The Structure of the Earth and Plate Tectonics

The Earth is made up of 3 main layers:

– Core

– Mantle

– Crust

The Crust

• This is where we live!

• The Earth’s crust is made of:

Continental Crust

- thick (10-70km)

- buoyant (less dense than oceanic crust)

- mostly old

Oceanic Crust

- thin (~7 km)

- dense (sinks under continental crust)

- young

How do we know what the Earth is made of?

• Geophysical surveys: seismic, gravity, magnetics, electrical, geodesy

– Acquisition: land, air, sea and satellite

– Geological surveys: fieldwork, boreholes, mines

What is Plate Tectonics?

If you look at a map of the world, you may notice that some of the continents could fit together like pieces of a puzzle.

The Earth’s crust is divided into 12 major plates which are moved in various directions.

• The plates collide, pull apart, or scrape against each other.

• Each motion causes different types of features on the Earth’s crust.

• The word, tectonic, refers to changes in the crust because of plate interaction.

What are tectonic plates made of?

• Plates are made of rigid lithosphere. The lithosphere is made up of the

crust and the upper part of the mantle.

What lies beneath the tectonic plates?

• Below the lithosphere (which makes up the tectonic plates) is the asthenosphere.

Plate Movement

• “Plates” of lithosphere are moved around by the underlying hot mantle convection cells.

What happens at tectonic plate boundaries?

Three types of plate boundary:

* Divergent
* Convergent
* Transform

Divergent Boundaries

• Spreading ridges

– As plates move apart magma fills up the gap

Iceland: An example of continental rifting

• Iceland has a divergent plate boundary running through its middle.

Convergent Boundaries

• There are three styles of convergent plate boundaries

– Continent-continent collision

– Continent-oceanic crust collision

– Ocean-ocean collision

Continent-Continent Collision

• Forms mountains, e.g. European Alps, Himalayas

Continent-Oceanic Crust Collision

• Called SUBDUCTION

- Oceanic plates subducts underneath the continental plate

- Oceanic plate heats and melts

-The melt rises forming volcanoes

-E.g. The Andes

Ocean-Ocean Plate Collision

• When two oceanic plates collide, one runs over the other which causes it to sink into the mantle forming a subduction zone.

• The subducting plate is bent downward to form a very deep depression in the ocean floor called a trench.

• The world’s deepest parts of the ocean are found along trenches.

– E.g. The Mariana Trench is 11 km deep!

Transform Boundaries

• Where plates slide past each other

Volcanoes and Plate Tectonics… …what’s the connection?

Pacific Ring of Fire

* Volcanism is mostly focused at plate margins
* Hotspots

Volcanoes are formed by:

- Subduction

- Rifting

- Hotspots

What are Hotspot Volcanoes?

* Hot mantle plumes breaching the surface in the middle of a tectonic plate
* The Hawaiian island chain are examples of hotspot volcanoes.

-The tectonic plate moves over a fixed hotspot forming a chain of volcanoes.

* The volcanoes get younger from one end of the chain to the other end.

Earthquakes and Plate Tectonics… …what’s the connection?

Where do earthquakes form?

* As with volcanoes, earthquakes are not randomly distributed over the globe
* At the boundaries between plates, friction causes them to stick together.
* When built up energy causes them to break, earthquakes occur.

Plate Tectonics Summary

• The Earth is made up of 3 main layers (core, mantle, crust)

• On the surface of the Earth are tectonic plates that slowly move around the globe

• Plates are made of crust and upper mantle (lithosphere)

• There are 2 types of plates

• There are 3 types of plate boundaries

• Volcanoes and Earthquakes are closely linked to the margins of the tectonic plates