

Plate Tectonics

Homework:

- a) Study the terms and definitions.
- b) Read the text and prepare the tasks.

Task 1: Find the word (in the first part of the text) which fits the following explanation.

Formed by or composed of -

Wholly, completely -

Inserted as an integral part of a whole -

Decreases in size, extent, or range -

Small earthquakes, or earth vibrations -

Earth's outer shell, the **lithosphere**, long thought to be a continuous, unbroken, crust is actually a fluid mosaic of many irregular rigid segments, or **plates**. Comprised primarily of cool, solid rock 20 to 60 km thick, these enormous blocks of Earth's crust vary in size and shape, and have definite borders that cut through continents and oceans alike. **Oceanic crust** is much thinner (about 5 km) and denser than **continental** or terrestrial crust.

There are nine large plates and a number of smaller plates. While most plates are comprised of both continental and oceanic crust, the giant Pacific Plate is almost entirely oceanic, and the tiny Turkish-Aegean Plate is entirely land. Of the nine major plates, six are named for the continents embedded in them: **the North American, South American, Eurasian, African, Indo-Australian, and Antarctic**. The other three are oceanic plates: **the Pacific, Nazca, and Cocos**. The relative small size of the numerous other plates neither diminishes their significance, nor their impact on the surface activity of the planet. The tiny **Juan de Fuca Plate**, for example, sandwiched between the Pacific and North American Plate near the state of Washington, is largely responsible for the frequent tremors and periodic volcanic eruptions in that region of the country.

Task 2: Answer these questions:

1. Which of the plates is almost totally oceanic? Any more?
2. On the other hand, which of them is only terrestrial/ continental?
3. True or false? The smallest plates have no effect on the surface activity of the Earth.

How Plates Move

Powered by forces originating in Earth's radioactive, solid iron inner core, these tectonic plates move at varying speeds and in different directions atop a layer of much hotter, softer, more ductile rock called the **asthenosphere**. Because of the high temperatures and immense pressures found here, the uppermost part of the asthenosphere is deformed and flows almost plastically just beneath the Earth's surface. This characteristic of the asthenosphere to flow allows the plates to move slowly on the surface of the earth.

One idea that might explain the ability of the asthenosphere to flow is the idea of **convection currents**. When mantle rocks near the radioactive core are heated, they become less dense than the cooler, upper mantle rocks. These warmer rocks rise while the cooler rocks sink, creating slow, vertical currents within the mantle (these convection currents move mantle rocks only a few centimeters a year). This movement of warmer and cooler mantle rocks, in turn, creates pockets of circulation within the mantle called **convection cells**. The circulation of these convection cells could very well be the driving force behind the movement of tectonic plates over the asthenosphere.

As the giant plates move, tremendous energies are released resulting in tremors that transform Earth's surface. While all the plates appear to be moving at different relative speeds and independently of each other, they are interconnected just like the interlocking pieces of a jigsaw puzzle. No single plate can move without affecting others, and the activity of one can influence another thousands of miles away. For example, as the Atlantic Ocean grows wider with the spreading of the African Plate away from the South American Plate, the Pacific sea floor is being consumed in deep subduction trenches over ten thousand miles away.

Tasks:

1. Substitute the underlined words without changing the meaning of the sentence.

immense =

in turn =

2. Decide whether the following statements are true or false:

a) Forces which power the movement of the plates arise from the inner core.

b) Horizontal convection currents move just a few centimeters a year.

c) All tectonic plates move at the same speed - very slowly.

3. What is the name of the ocean trench which is parallel with the Andes?

Plate Boundaries

There are 3 primary types of tectonic plate boundaries: divergent, convergent and transform.

1. Divergent boundaries

Iceland, splitting along the **Mid-Atlantic Ridge**, offers scientists a natural laboratory for studying the processes that occur along submerged parts of a divergent boundary. As North American Plate moves westward and Eurasian Plate eastward, new crust is created on both sides of the diverging boundary in a process commonly known as **sea-floor spreading**. It also creates a **rift** along the boundary, and thus Iceland will inevitably break apart into two separate land masses at some point in the future, as the Atlantic waters eventually rush in to fill the widening and deepening space between.

Tasks:

1) What happens on both sides of the divergent boundary?

2) Do the underlined words inevitably and eventually have the same or different meaning?

3) True or false? It is quite sure that Iceland will be divided in 2 pieces of land one day.

Task 4: Watch the video Mid-Atlantic Ridge and answer these questions.

1. What does the ridge consist of?
2. How do the opposite sides of the Mid-Atlantic Ridge move?
3. What does the rifting in its central part enable?
4. How often does the Earth magnetic field reverse itself?
5. Where is the information about its reversals recorded?

Task 5: Use these words to complete the last part of the text.

arcs debris earthquakes faults fold heights range zones

2. Convergent Boundaries

Here crust is destroyed and recycled back into the interior of the Earth as one plate dives under another in **subduction** _____. Mountains and volcanoes are often found where plates converge. There are 3 types of convergent boundaries:

a) Oceanic-Continental Convergence

When an oceanic plate pushes into and subducts under a continental plate, the overriding continental plate is lifted up and a **mountain** _____ is created. Even though the oceanic plate as a whole sinks smoothly and continuously into the subduction trench, the deepest part of the subducting plate breaks into smaller pieces which become locked for long periods of time before moving suddenly and generating large _____. Such earthquakes are often accompanied by uplift of the land by as much as a few meters.

b) Oceanic-Oceanic Convergence

The Marianas Trench is a deep trench created as the result of the Philippine Plate subducting under the Pacific Plate. Oceanic-oceanic plate convergence also results in the formation of undersea volcanoes. Over millions of years, however, the erupted lava and volcanic _____ pile up on the ocean floor until a submarine volcano rises above sea level to form an island volcano. Such volcanoes are typically grouped in chains called **island** _____.

c) Continental-Continental Convergence

When two continents meet head-on, neither is subducted because the continental rocks are relatively light and resist downward motion. Instead, the crust tends to _____ and be pushed upward or sideways. After the collision of India into Eurasia, the slow continuous convergence of the two plates over millions of years pushed up the Himalayas and the Tibetan Plateau to their present _____.

3) Transform-Fault Boundaries: Transform-Fault Boundaries are where two plates are sliding horizontally past one another. These are also known as transform boundaries or more commonly as _____.

Task:

1. Which type of the boundary means the plates are pulling apart?
2. Sum up the classification of the boundaries.

Video Pangaea

Let's introduce some names first. (See picture in the syllabus)

- a) What does Pangaea stand for?
- b) What do you think the word Panthalassa mean?
- c) What is the name for its future northern part?
- d) What is its southern part called?

Task: Watch the first 2 minutes of the video and answer these questions:

1. a) Which continent moved away 180 mya (million years ago)?
b) What did this movement create?
2. When did the South Atlantic begin to form?
3. Which future continent began to move away from Africa 110 mya?
4. True or false? Africa's northward movement was faster than that of India.
5. How did the northward movement of Africa influence the ancient Tethys Sea?
6. What was the result of the collision of northern Africa with southern Europe?
7. What did Asia look like 200 mya?
8. Which other continents began to move away from Africa in about the same time as India (110 mya)?
9. What happened when India reached the southern part of Asia 40 mya?

Watch the rest of the video to hear more information about the movement of the continents.

Adapted from <http://www.platetectonics.com>, Tasks Věra Hranáčová



English for Science

