyssal hills, seamounts (volcanoes), guyots (or flat-topped seamounts), channels, and gaps and local rises.

Deep Ocean Trench. A long narrow oceanic feature where oceanic crust is being dragged downward beneath a continental plate.

Deep Earthquakes. Earthquakes occurring 100s of kilometers within the earth in relation to plate subduction.

Divergent Plate Boundary. The zone at the mid-ocean ridge, where a pair of oppositely-moving plates are being formed.

Echo Sounding. The measurement of ocean depth by timing the reflection of sound off of the ocean bottom.

Elastic. A property of any solid that deforms under a load and then tends to return to its original shape after the load is released.

Energy. The capacity of any system to do work.

Epicenter. The point at the surface immediately above the location of a sudden movement in the Earth's crust generating an earthquake.

Fault. A planar zone where one part of the Earth's crust moves relative to another; categorized according to the actual horizontal or vertical directions of movement.

Fracture Zone. A linear zone of irregular topography on the sea floor, averaging 100 miles wide and more than 1000 miles long, which are great faults along which sea-floor spreading, with associated earthquakes and volcanoes, has taken place.

Friction. The force due to the resistance of one particle sliding over another; due to irregularities on the surfaces of both particles.

Geophysical. Dealing with the structure, composition, and development of the Earth, including the atmos-

phere and oceans.

Hot Spots. Fixed plumes of rising lava that have their origin in the mantle and are found within the ocean basins at the end of a chain of progressively older volcanoes; or at divergent plate boundaries.

Island Arc. Arc-shaped island chains, located on the continental plate-side of a deep ocean trench, under which gas-rich crust is being subducted to produce andesitic magma.

Isobath. A line connecting points of equal depth on a chart (equivalent to a contour line on land maps).

Isostatic Equilibrium. Layers of material that are “floating” upon one another - having fully adjusted vertically to any thickness and/or density changes due to tectonic activity.

Kinetic Energy. Energy any system possesses by virtue of its motion.

Landslide. The general term given to movement of material downslope in a mass.

Lapilli. Volcanic fragments about 2-60 mm in diameter.

Lava. Molten rock derived from magma.

Lithosphere. The coherent rigid outer shell of the earth that includes both the crust and upper mantle. This layer is about 150 kilometers thick under the continents and about 60 kilometers thick under the ocean.

Magma. Molten rock material within the earth that is derived from the mantle; once having reached the surface of the earth is called *lava*.

Magnetic Reversal. The Earth has a magnetic north-south polarity centered within 1000 km of its present axis of rotation. At intervals of a few hundreds of thousands of years, the intensity of this magnetic field is known to have weakened and reversed polarity very rapidly.

Magnetic Anomaly. Small deviations in sea floor magnetic measurements due to the reversed magnetic orientation of iron particles in the seafloor rocks that were formed from lava (or magma) at the mid-ocean ridge at different times of Earth magnetic field orientation.

Magnetic Stripes. Evidence for plate formation at mid-ocean ridges consisting of swaths of seafloor having reversed magnetic anomalies that are parallel to mid-ocean ridges.

Mantle. That part of the Earth from the crust to depths of 3000 km, which consists of molten, dense rock made up of silicates of magnesium, iron, calcium, and aluminum.

Mid-Ocean Ridges and Rises. Ridges are elongate, steep-sided elevations of the sea floor having a central rift (valley) and rough marginal topography that flanks the crest; e.g. the Mid-Atlantic Ridge.

Passive Continental Margin. A continental margin, with broad shelves, gentle wide slopes, and rises that generally has few earthquakes, no volcanic activity, and low heat flow. These are typically part of a larger ocean-continental crustal plate; e.g. North America & Atlantic Ocean.

Plate. The Earth's crust is subdivided into six or seven large segments or plates that move independently of each other at rates of 4-10 cm per year over the underlying mantle. These plates can collide with (converge), or separate from (diverge) each other.

Plastic. A property of any solid that permanently deforms without breaking up or rupturing when subject to a load.

Potential Energy. Energy any system possesses by virtue of its position.

Power. The rate at which energy is expended.

Pumice. Volcanic ash filled with gas particles and hence able to float on water.

Pyroclastic Ash. Fine, hot ash or sediment produced from the fragmentation of magma in the atmosphere by the force of a volcanic eruption, and the gases contained within.

Pyroclastic Ejecta. Pyroclastic material blown out into the atmosphere.

Pyroclastic Flow. Derived from a cloud of hot ash that, blown upwards during an eruption, collapses under the weight of gravity, and begins to flow downslope at great velocity suspended by the gases expelled in the eruption.

Rift Valley. A zone of near-vertical fracturing found at the center of the mid-ocean ridge; where new plates are formed by upwelling magma.

Seismicity. Related to sudden and usually large movement of the Earth's crust, usually called an earthquake.

Seismic Gap. That part of an active fault zone that has not experienced moderate or major earthquake activity for at least three years.

Seismic Risk. The probability of earthquakes of given magnitude occurring in a region.

Shallow Earthquakes. Earthquakes occurring within 60 km of the surface.

Shear Strength. The internal resistance of a body of material to any stress applied with a horizontal component.

Shear Stress. The force applied to a body of material, which tends to move it parallel to the contact with

another solid or fluid.

Shearing. A stress caused by two adjacent moving objects tending to slide past each other parallel to the plane of contact.

Spreading Center. A mid-ocean rise or ridge where molten material (basalt) rises to create new sea floor.

Subduction Zone. A laterally narrow region along which the oceanic crust descends beneath a continental plate to be consumed into the mantle; accompanied by earthquakes and volcanism.

Subsidence. The downward failure of the Earth's surface brought about mainly by removal of material from below.

Tectonic. The process characterizing the deformation of the Earth's crust because of earthquakes.

Tectonic Creep. Deformation of the Earth's crust that occurs in such small increments that it is virtually undetectable, except over time.

Thermal Energy. Energy any system possesses by virtue of its heat.

Thermal Expansion. The increase in volume of a substance (including sea water) with an increase of temperature, normally with reduced density. *Fresh water* is unusual in that it has its greatest density at 4°C, while it has its greatest volume around the freezing point.

Transform Fault. A special variety of lateral-slip fault along which the displacement suddenly stops. Where these faults offset mid-ocean ridges the actual slip is opposite the apparent displacement.

Tsunami. A Japanese word for 'harbor' (tsu) 'wave' (nami). It is used to define a water wave generated by several mechanisms including a (1) sudden vertical displacement of the seafloor resulting from an earthquake, (2) volcanic eruption, or (3) landslide.

Geologic Time Zones

- **Holocene.** The most recent part of the Quaternary, beginning 15,000 years Before Present (9BP), when the last major glaciation terminated.
- **Pleistocene.** The geological age in the Quaternary beginning about 2-3 million years BP. It was characterized by periods of worldwide glaciation.
- **Quaternary.** The most recent geological period, beginning about 2-3 million years BP and consisting of the Pleistocene and the Holocene.
- **Pliocene.** The last period in the Tertiary, between 12-2 million years BP. The Pliocene terminated when large-scale glaciation began to dominate the Earth.
- **Tertiary.** The geological period from 65 to 2-3 million years BP.
- **Cretaceous.** The geological period 135-65 million years BP; characterized by sudden, large extinctions of many plant and animal species.
- **Jurassic.** The geological period 180-135 million years BP; dominated by the dinosaurs.