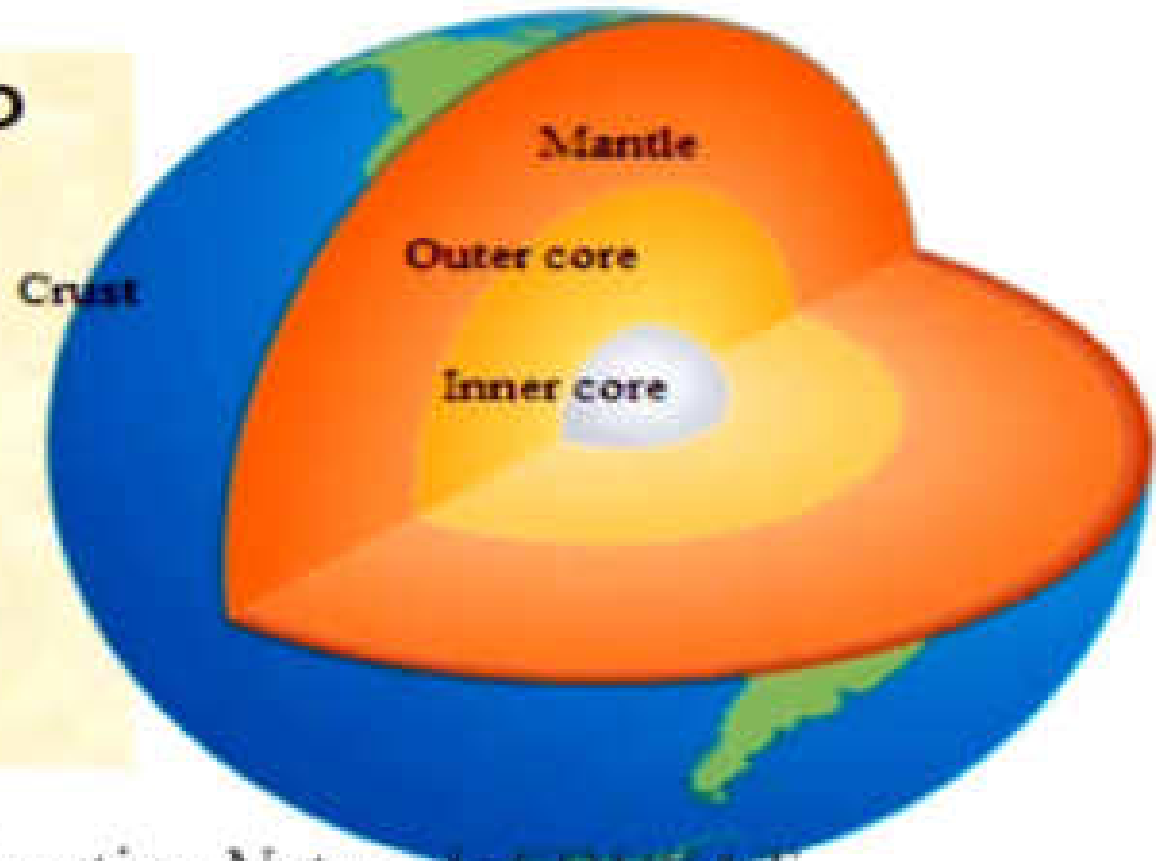


# Structure of the Earth

- The Earth is made up of 3 main layers:
  - Core
  - Mantle
  - Crust



# The Crust

This is where we live!

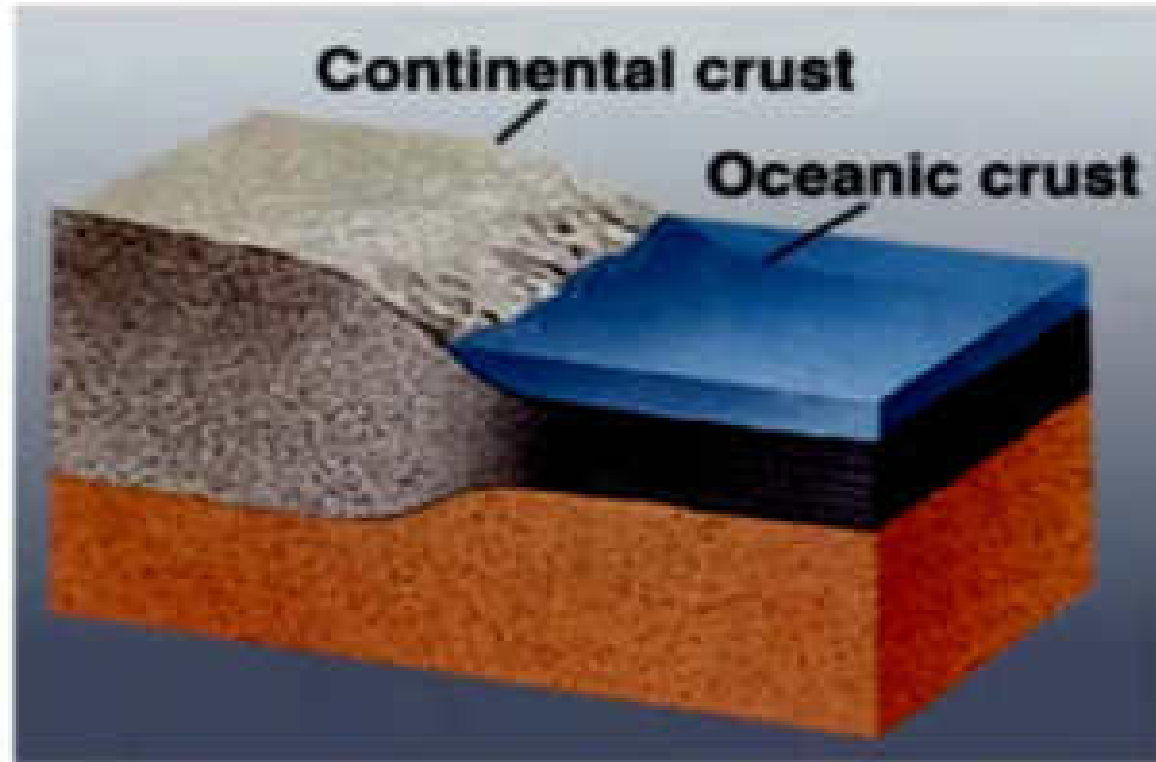
The Earth's crust is made of:

## **Continental Crust**

- thick (10-70km)
- buoyant (less dense than oceanic crust)
- mostly old

## **Oceanic Crust**

- thin (~7 km)
- dense (sinks under continental crust)
- young

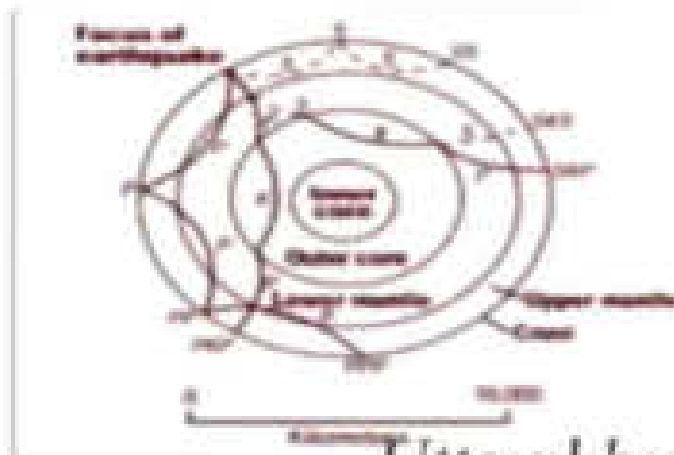


# How do we know what the Earth is made of?

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

**Acquisition: land, air, sea and satellite**

**Geological surveys: fieldwork, boreholes, mines**



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.



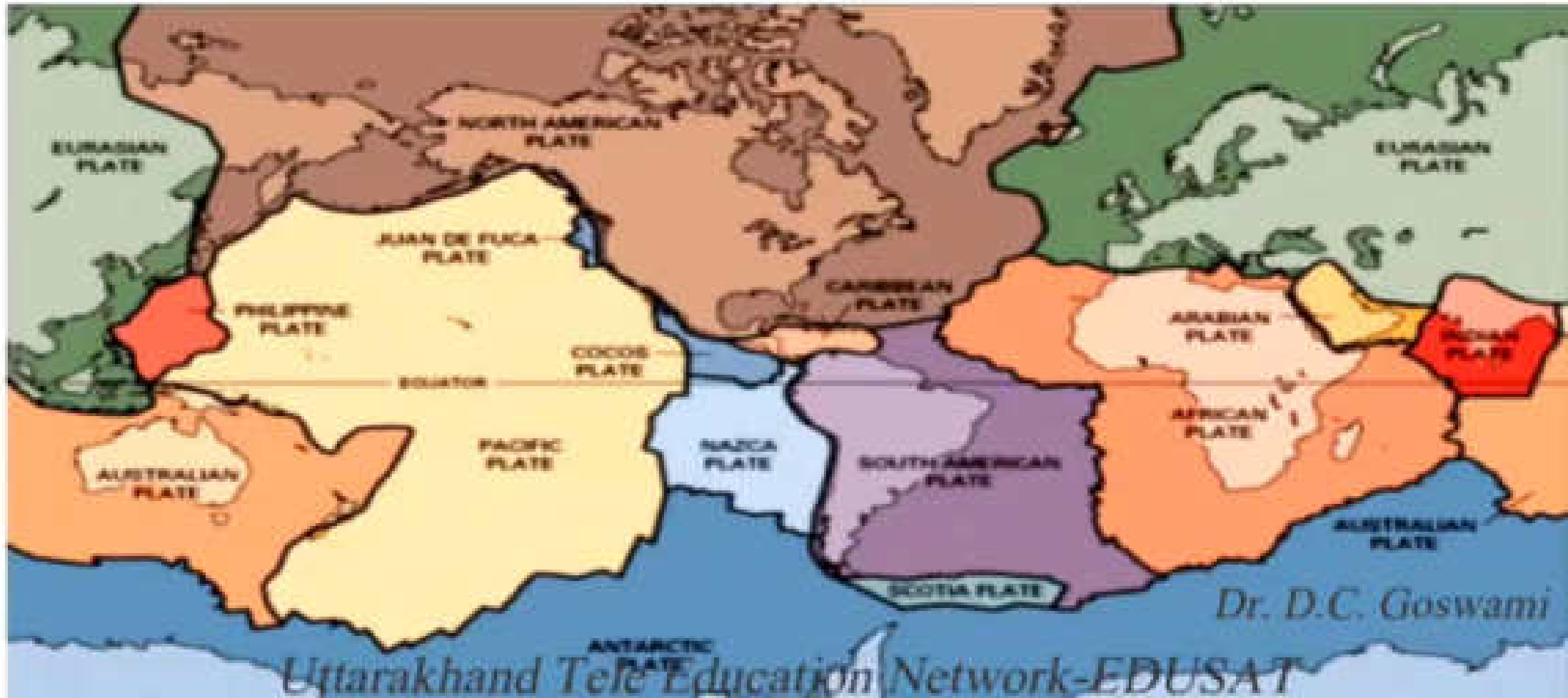
# Plate Tectonics

- The Earth's crust is divided into 12 major plates which are moved in various directions.
- This plate motion causes them to collide, pull apart, or scrape against each other.
- Each type of interaction causes a characteristic set of Earth structures or "tectonic" features.
- The word, tectonic, refers to the deformation of the crust as a consequence of plate interaction.

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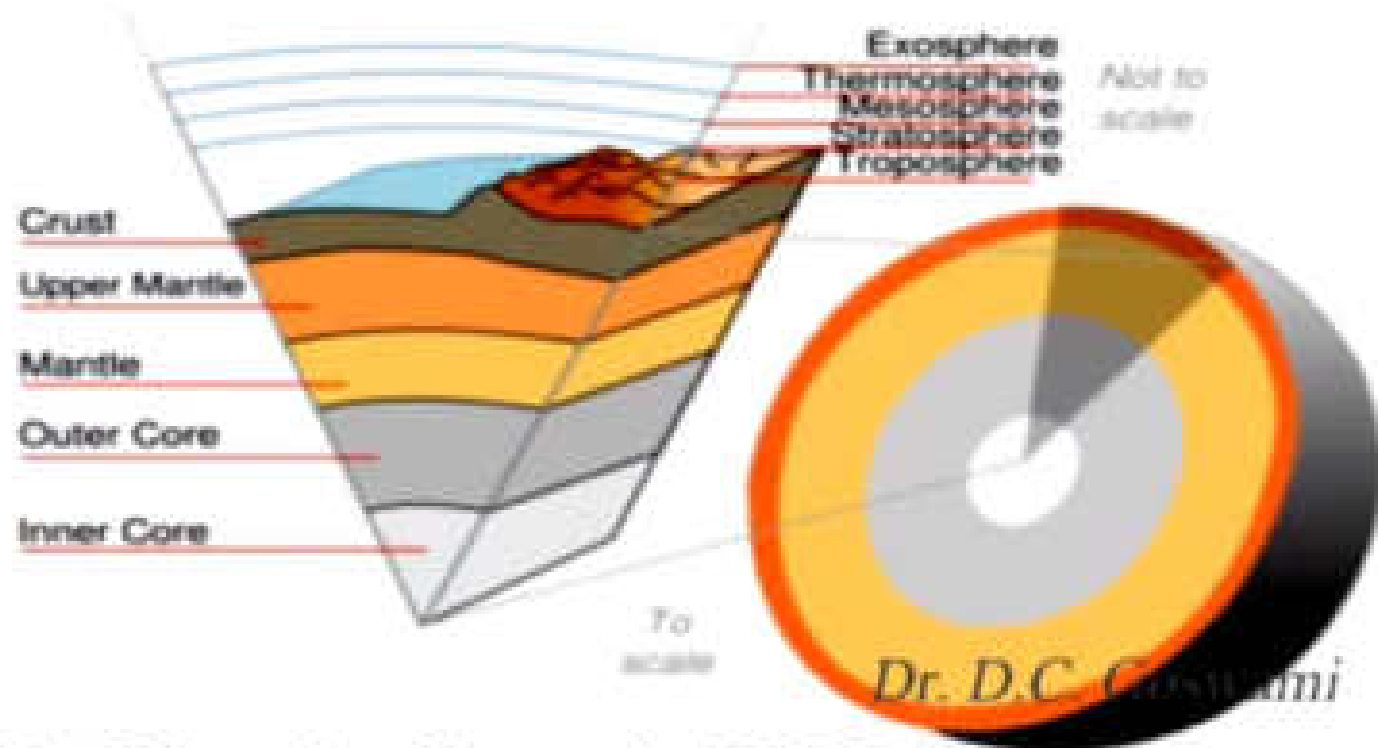
# World Plates



# What are tectonic plates made of?

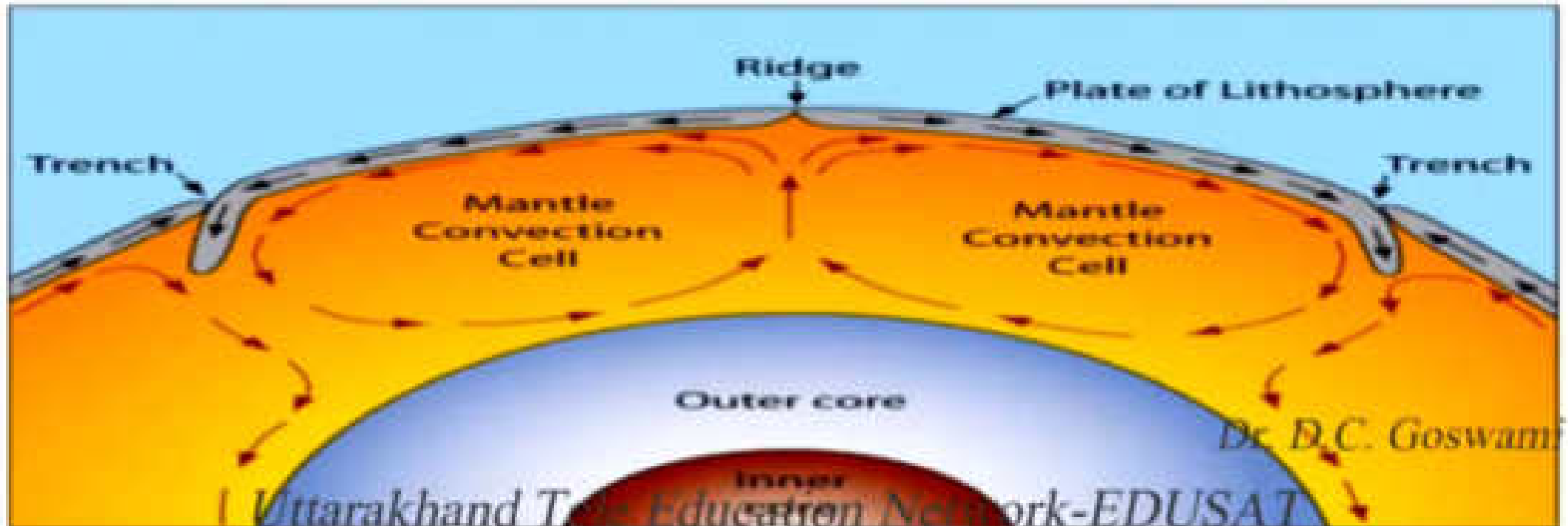
- Plates are made of rigid **lithosphere**.

The lithosphere is made up of the crust and the upper part of the mantle



# Plate Movement

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





- **Supercontinents!**

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What happens at tectonic  
plate boundaries?

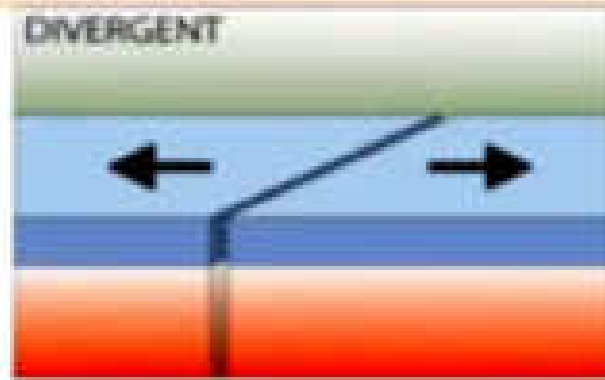
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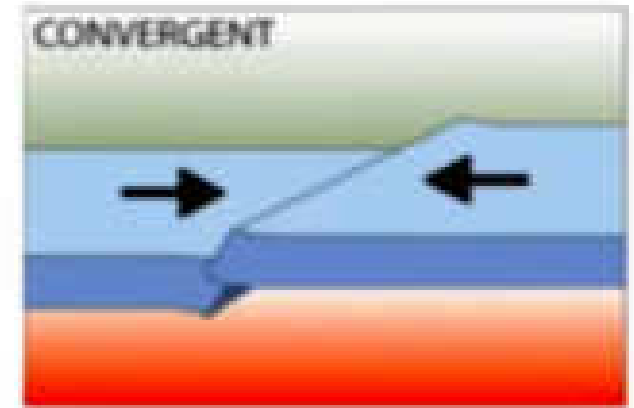
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# Three types of plate boundary

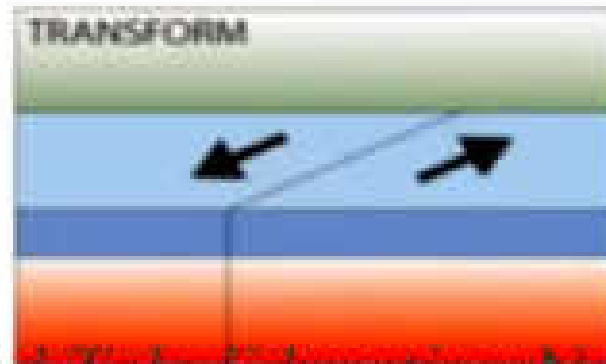
- Divergent



- Convergent

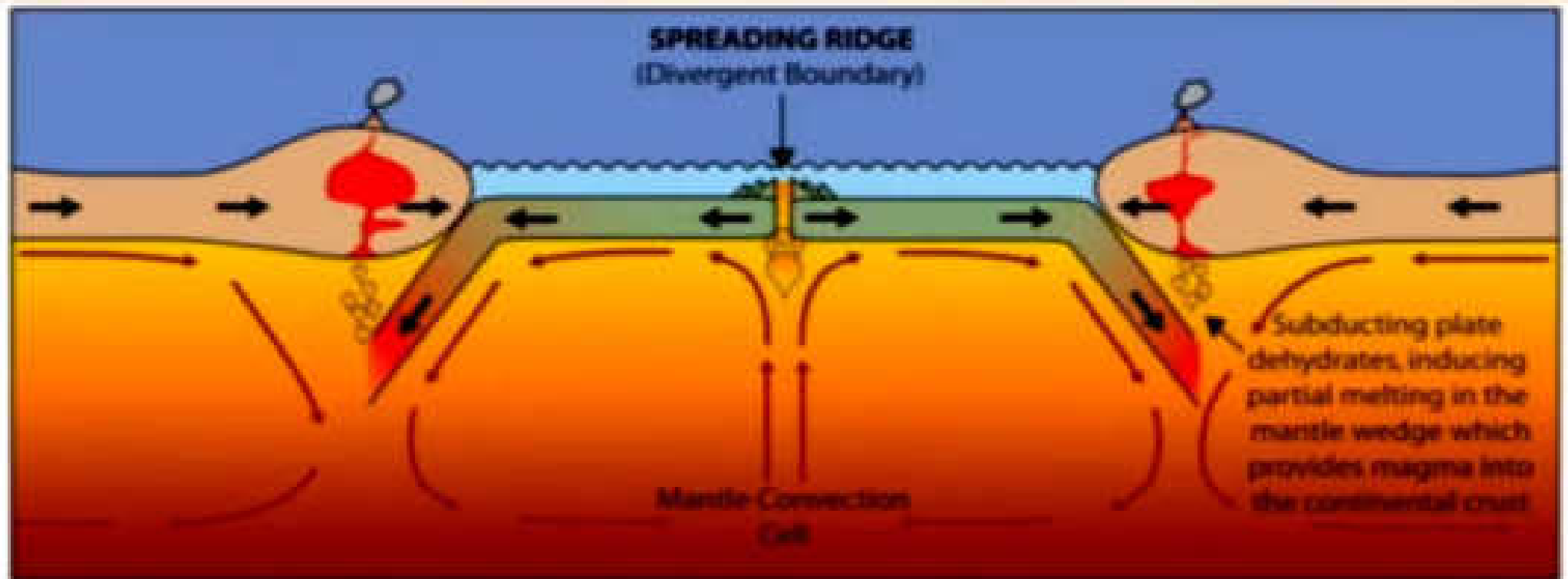


- Transform



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# Divergent Boundaries



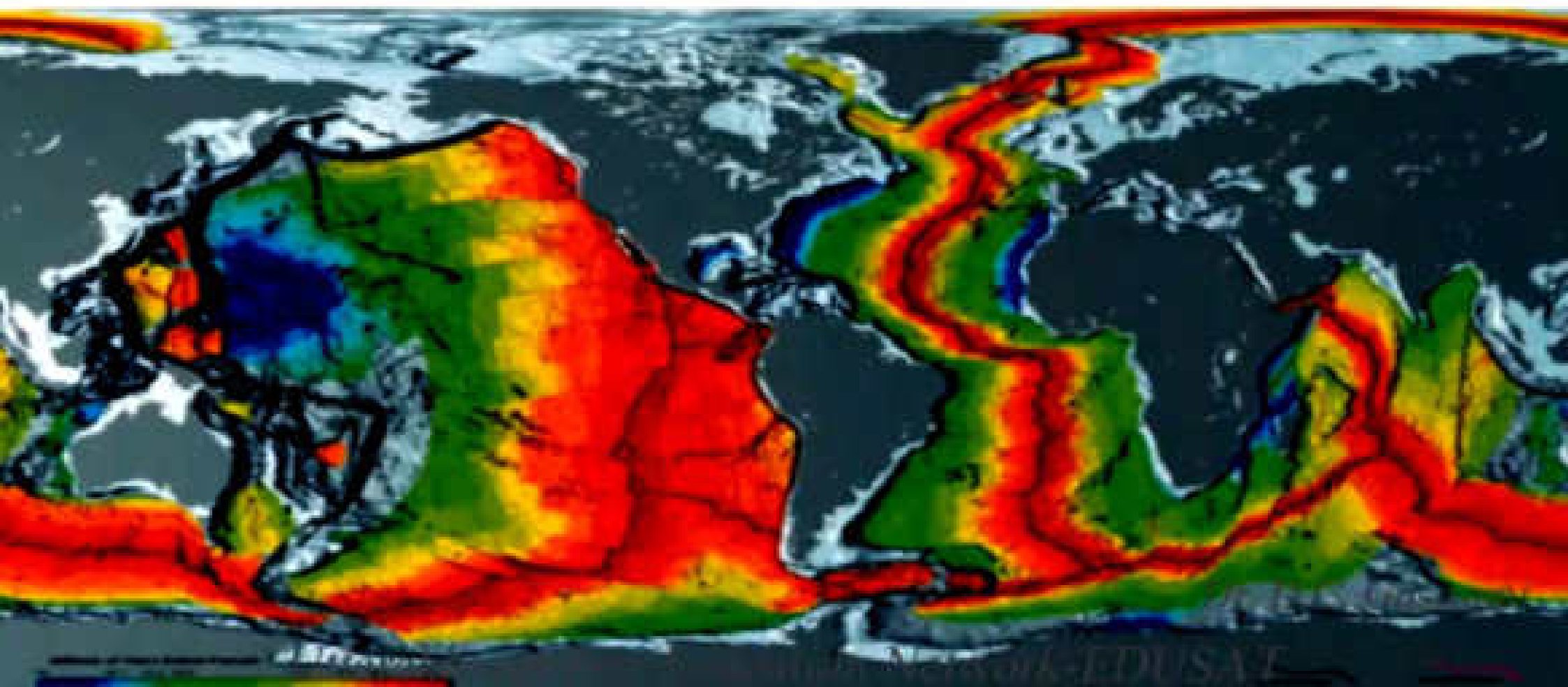
## Spreading ridges

-As plates move apart new material is erupted to fill the gap

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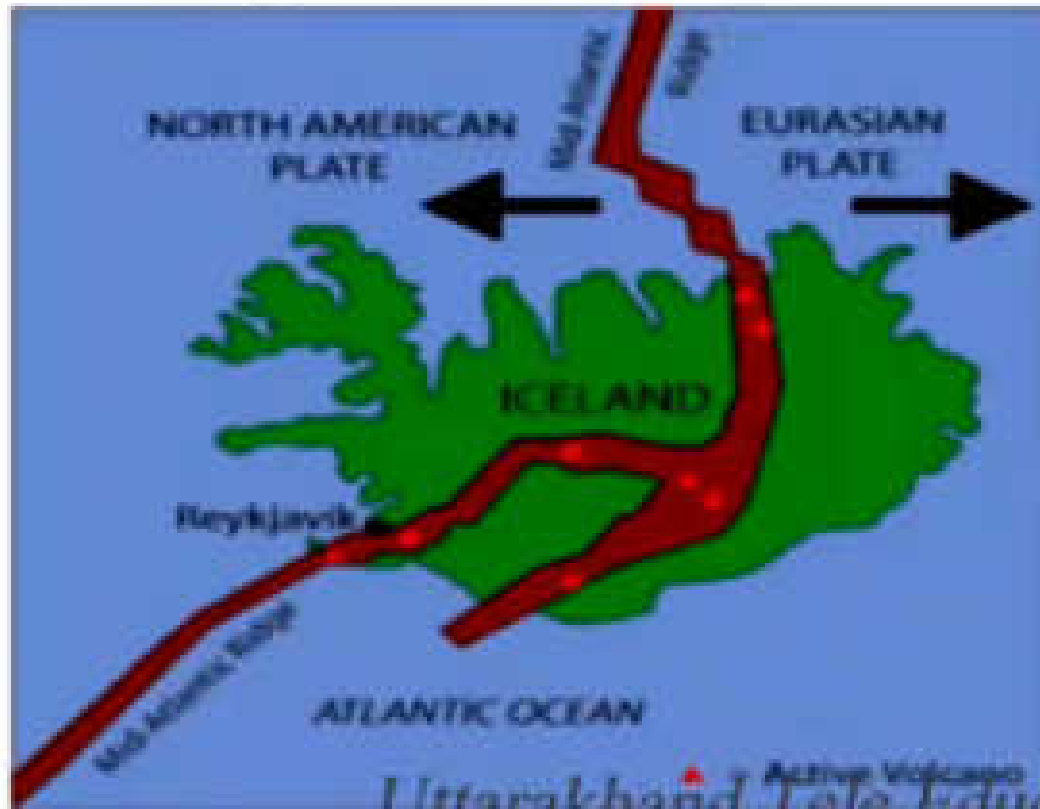
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# Age of Oceanic Crust



# Iceland: An example of continental rifting

- Iceland has a divergent plate boundary running through its middle



# Convergent Boundaries

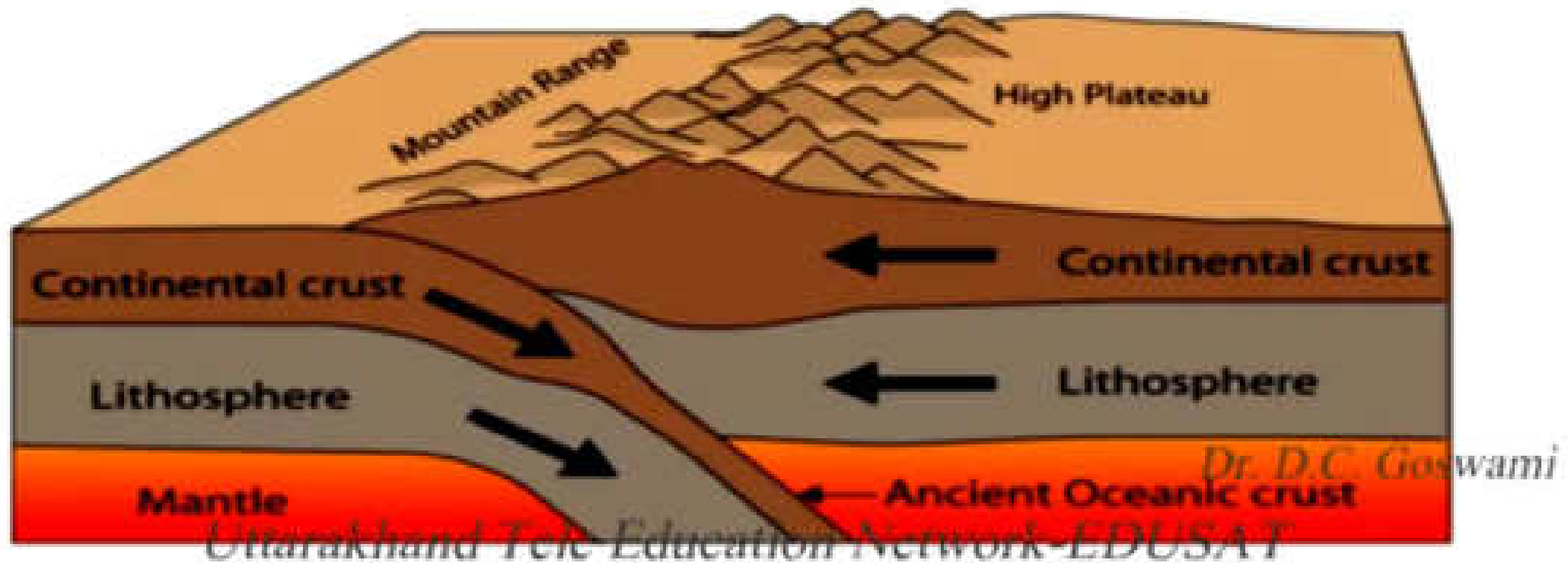
- There are three styles of convergent plate boundaries
- Continent-continent collision
- Continent-oceanic crust collision
- Ocean-ocean collision

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# Continent-Continent Collision

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



# Himalayas

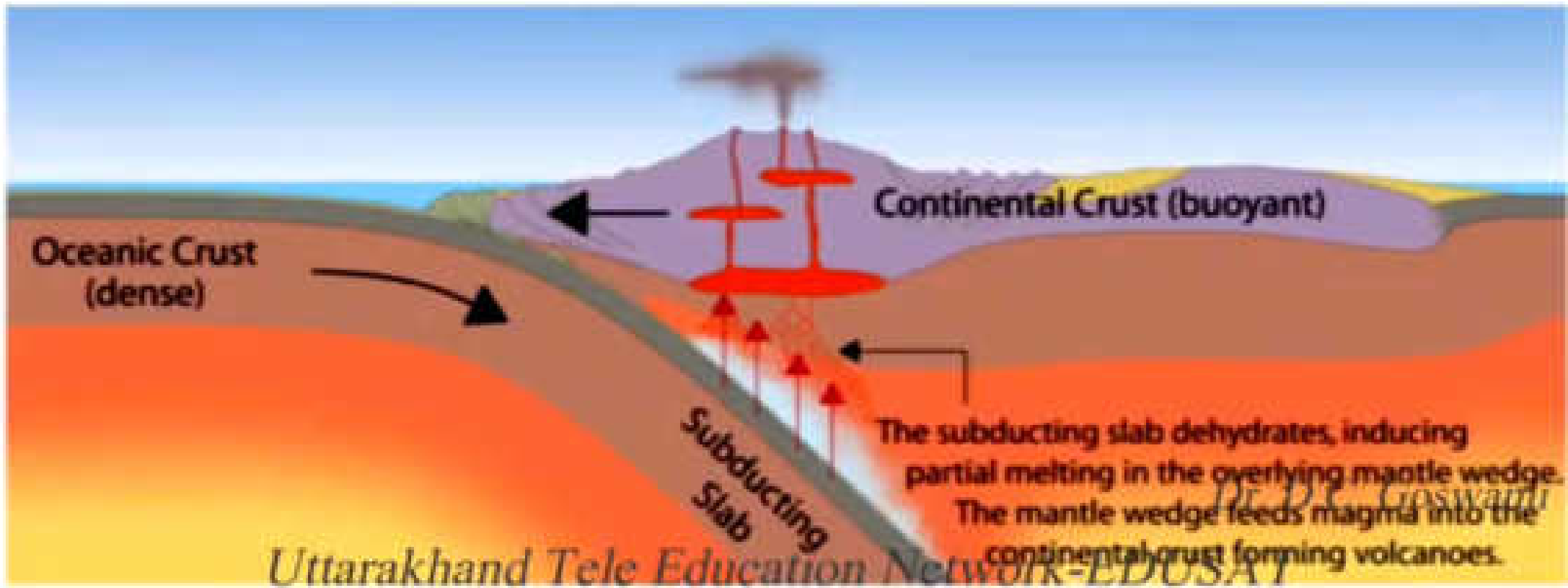


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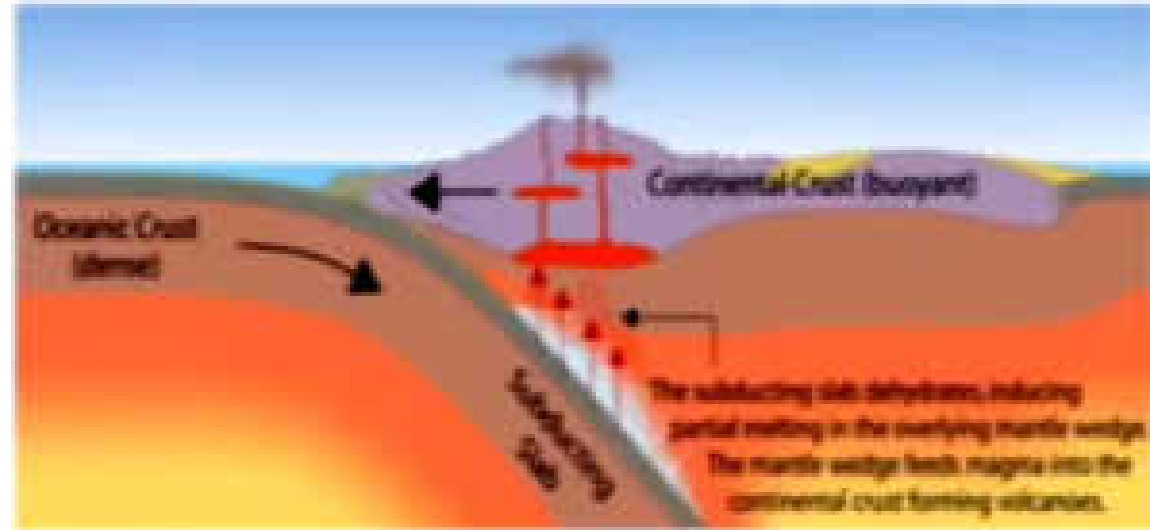


# Continent-Oceanic Crust Collision

Called **SUBDUCTION**



# Subduction



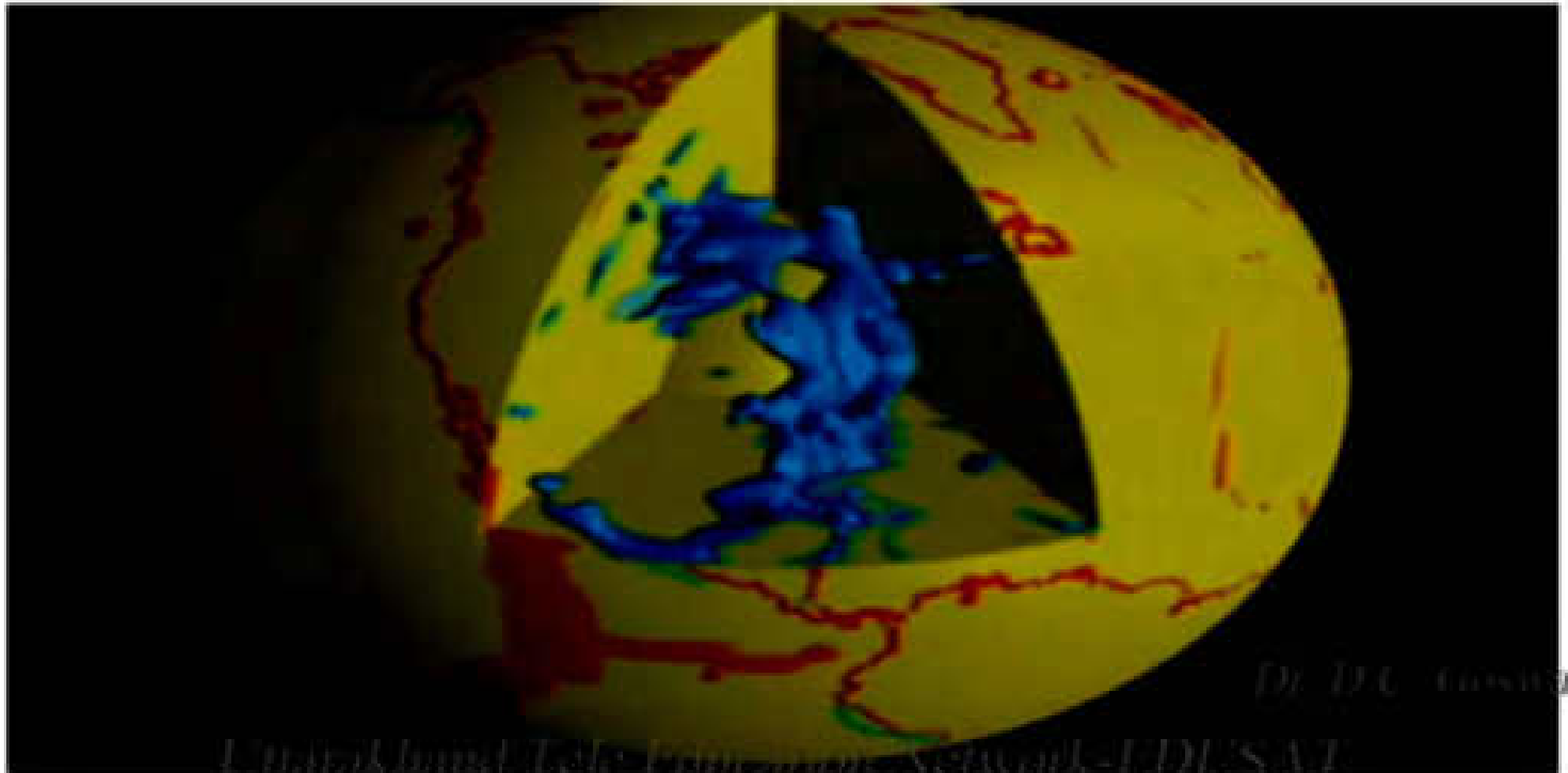
Oceanic lithosphere subducts  
underneath the continental lithosphere

Oceanic lithosphere heats and  
dehydrates as it subsides

The melt rises forming volcanism

E.g. The Andes

Remnants of the Farallon Plate, deep in Earth's mantle. It is thought that much of the plate initially went under North America (particularly the western United States and southwest Canada) at a very shallow angle, creating much of the mountainous terrain in the area (particularly the southern Rocky Mountains)

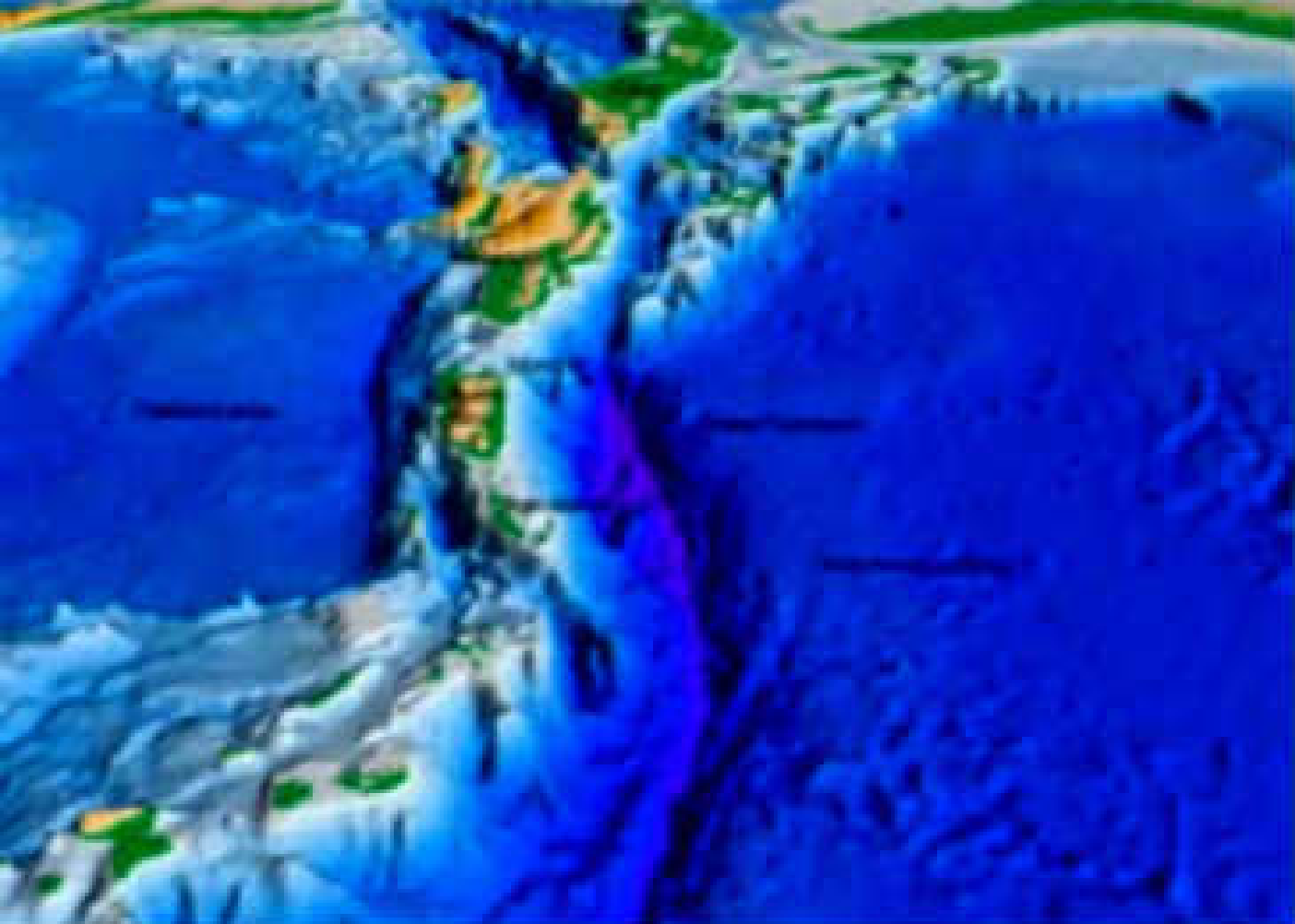


# Ocean-Ocean Plate Collision

- 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 worlds deepest parts of the ocean are found along trenches.
  - E.g. The Mariana Trench is 11 km deep!

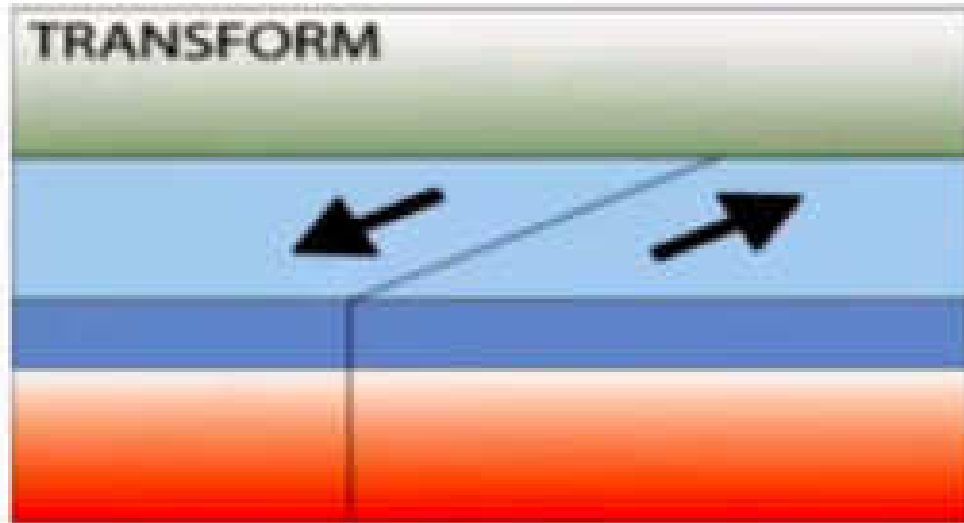
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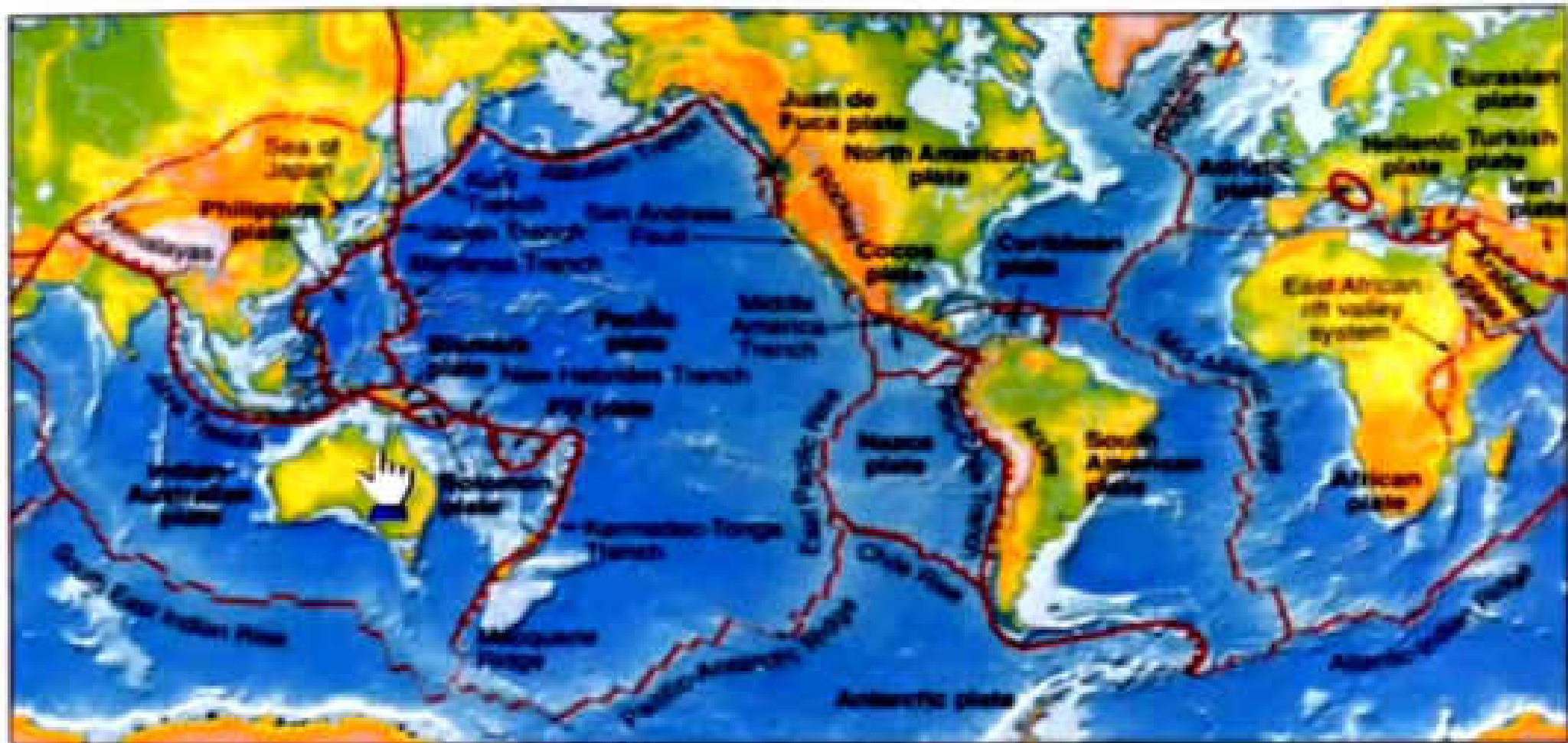


# Transform Boundaries

Where plates slide past each other



Above: View of the San Andreas transform fault  
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 Ridge axis  
 divergent boundary

 Transform

 Subduction zone  
 Convergent boundary

 Zones of Extension within continents

 Uncertain plate  
 boundaries

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Uttarakhand Tele Education Network-EDUSAT **Earth Plate**

# Three Types of Volcanoes

Each are different because of the way they erupt or the types of materials they erupt

- Composite Cone
- Cinder Cone
- Shield

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# Composite Cone

- \*Most explosive eruptions
- \*built of lava, cinders, and ash.
- \*The size increases after an eruption.
- \*Also called strato volcano.
- \*Serves as a transportation system for magma to rise to the surface from deep within Earth's crust.
- \*Can be so powerful that part of the volcano can be blown away, reshaping the mountain

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# Cinder Cone

- \*Formed by lava fragments called cinders
- \*Has only one vent in which magma can flow
- \*Lava fragments burst into the air and then fall into the vent of the volcano.
- \*Have steep sides
- \*Not as large as composite or shield volcanoes.

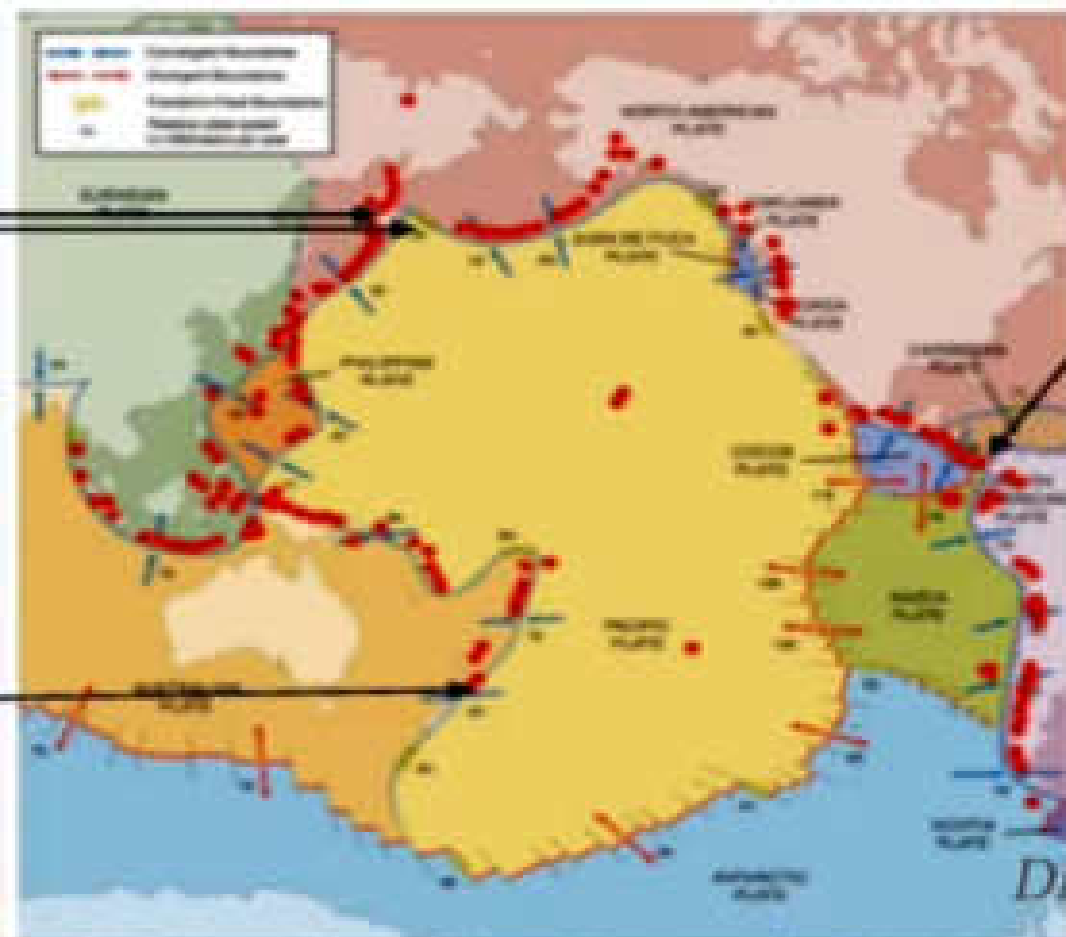
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# Shield

- \*Look like shields with their gentle sloping sides
- \*Slopes are caused by eruptions
- Eruptions usually have fluid lava which flows from it.
- \*Lava flows not only from the top but also from the cracks in the ground.
- \*Slow to erupt so usually animals and people have enough time to escape.
- \*Some of the largest volcanoes in the world

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# Pacific Ring of Fire

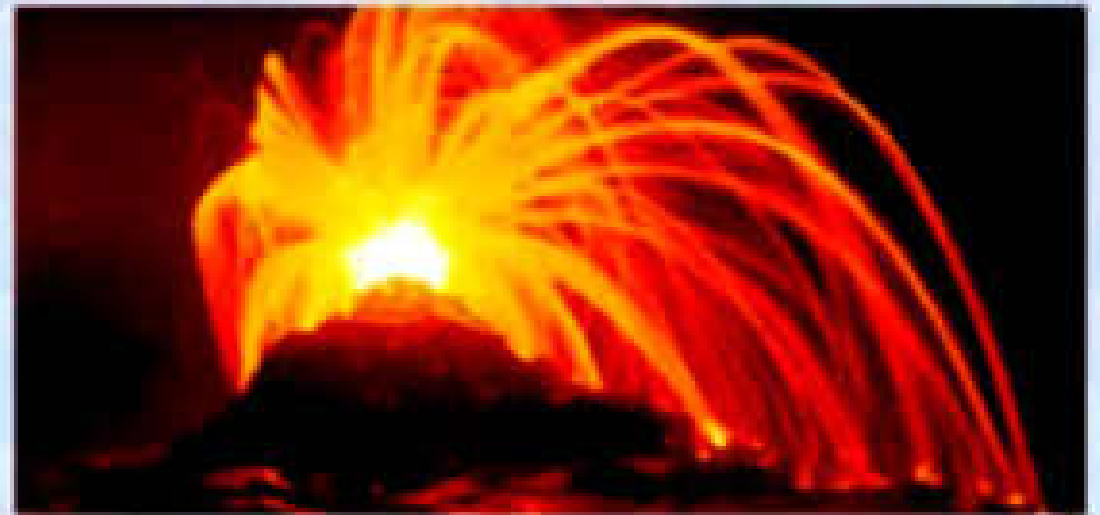
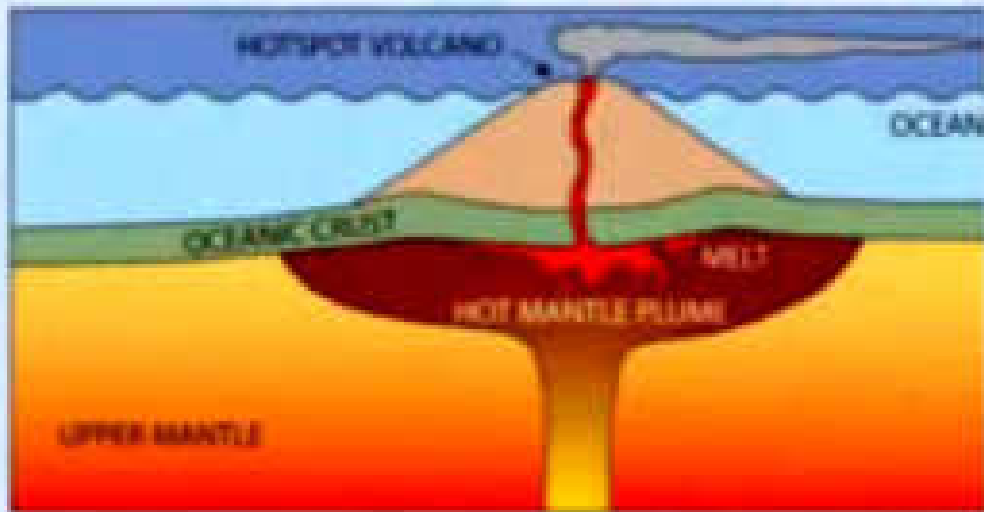


Volcanism is mostly focused at plate margins

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# What are Hotspot Volcanoes?

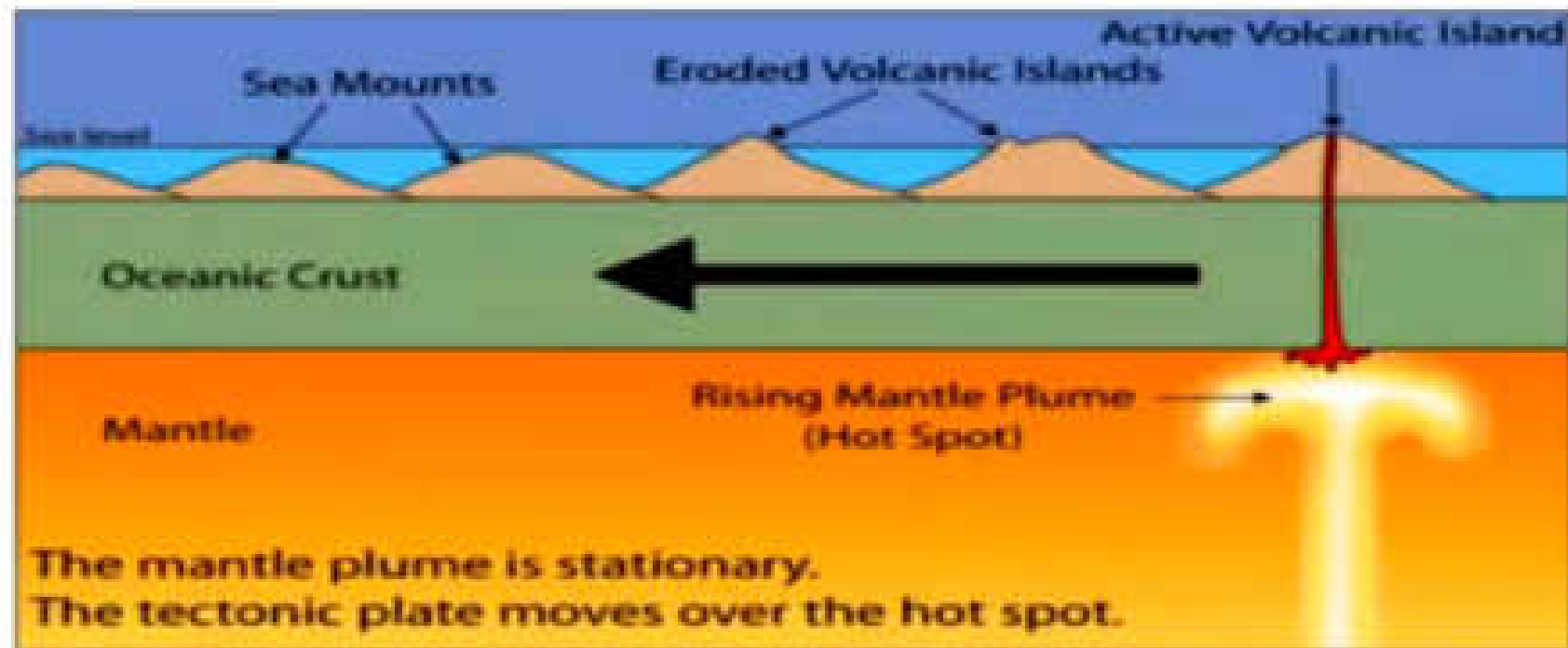
- Hot mantle plumes breaching the surface in the middle of a tectonic plate



The Hawaiian island chain are examples of hotspot volcanoes.

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



The volcanoes get younger from one end to the other.

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As with volcanoes, earthquakes are **not** randomly distributed over the globe



Figure showing the distribution of earthquakes around the globe

At the boundaries between plates, friction causes them to stick together. When built up energy causes them to break, earthquakes occur. *Dr. D.C. Goswami*

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# Where do earthquakes form?

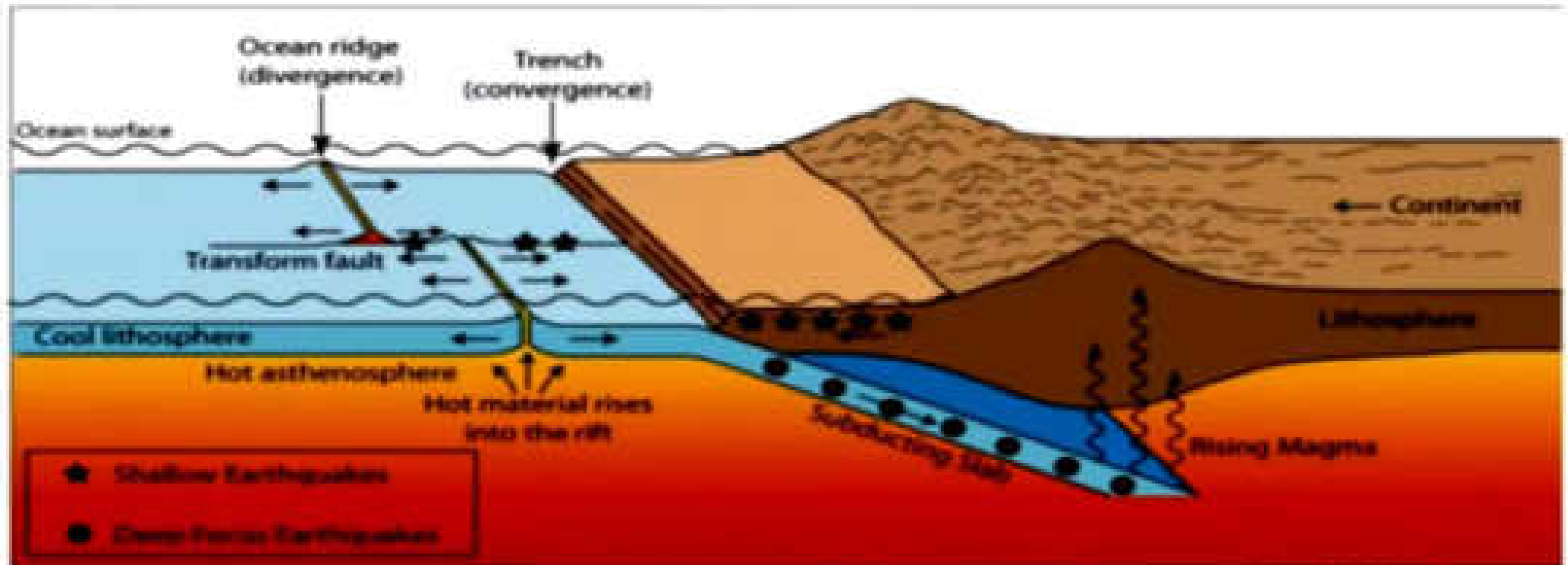


Figure showing the tectonic setting of earthquakes

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# 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 plate
- There are 3 types of plate boundaries
- Volcanoes and Earthquakes are closely linked to the margins of the tectonic plates

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