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Martina Monaco

- Geophysics PhD candidate, University of Florida
- Exploration Geology, MSc
- Geological Sciences, BSc

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A free program, aimed at building long-term collaborative relationships between teachers and scientists, to better integrate current scientific research and big data into classroom lessons.

For more information: bit.ly/SEFSsite

One day you may be calling this home!

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Geo Life

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QUESTION!

Where did you grow up?
Where would you like to live?
What's your dream?

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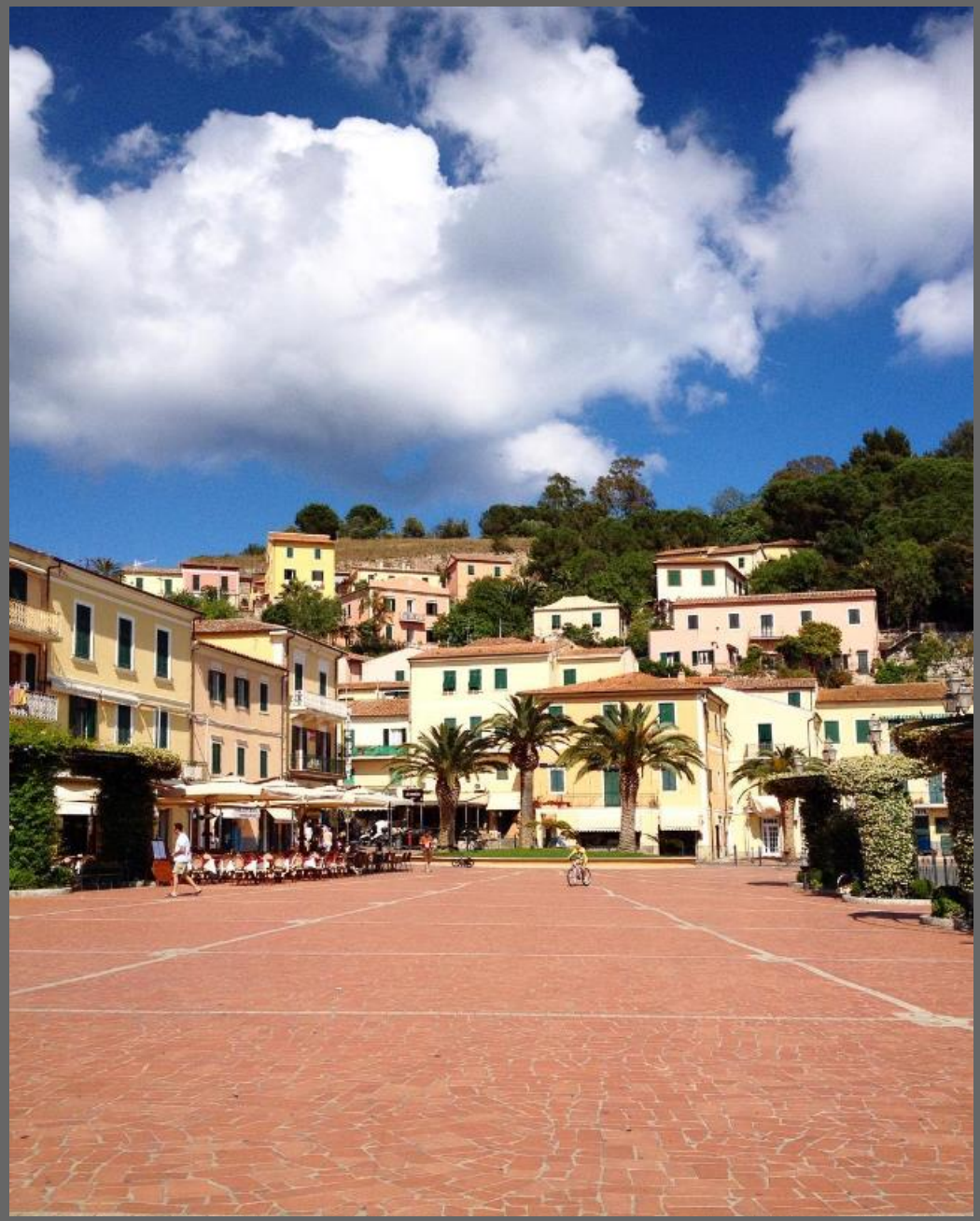
RFI/CEPRINI
MELZANILI (PT)



Big Rocks

This is where we got lost… And yes, we had a map!

We had to ask directions to a group of elderly Germans

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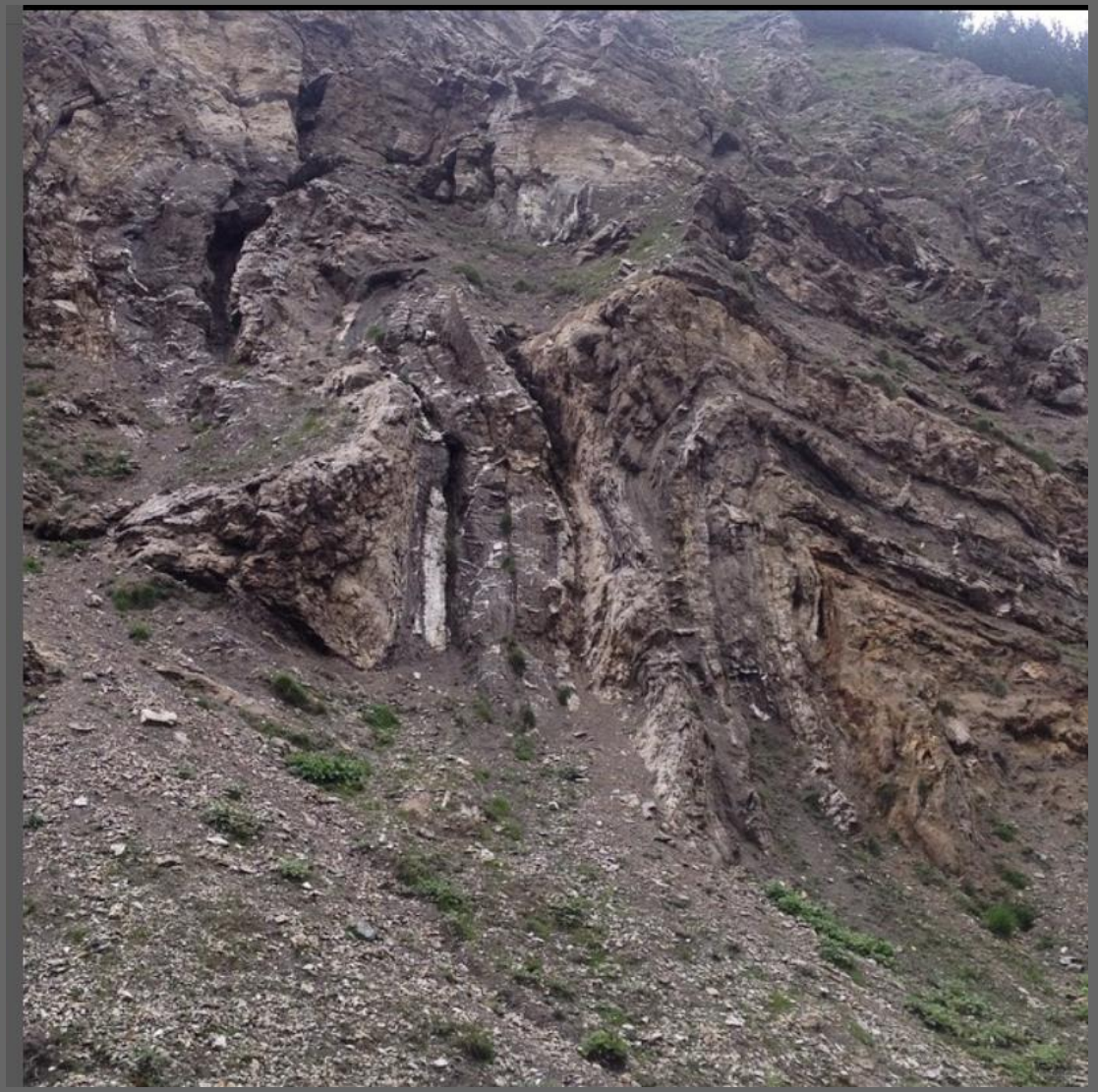
More Big Rocks



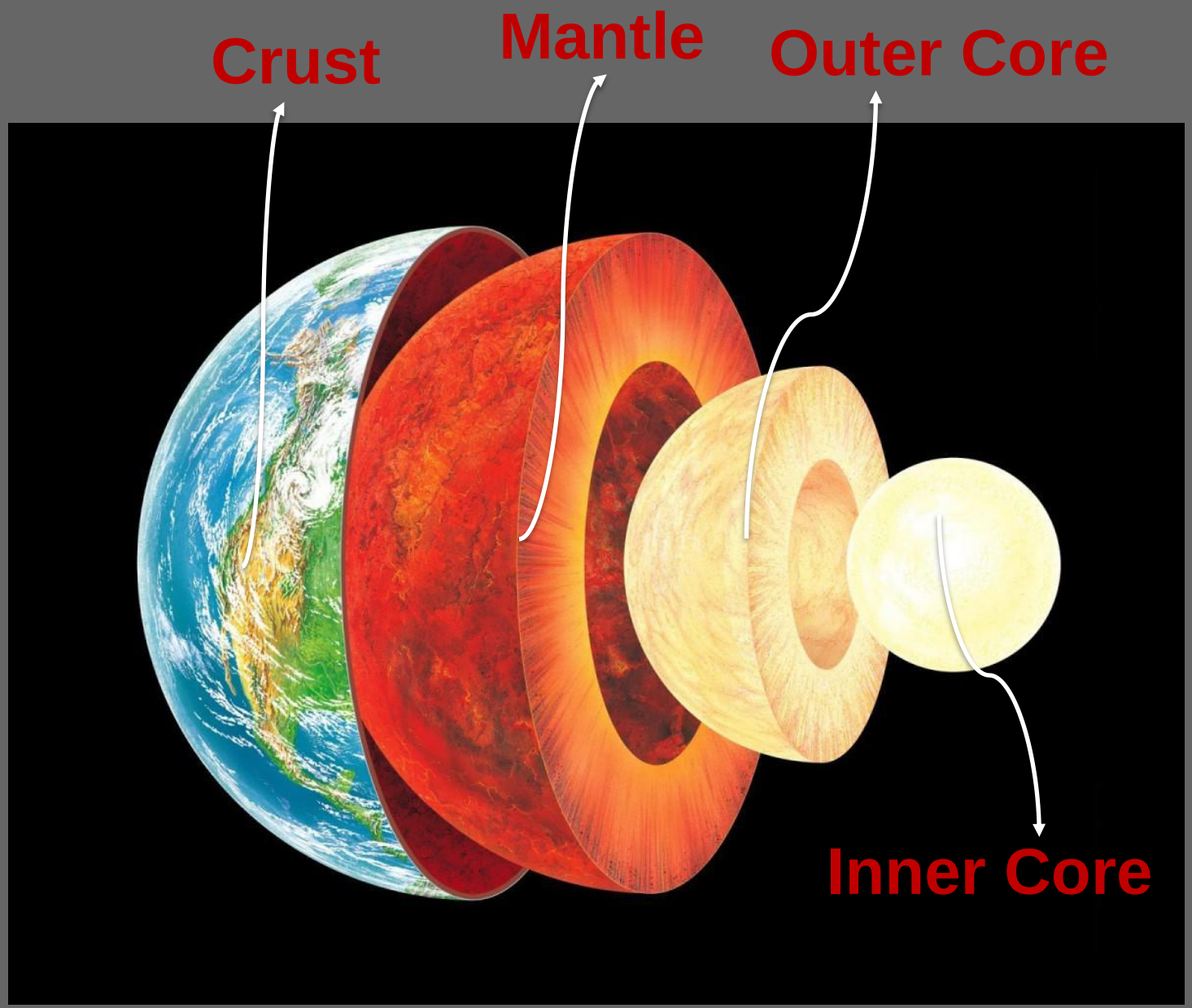
This can be you!

Have you ever seen the snow? If yes, when? Do you like it?

Lecture Topics

1. **The Crust**
2. **The Mantle**
3. **The Core**
4. **Plate Tectonics**

A layered planet



1. Seismic waves
2. Rocks (crust & upper mantle)
3. Numerical models
4. Magnetic field (core)

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1. The **Crust**

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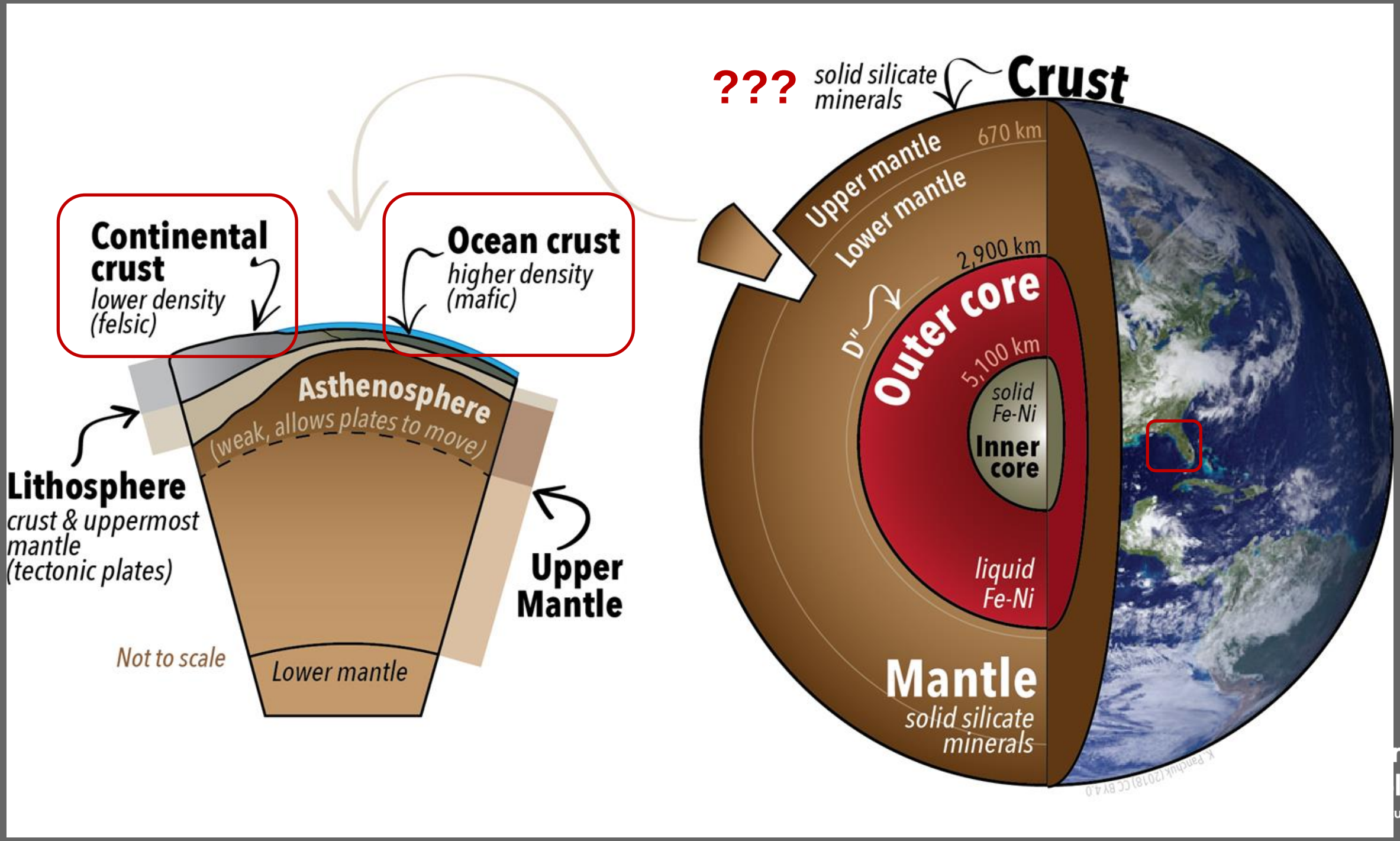
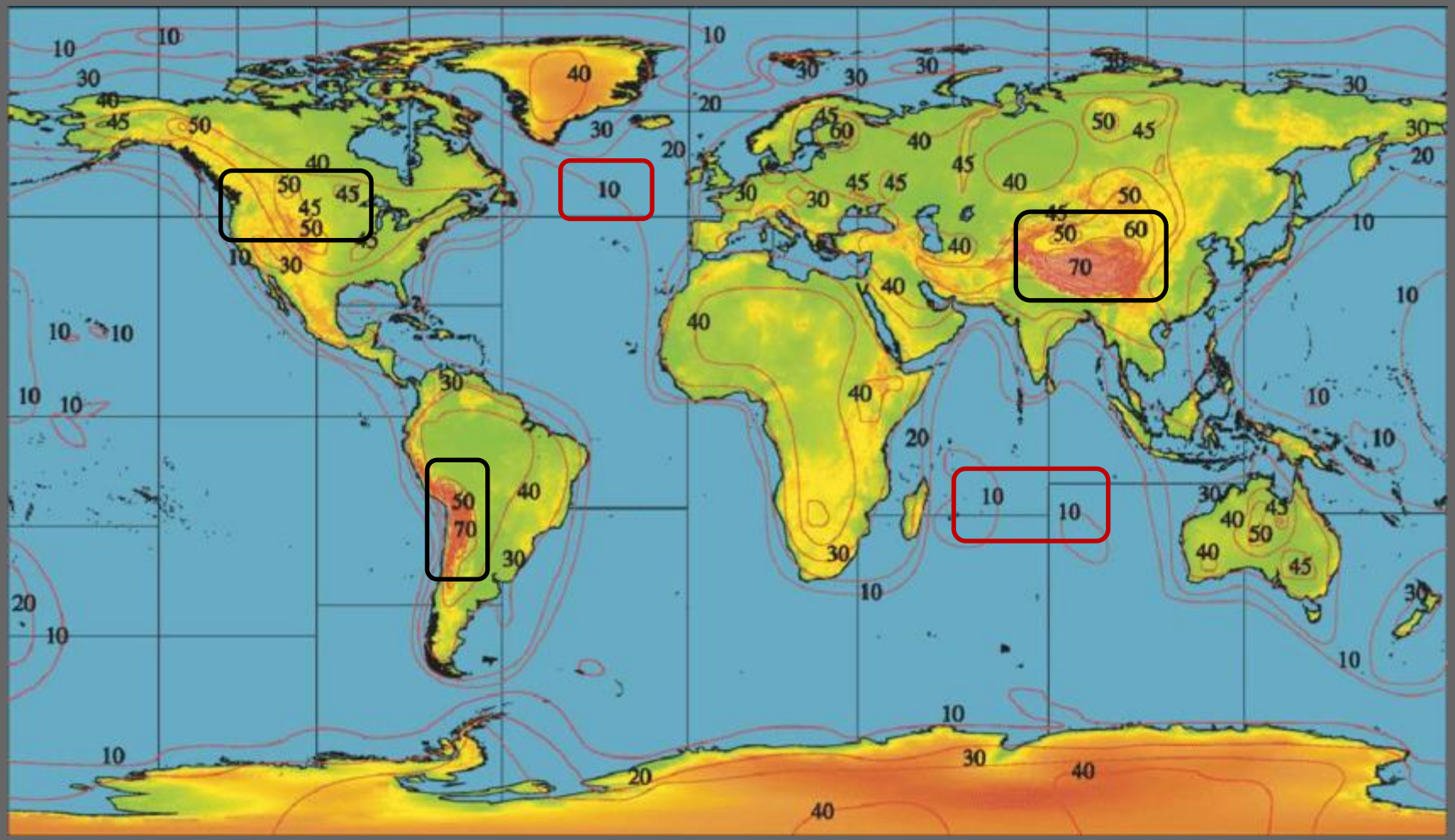

Continental crust
lower density
(felsic)
Ocean crust
higher density
(mafic)
Asthenosphere
(weak, allows plates to move)
Lithosphere
crust & uppermost mantle
(tectonic plates)
Upper Mantle
Not to scale
Lower mantle
???
solid silicate minerals
Crust
Upper mantle
Lower mantle
670 km
2,900 km
D"
Outer core
5,100 km
solid Fe-Ni
Inner core
liquid Fe-Ni
Mantle
solid silicate minerals

Types of Crust



Continental crust →**thicker (16-43 mi)**

Oceanic crust →**thinner (4.3-6.2 mi)**

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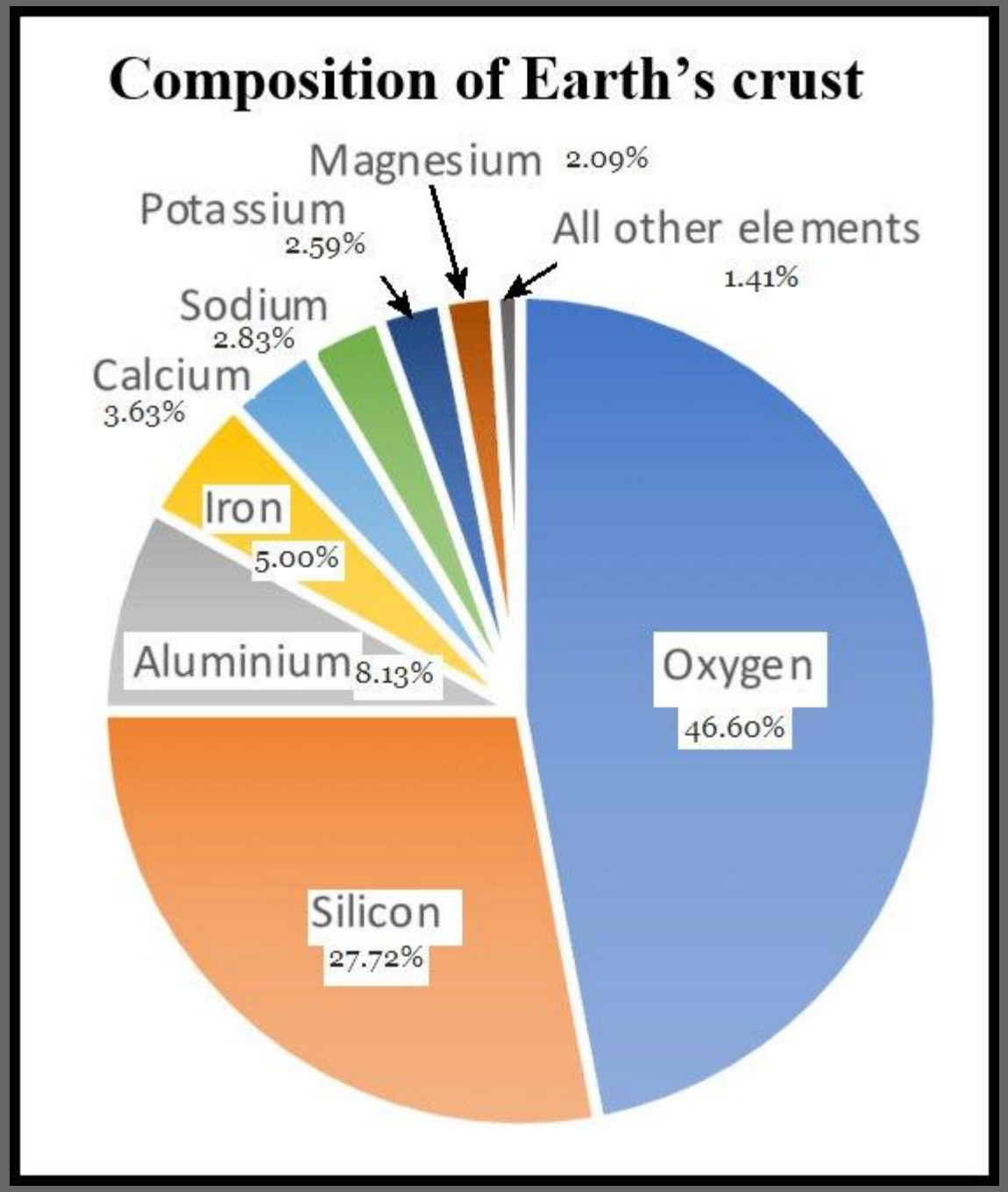

The magnificent eight make up more than 98% of the composition of the crust

These elements combine to form **silicate minerals**

Aggregates of minerals are called rocks

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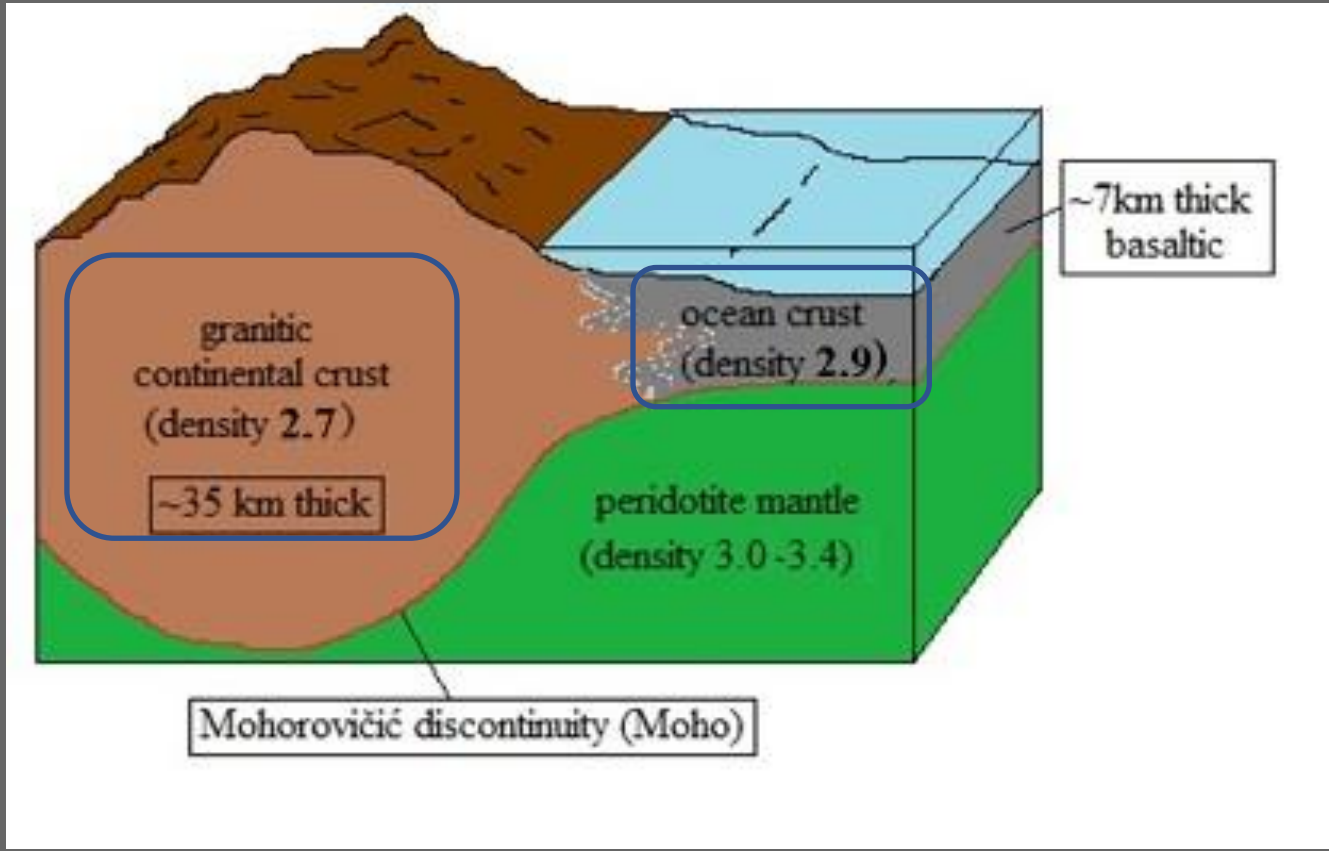
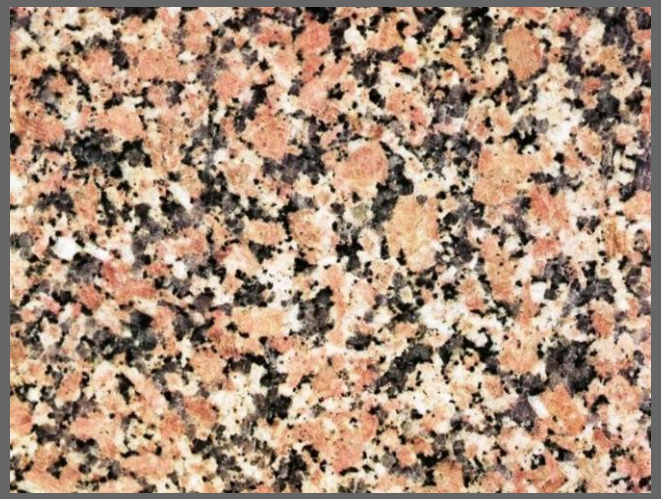
ALUMINUM → CONTINENTAL CRUST, 2.7 g/cm³

SILICON +
OXYGEN +
…

MAGNESIUM + IRON → OCEAN CRUST, 2.9 g/cm³



Reference Compositions



Granite

Basalt

Basalt

Granite

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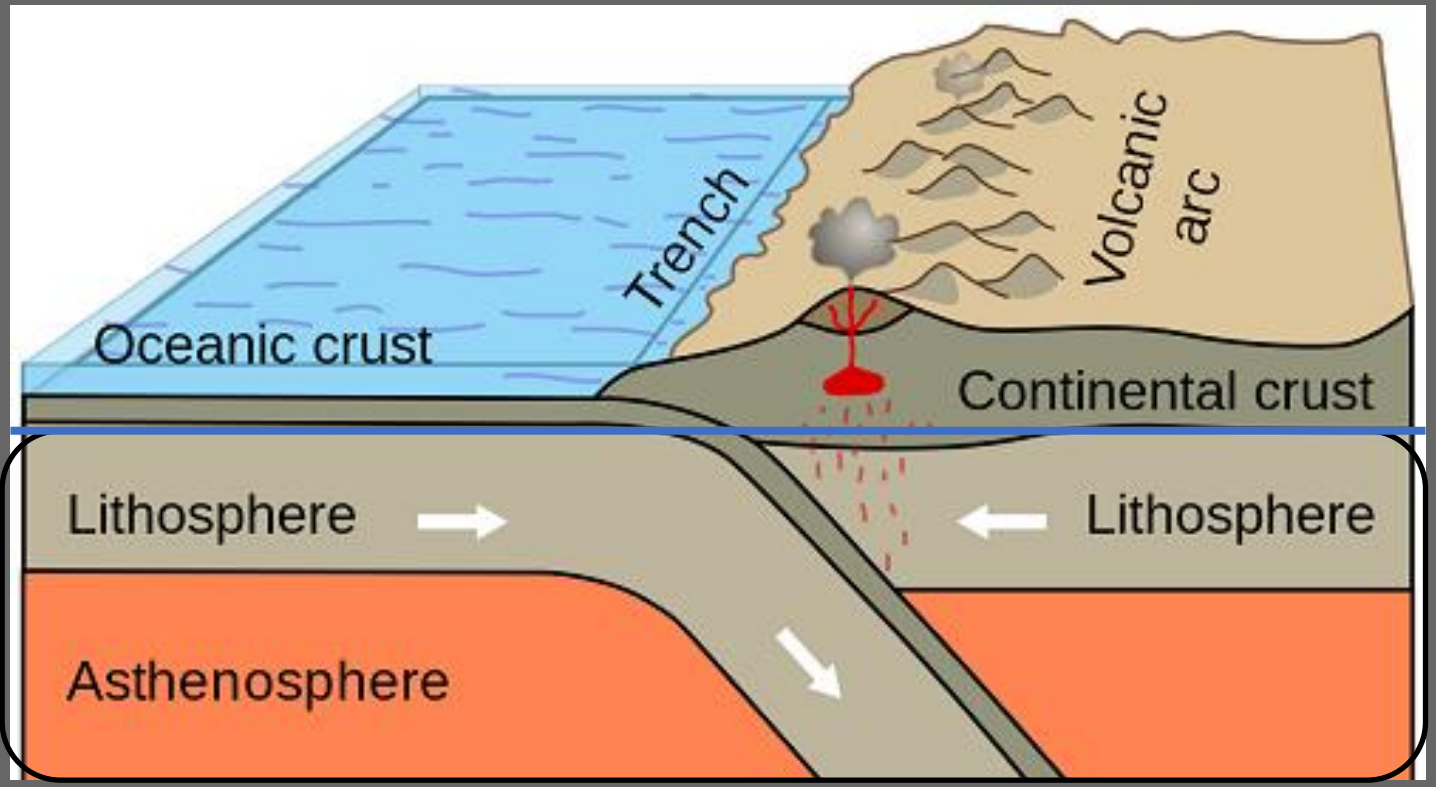
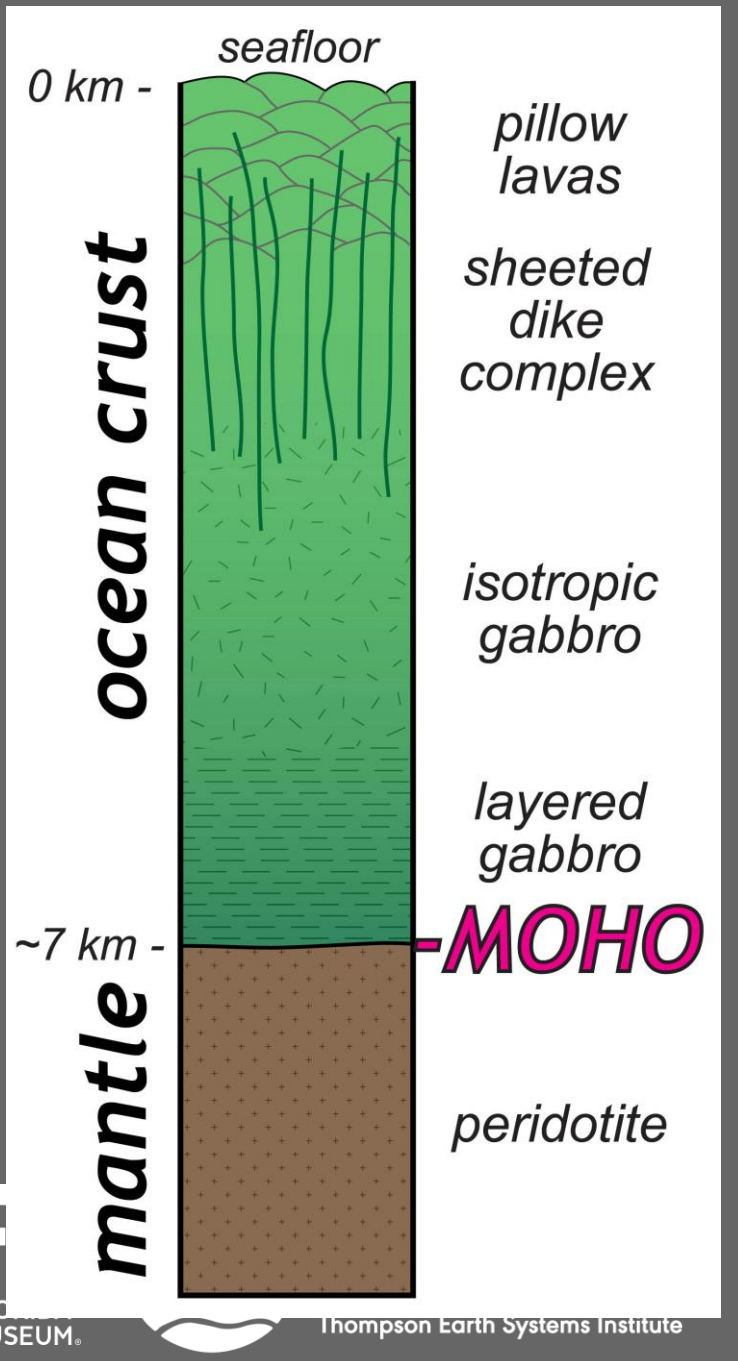
Crust and upper mantle are separated by a **seismic discontinuity: the Moho**

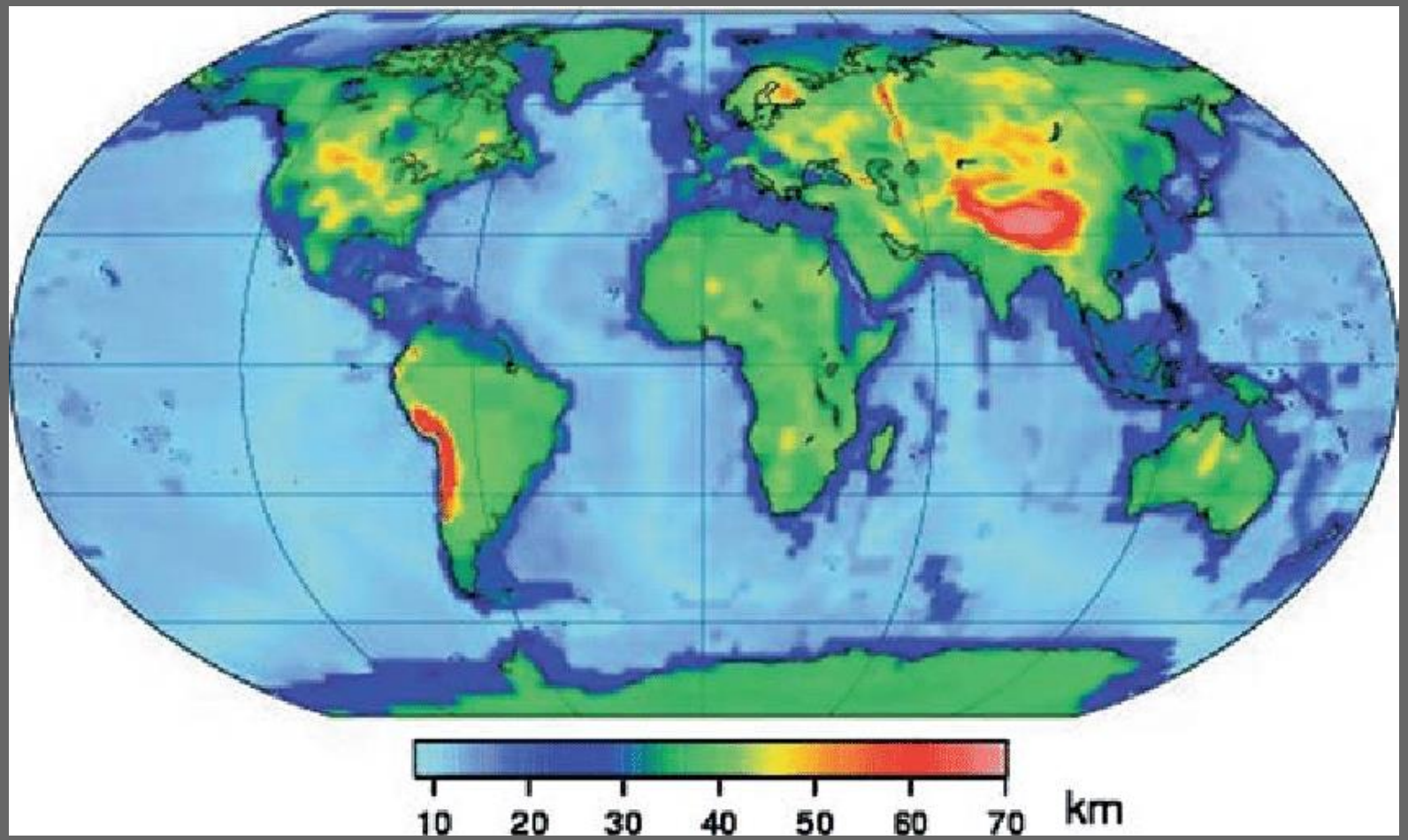


MOHO

MANTLE



Moho Depths

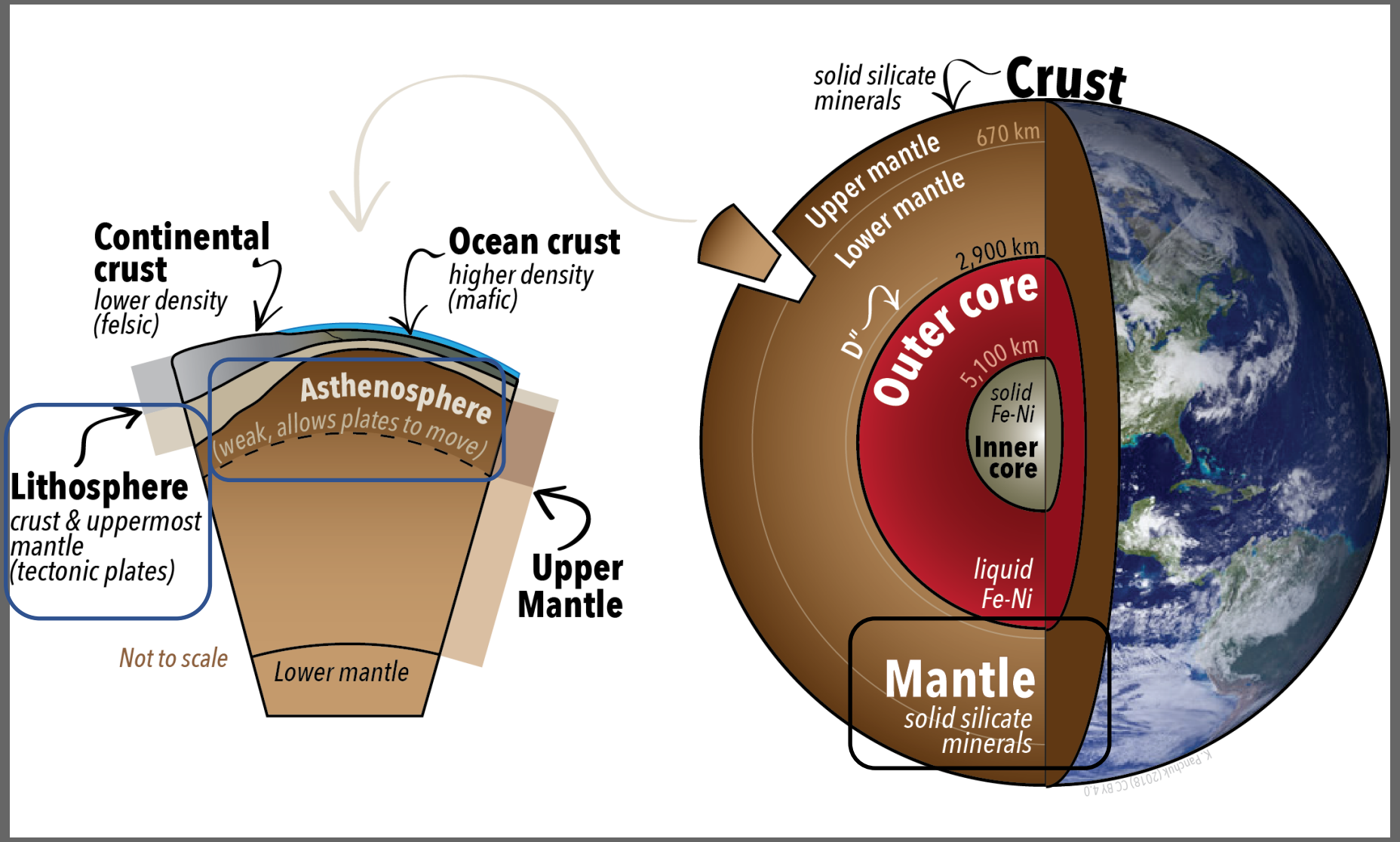


Looks familiar?

Yes!

Moho depth = crustal depth

2. The **Mantle**



- Thickest layer: 1802 mi
- **Solid**
- **Constituents:** the magnificent eight
- **Density: 4.5 g/cm³**

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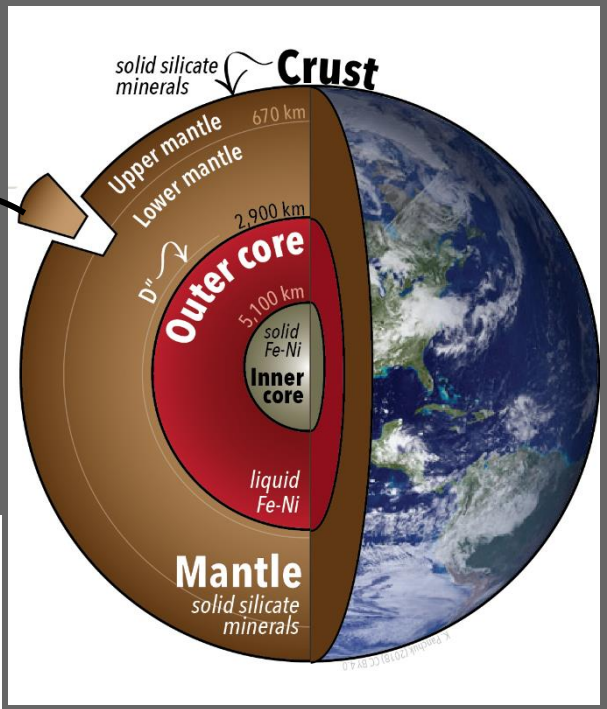
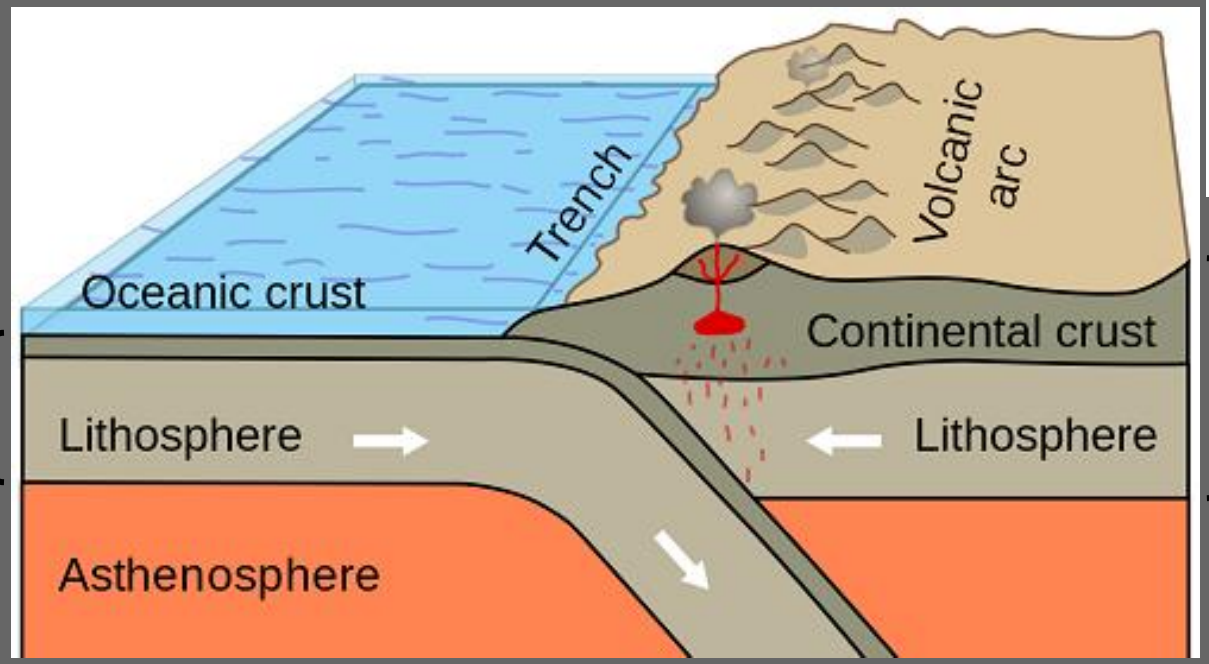
Tectonic plates: **crust + lithospheric mantle (starts as soon as we cross the Moho)**





Oceanic plate

Continental plate

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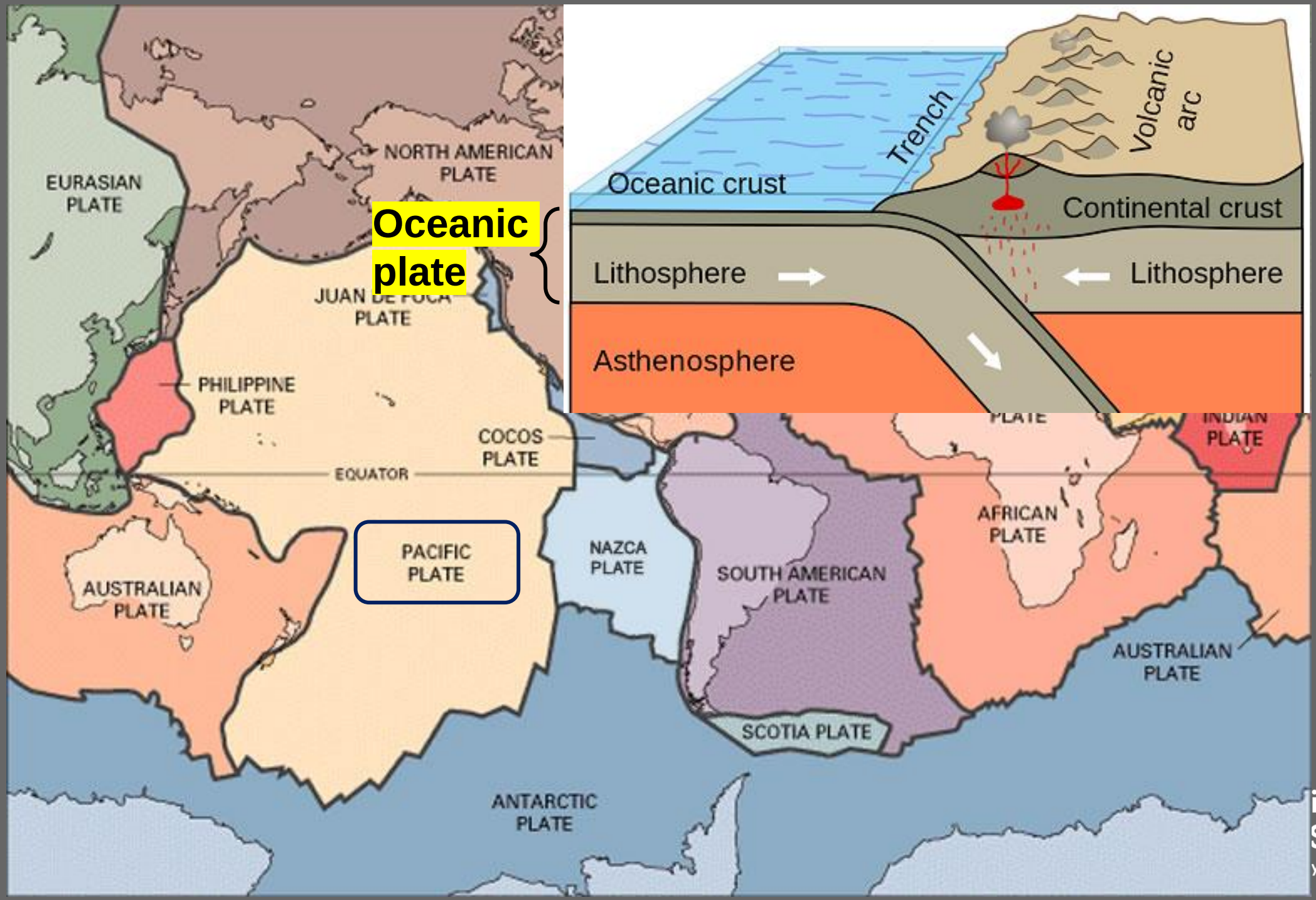

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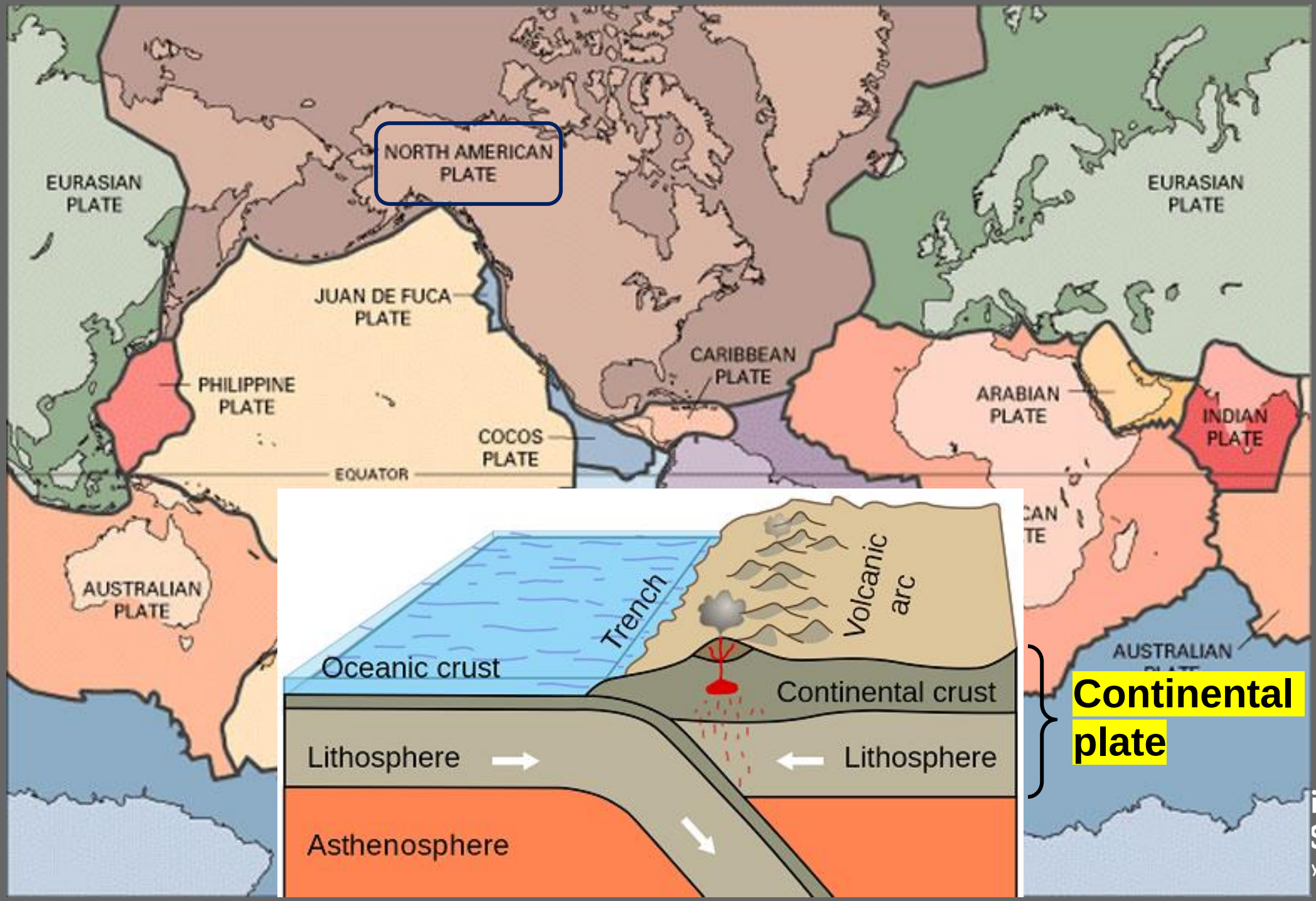

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Plates **(crust + lithosphere)** slowly move relative to each other

This movement is allowed by the **asthenosphere**, which is **less resistant than plates**

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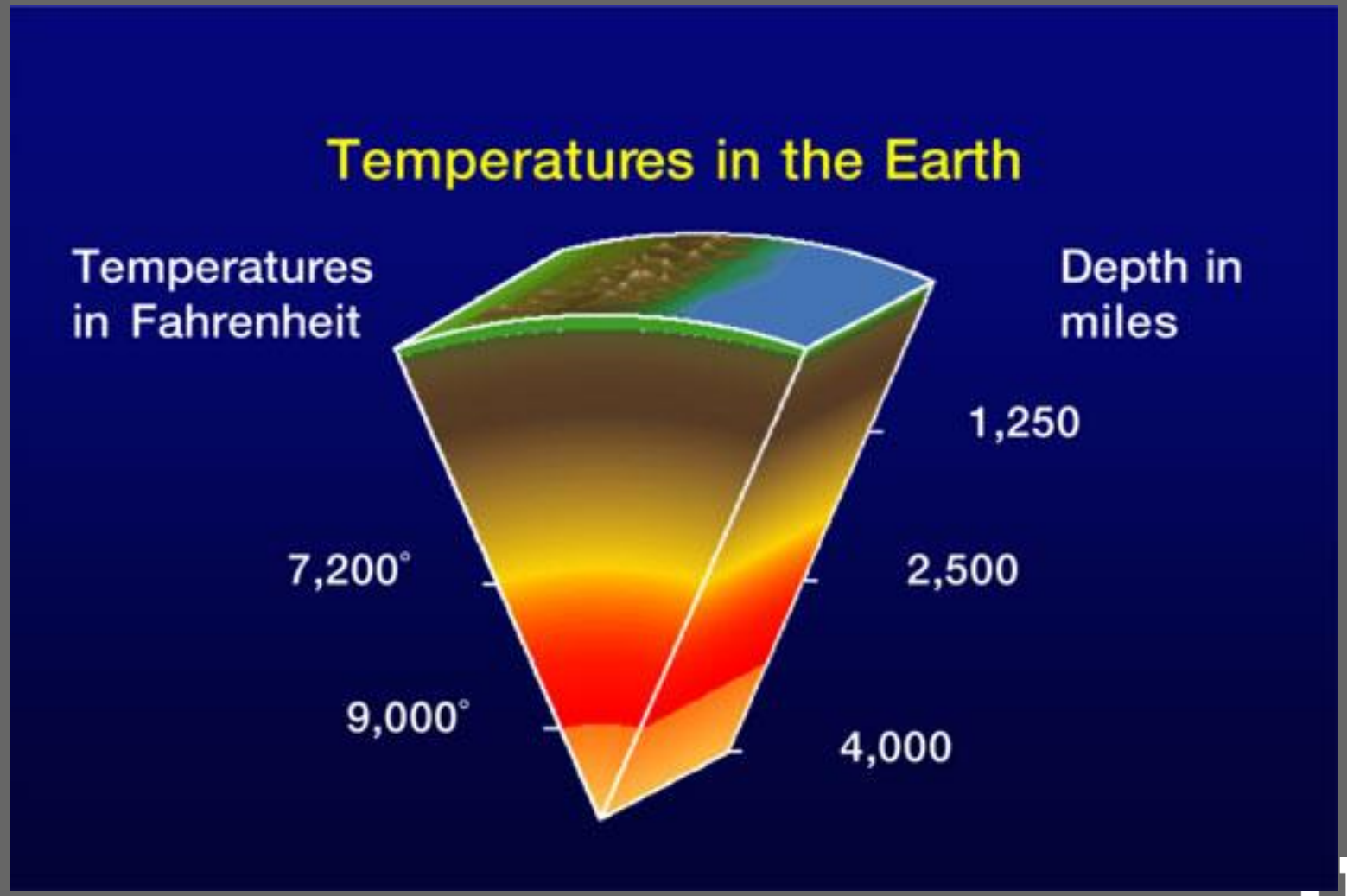
Mantle Convection



The mantle is **hot** but **solid: how?**

Heat is transferred via **convection**

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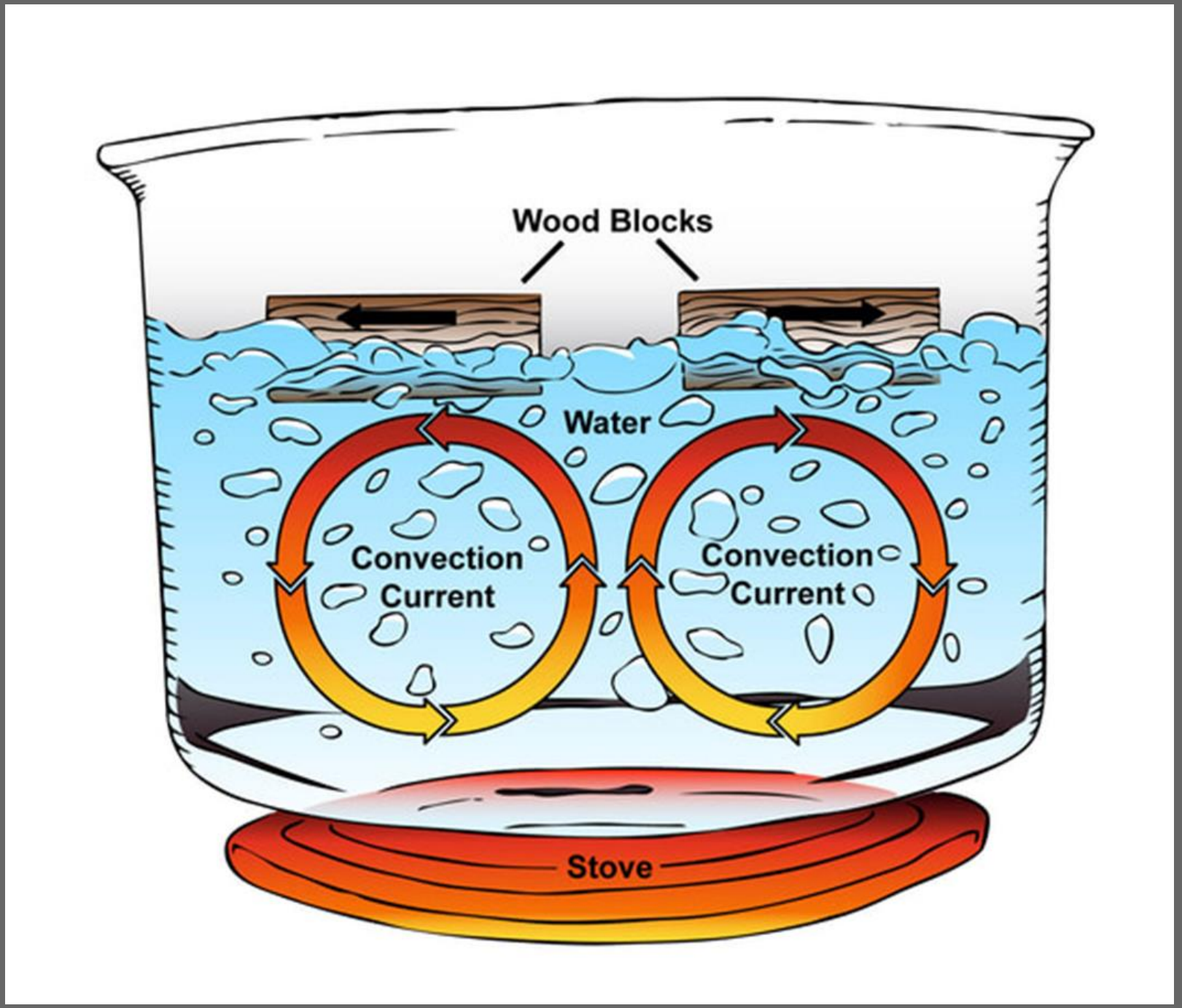
Convection?

- The stove heats
- Water moves
- Bubbles = less dense water → **rises**
- Colder water = denser → **sinks**
- And again and again…



QUESTION!

Can a solid **convect?**

YES!

The solid mantle has convection. In geology, you have to refer everything to **time**. Over the geologic times, the Earth's mantle behaves like a fluid.

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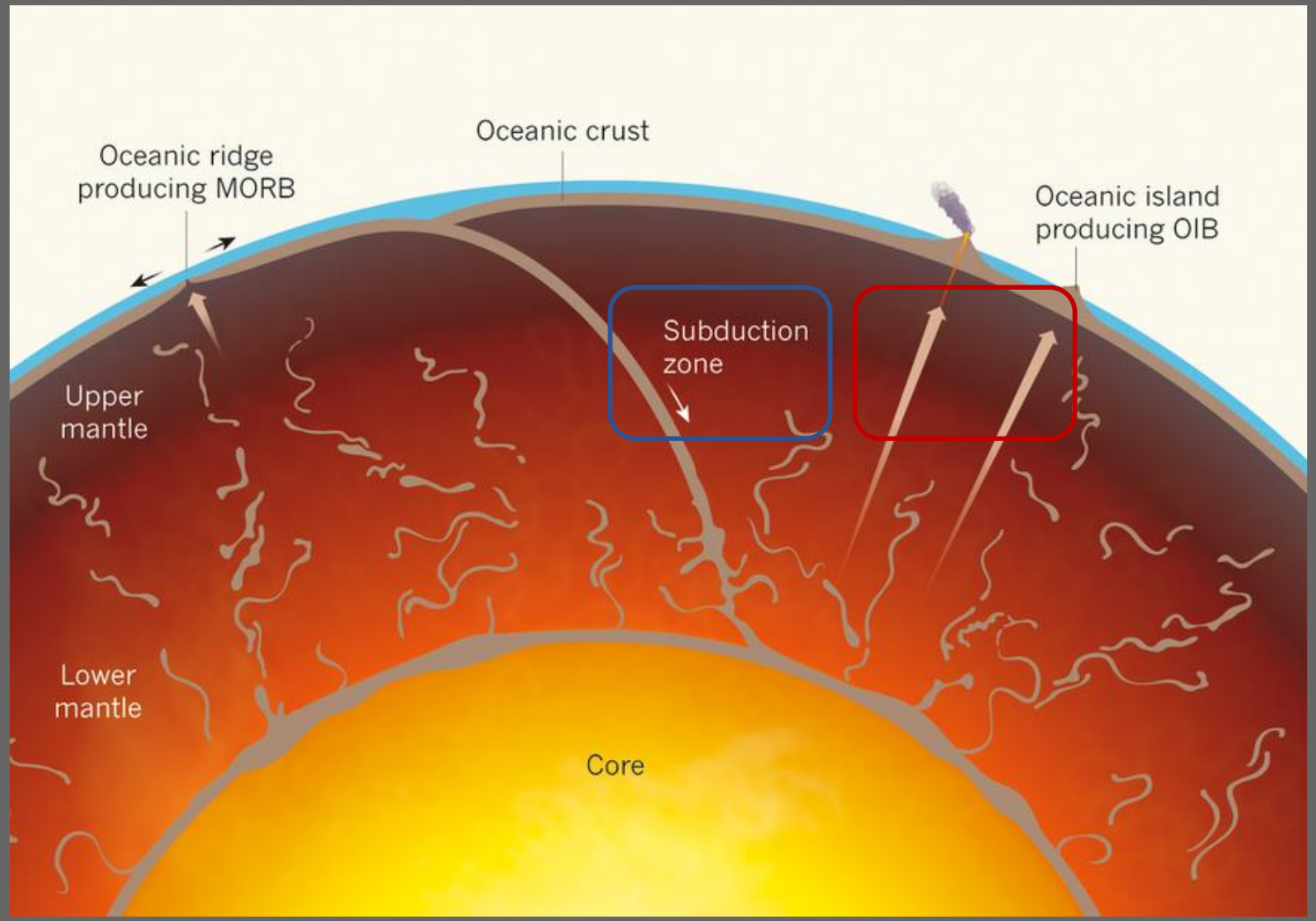
Also convection!



- Denser material → sinks → **subduction zones**
- Lighter material → rises → **mantle plumes**

(we'll talk about these later)

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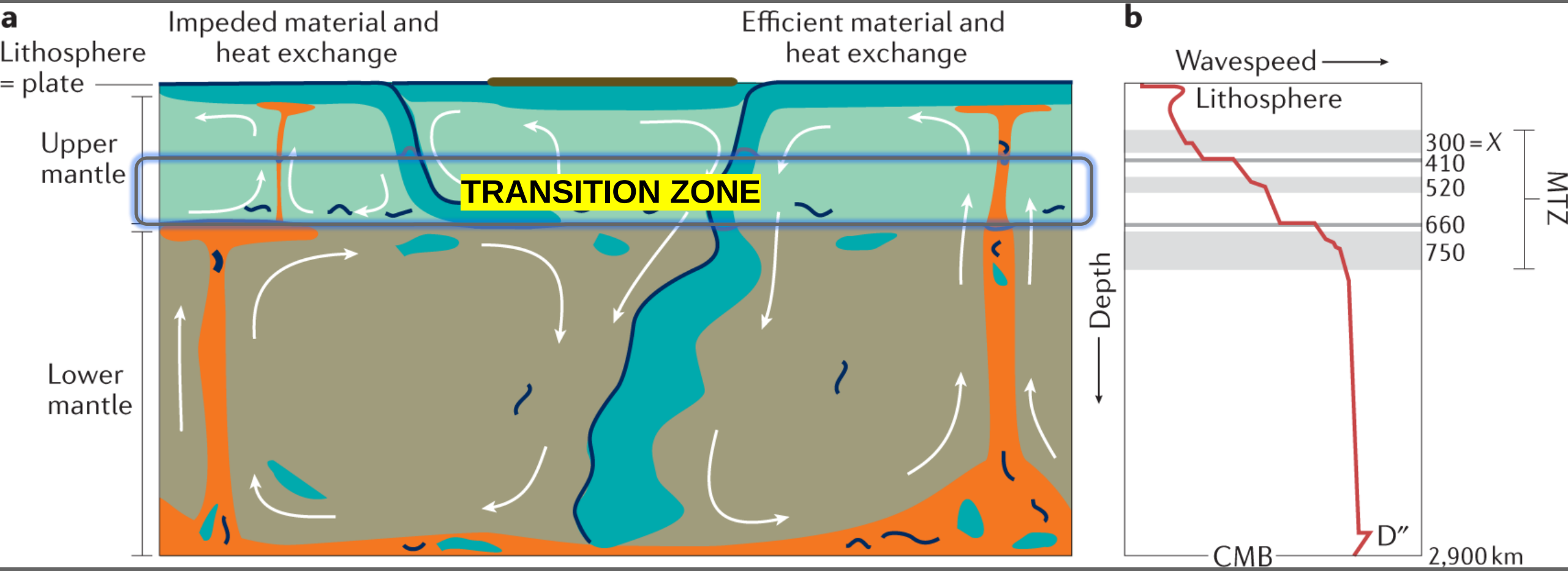
Lower mantle?



3. The **Core**

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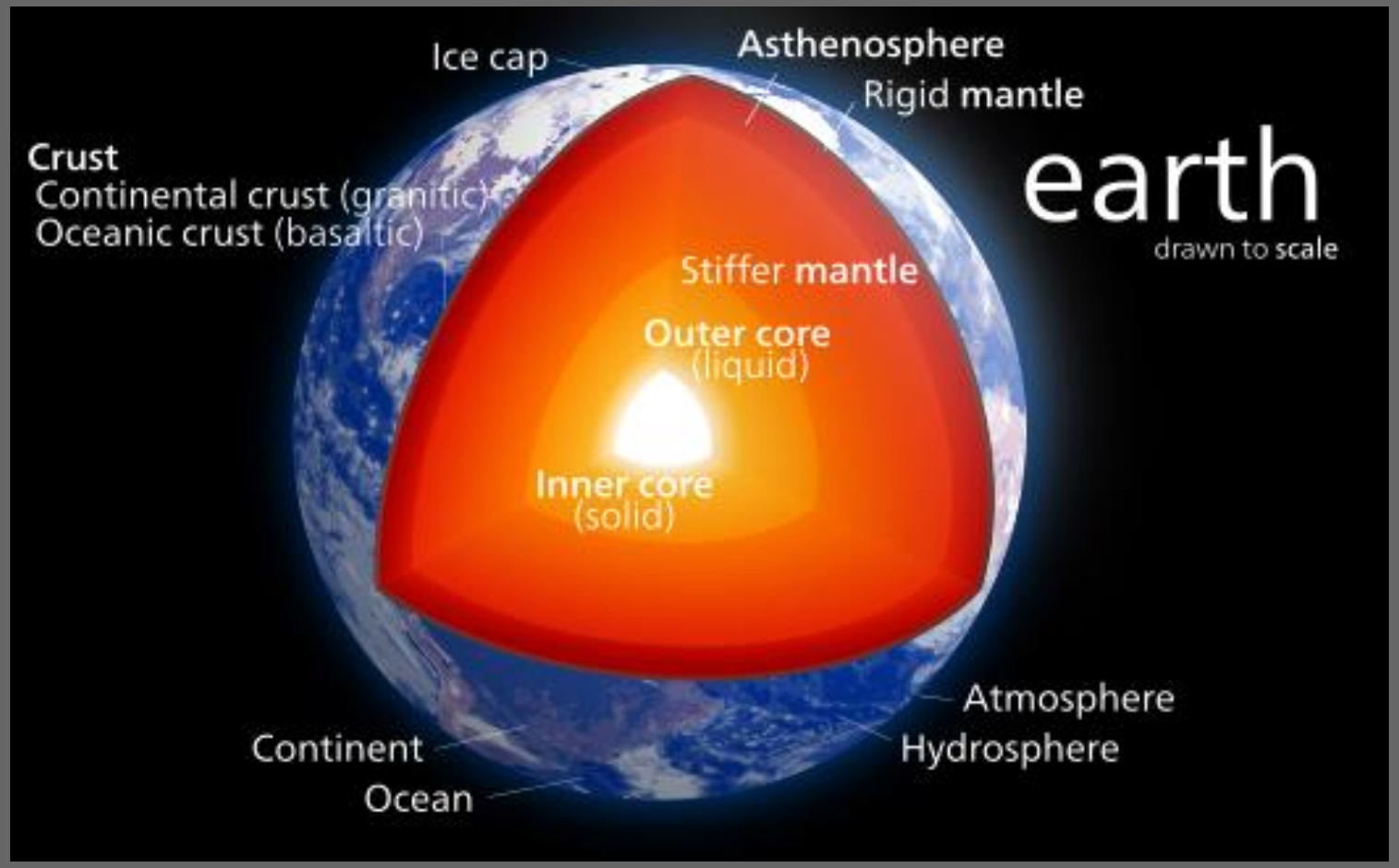
The Core



- Innermost layer
- **Outer core: liquid**
- **Inner core: solid**
- **IRON & NICKEL**
- **Density: 9.9-12.2 g/cm^3**

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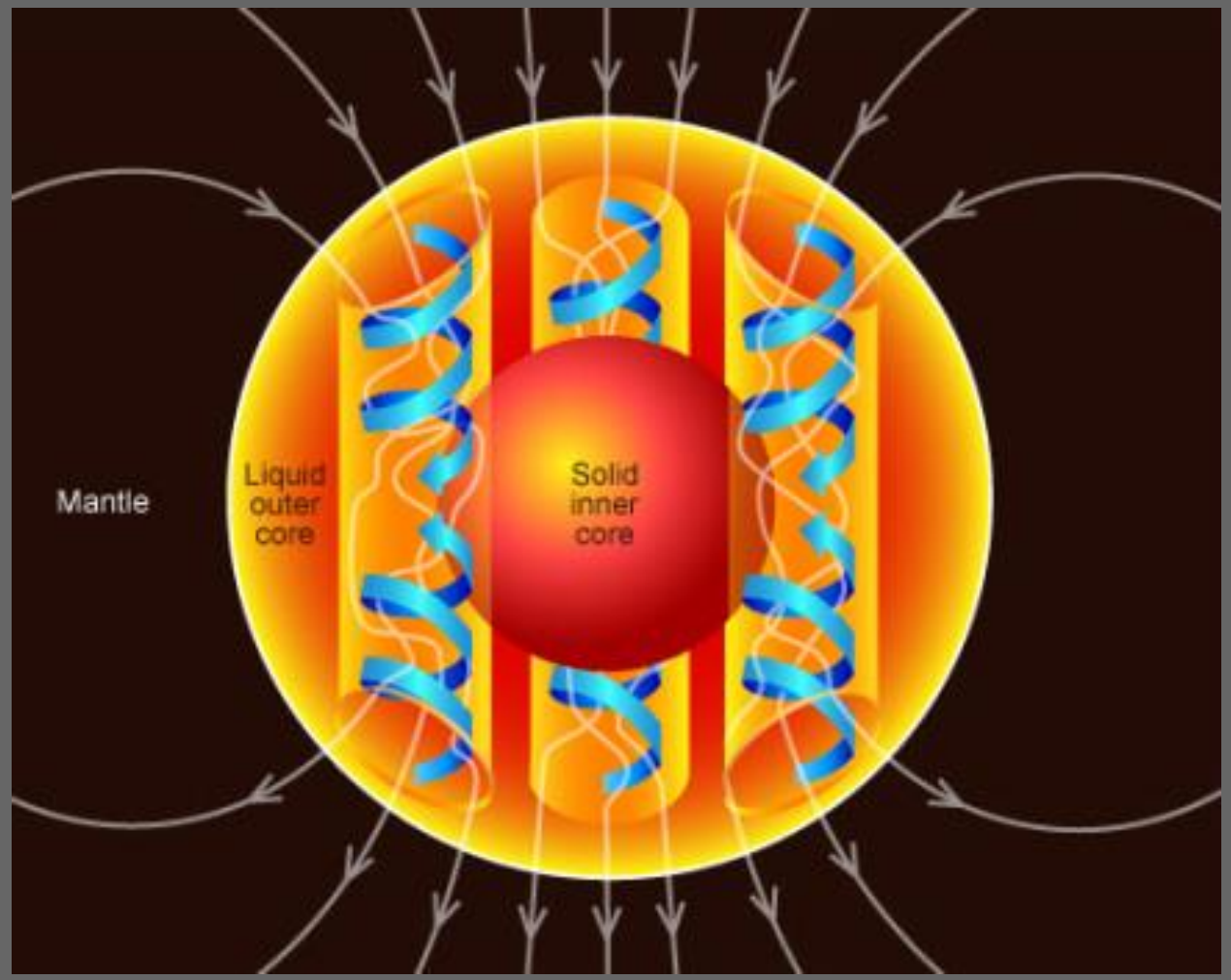
Magnetic Field



- **Core rotation: faster than the mantle's**
- **Outer core: where the Earth's magnetic field is generated**

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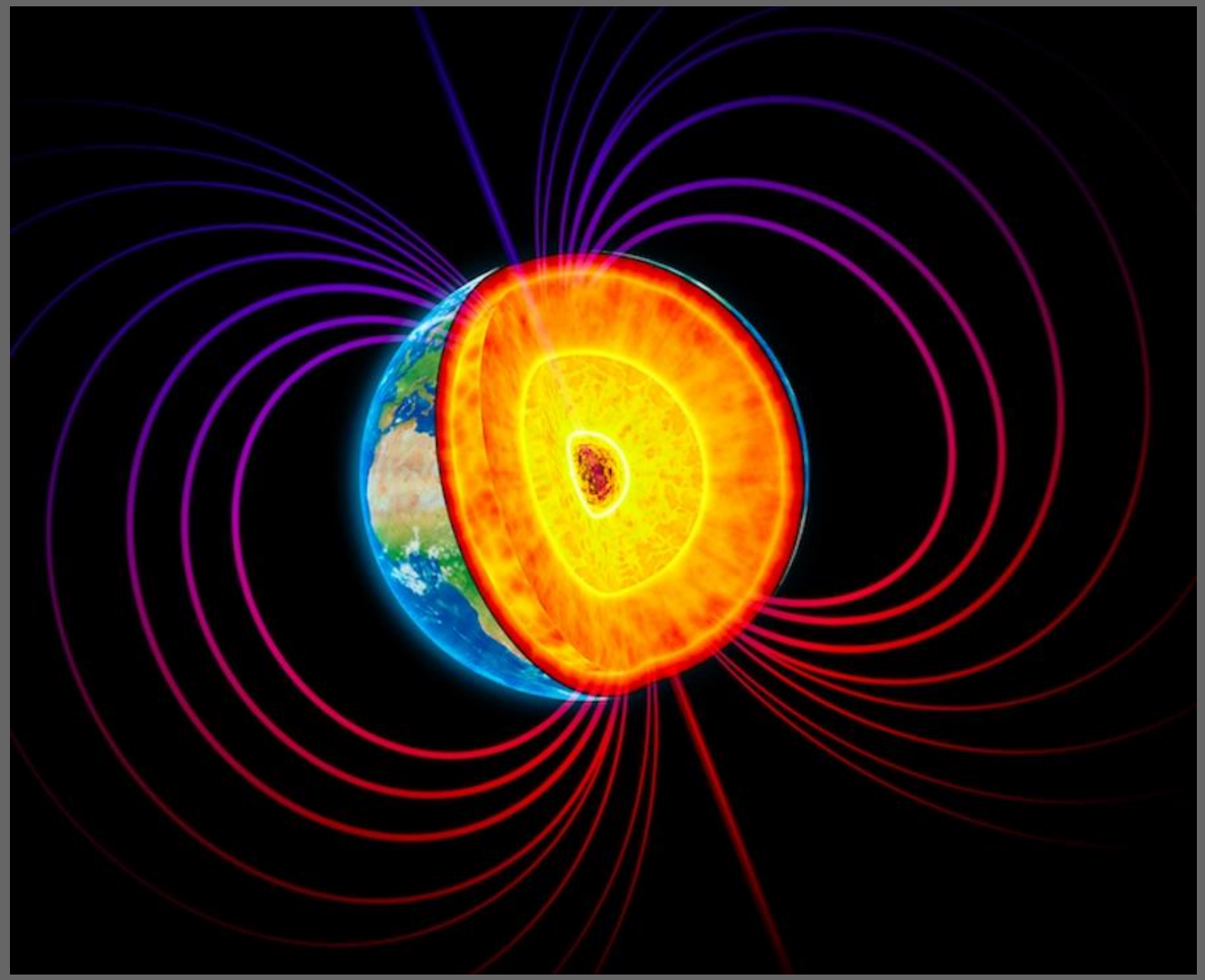
Magnetic Field



The **dynamo theory:**

The core is **extremely hot**

Heat escapes, causing convection & **electrical** currents

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Magnetic Field

A compass will always orient itself according to the Earth's magnetic field…

which is why we always know where the North is!

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4. Plate Tectonics

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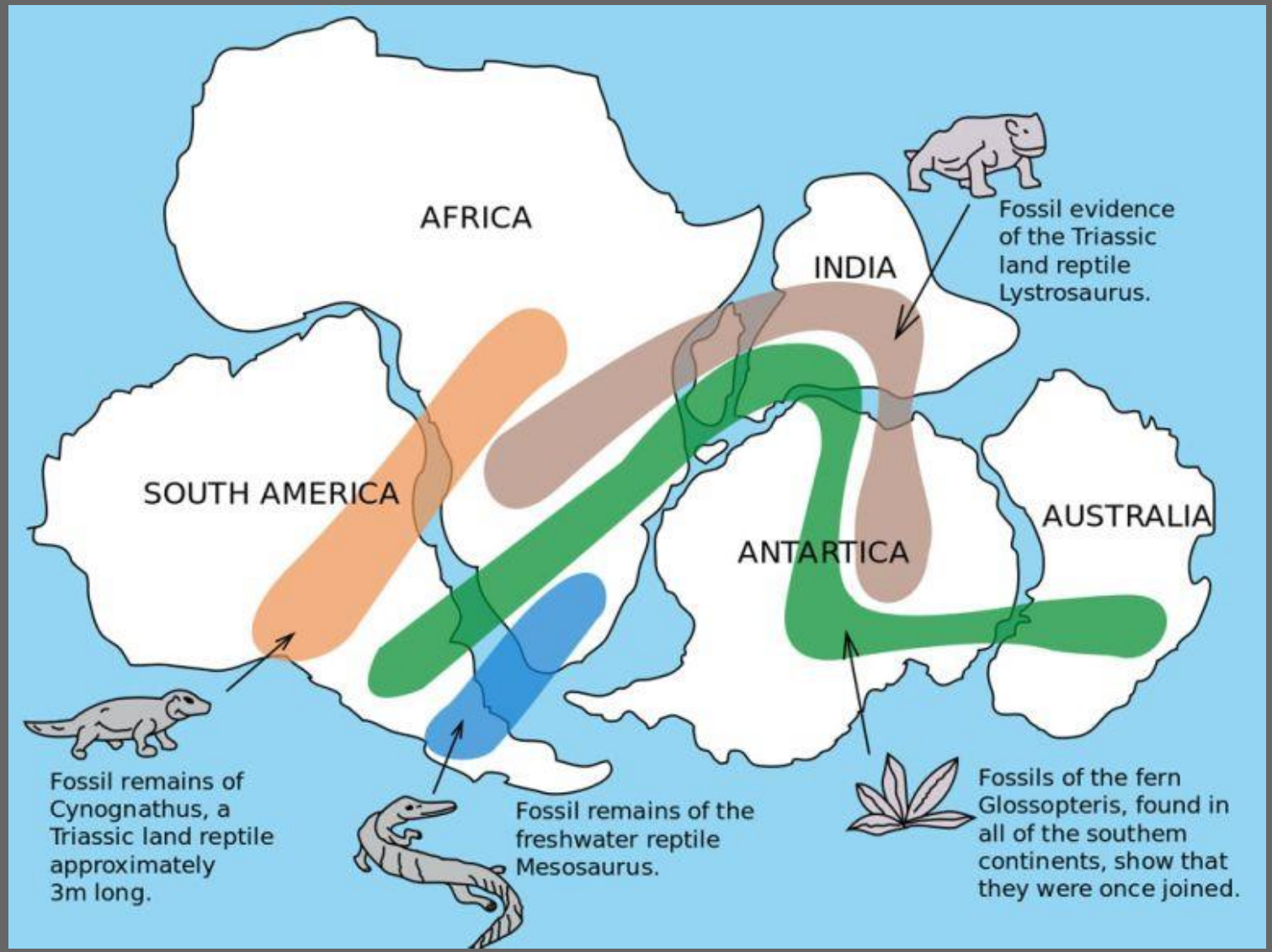
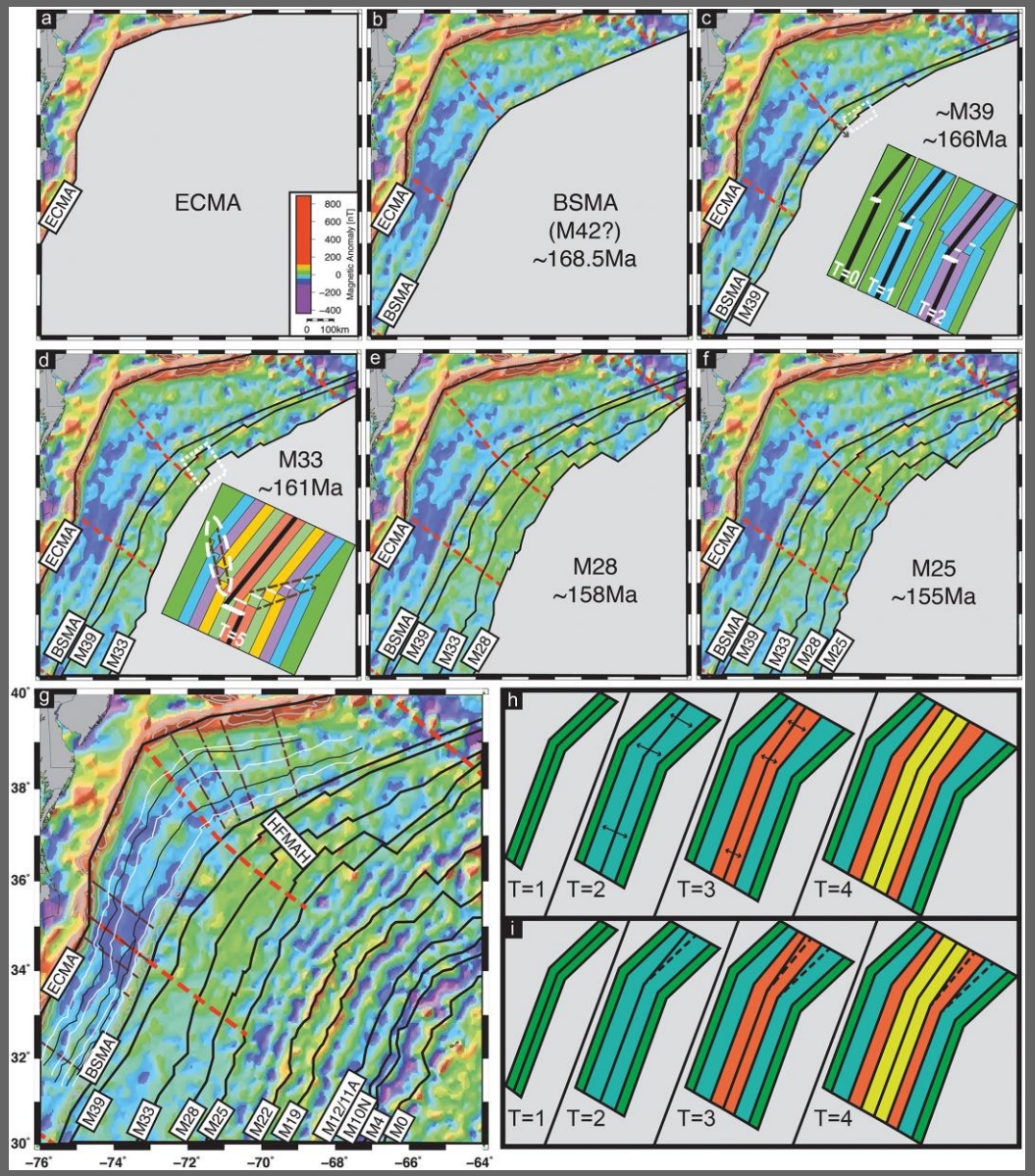
Continental Drift



- 1912, Alfred Wegener
- **Continents had drifted relative to each other (Africa and South America)**

Initially rejected because it lacked a driving mechanism

Towards Modernity



Submarines operating in the Atlantic Ocean in WW2 realized that its bottom had a lot going on:

- **Mountain ranges (mid-ocean ridge)**
- **Magnetic anomalies**

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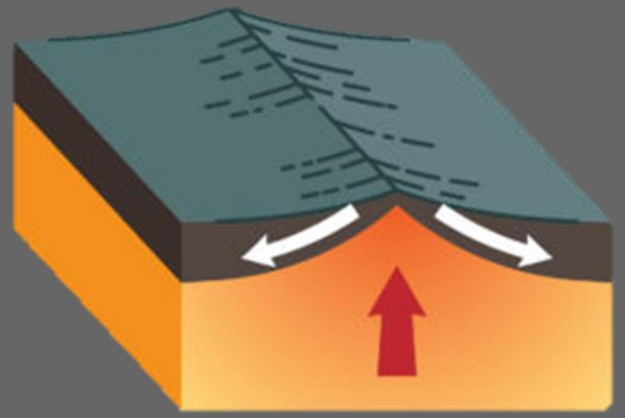
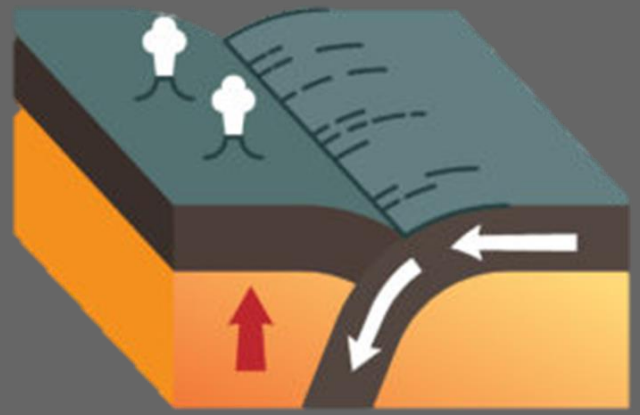
Plate Boundaries

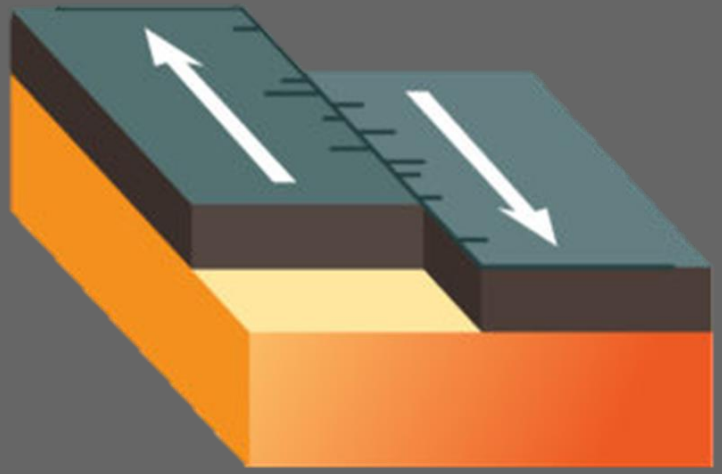
Divergent



Convergent



Transform



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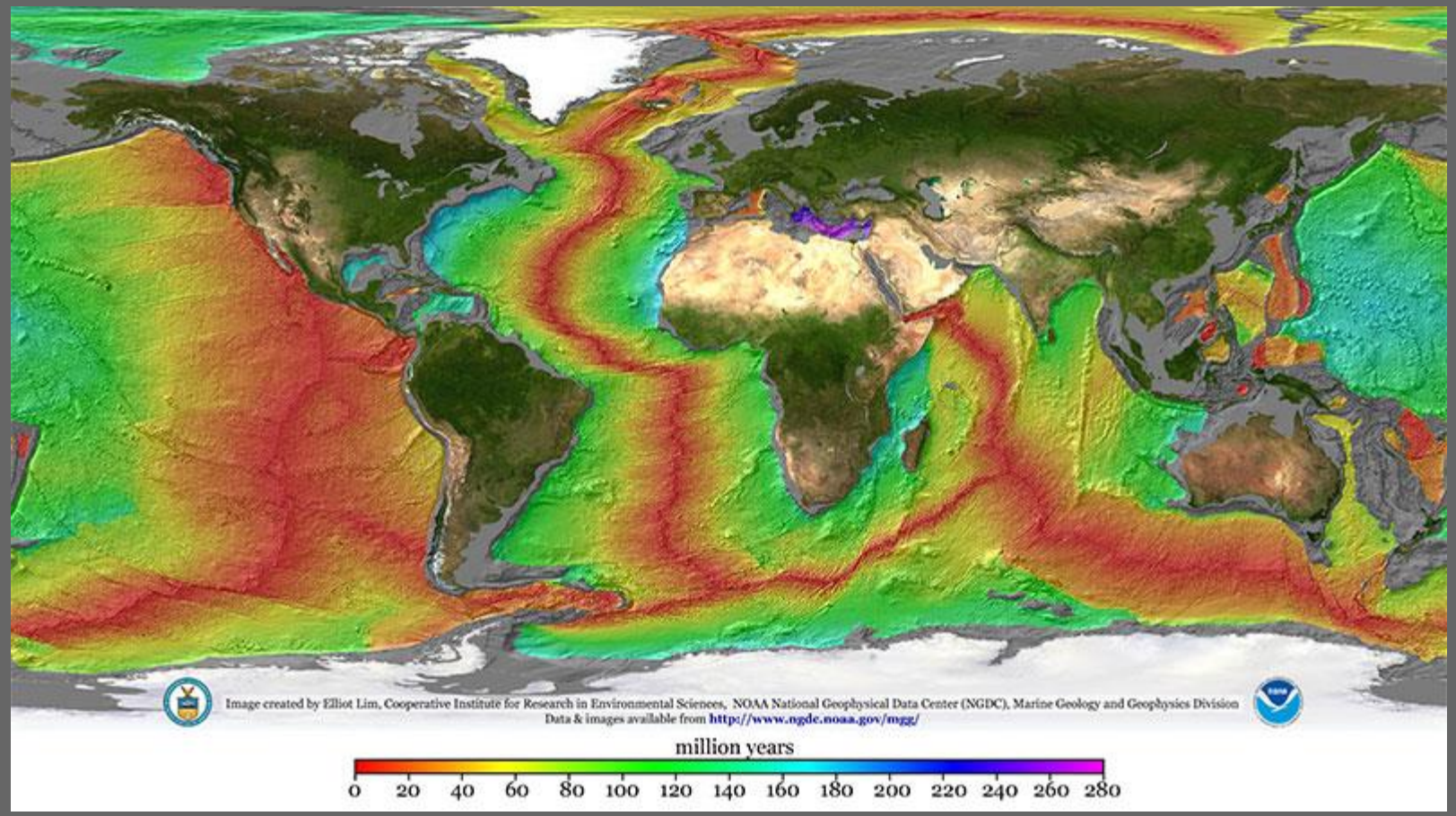
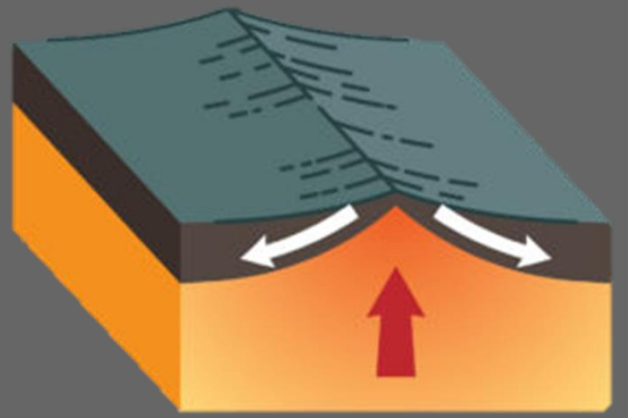
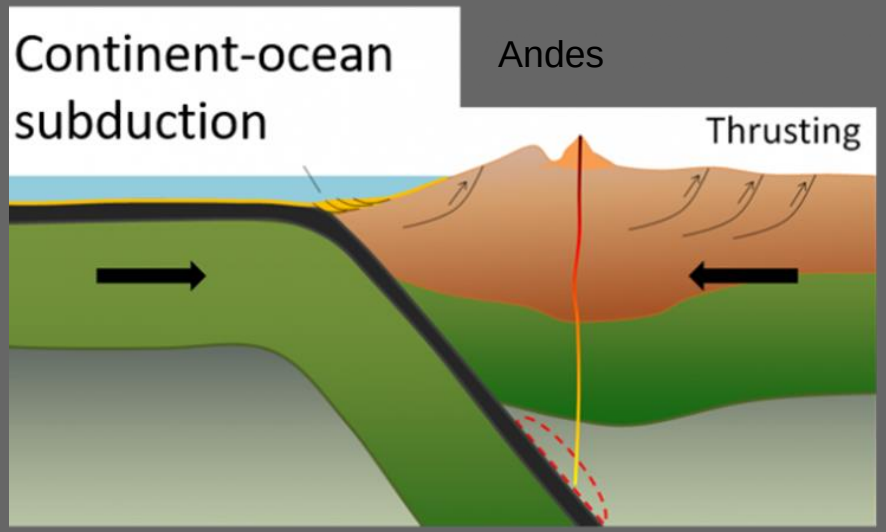
Divergence

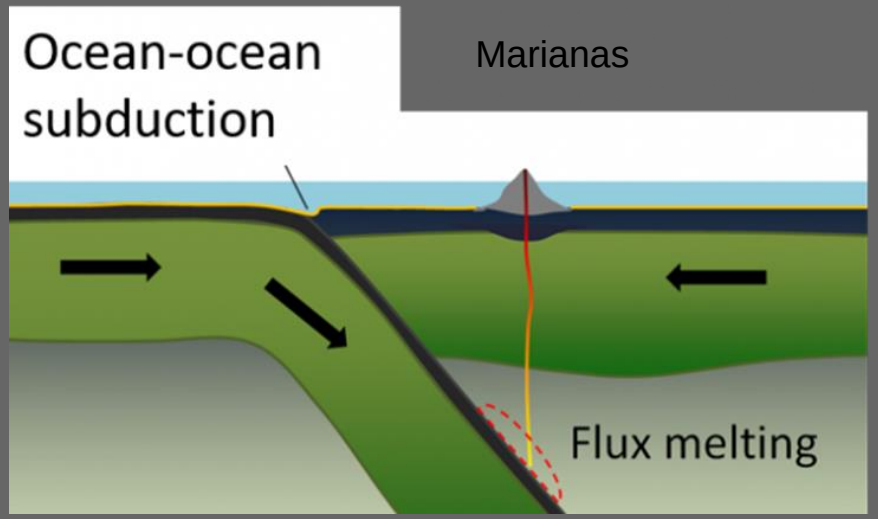


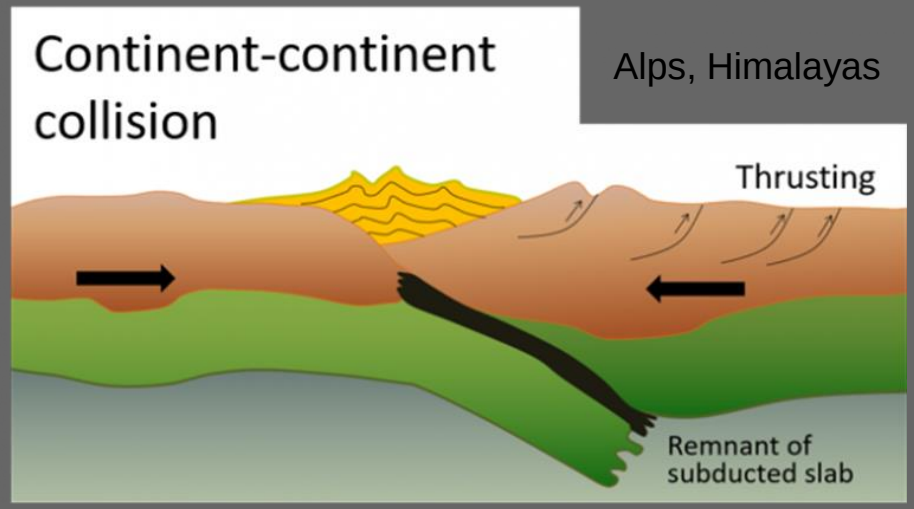
Divergent



Convergence







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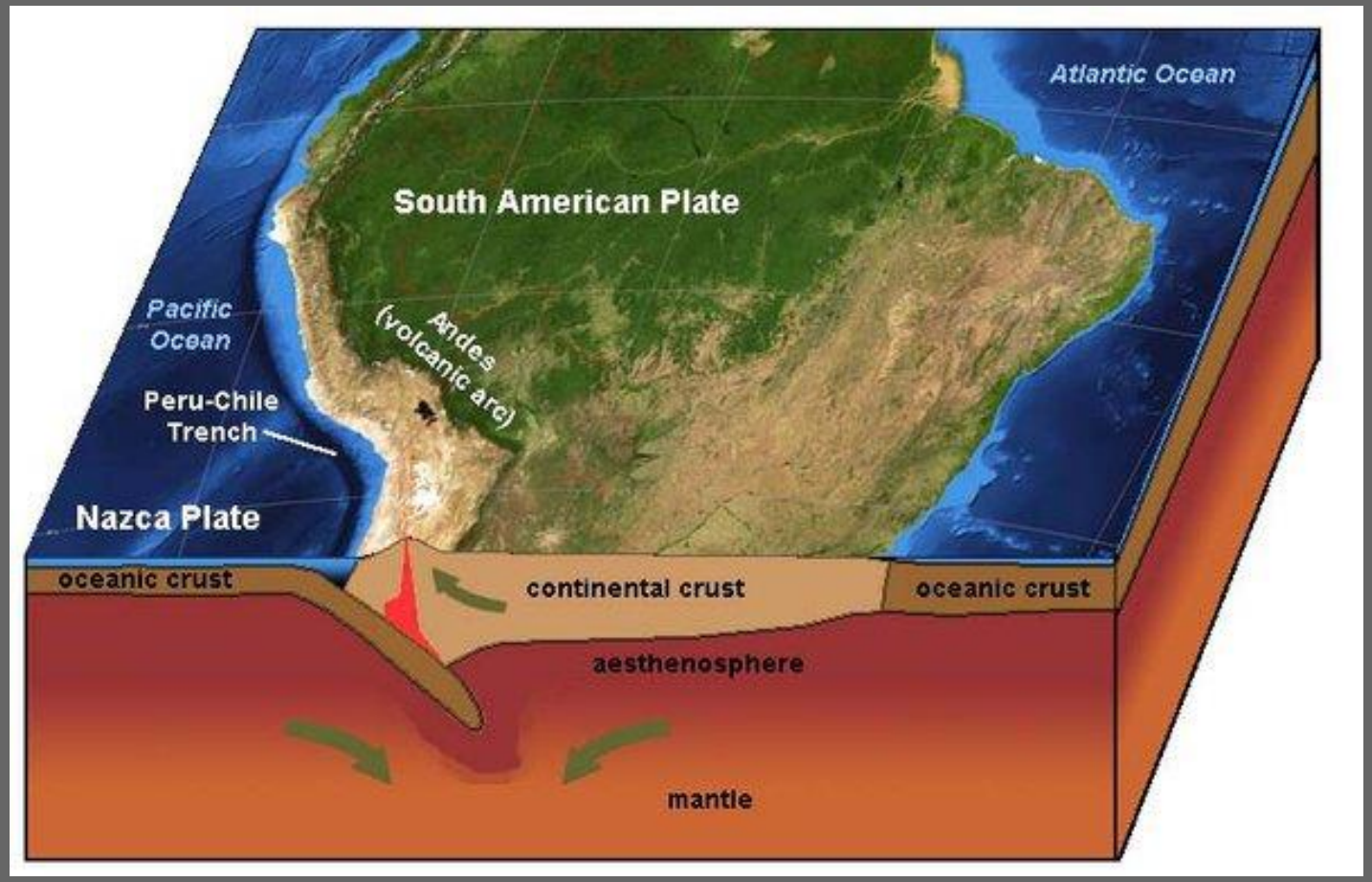
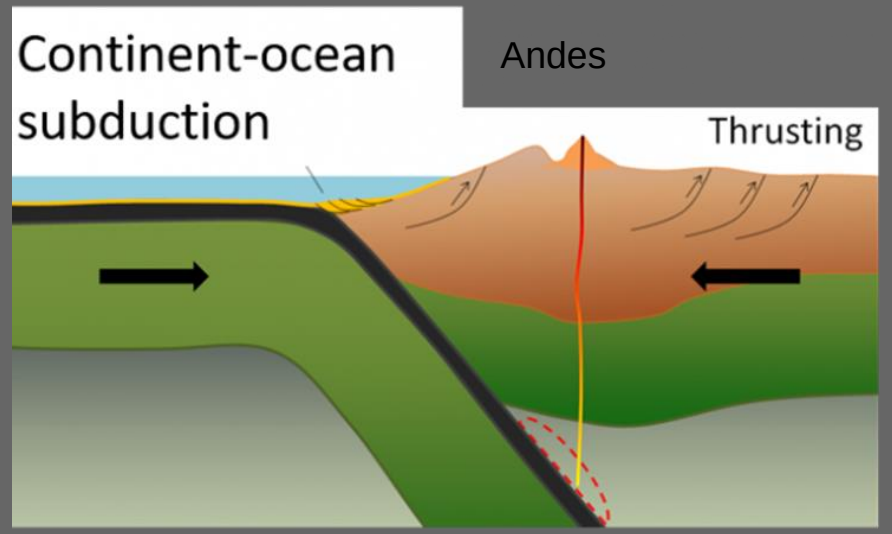
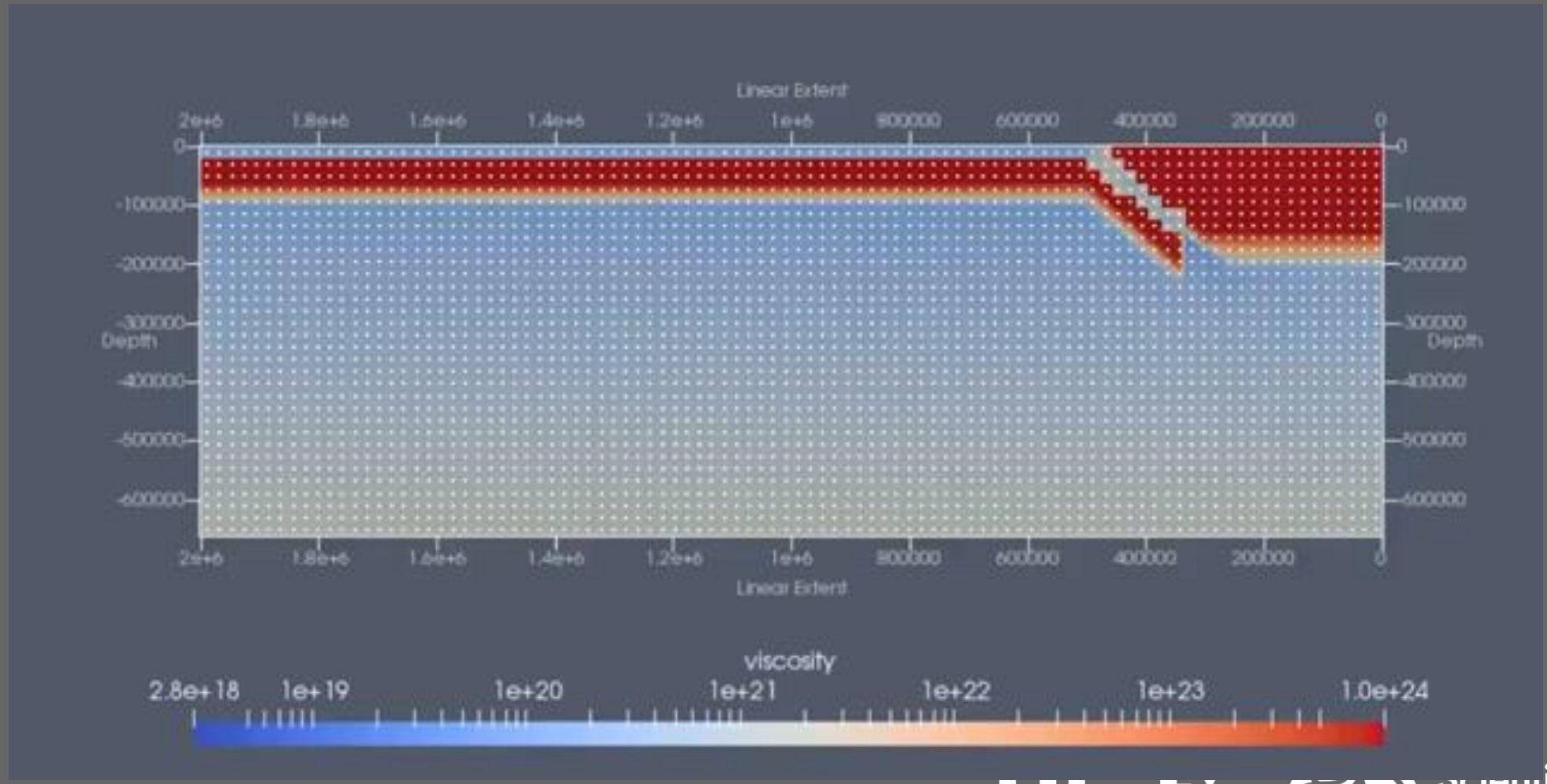
Convergence





Subduction Zones



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Subduction Zones

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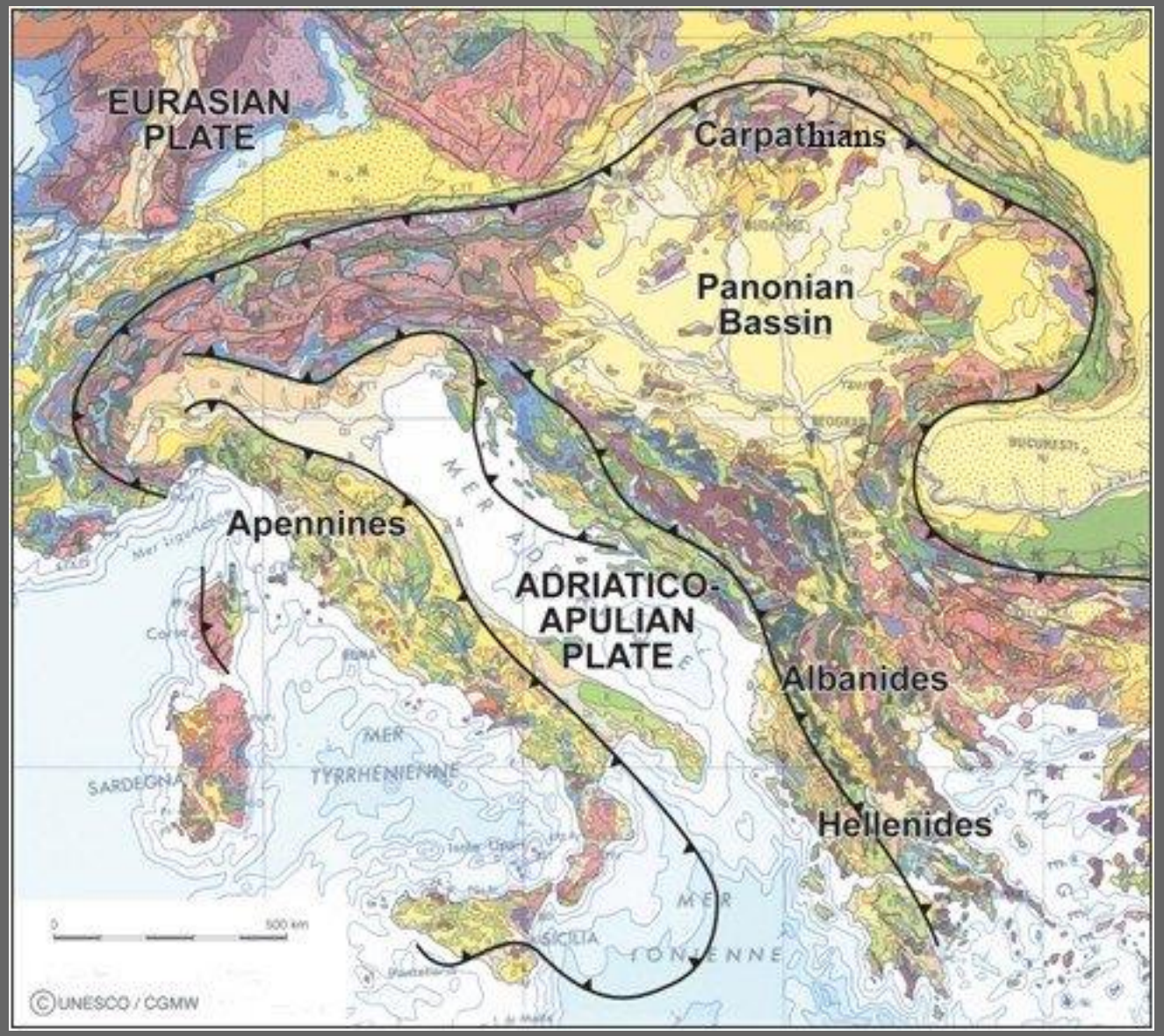
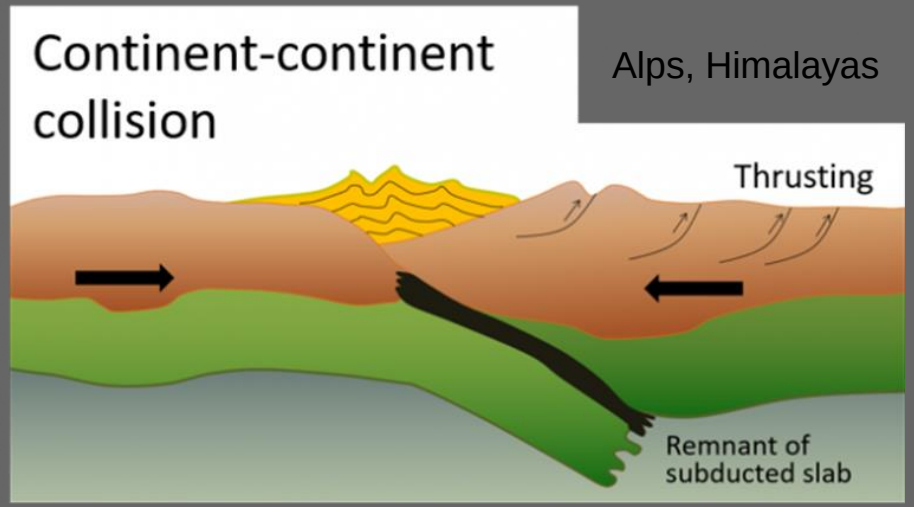
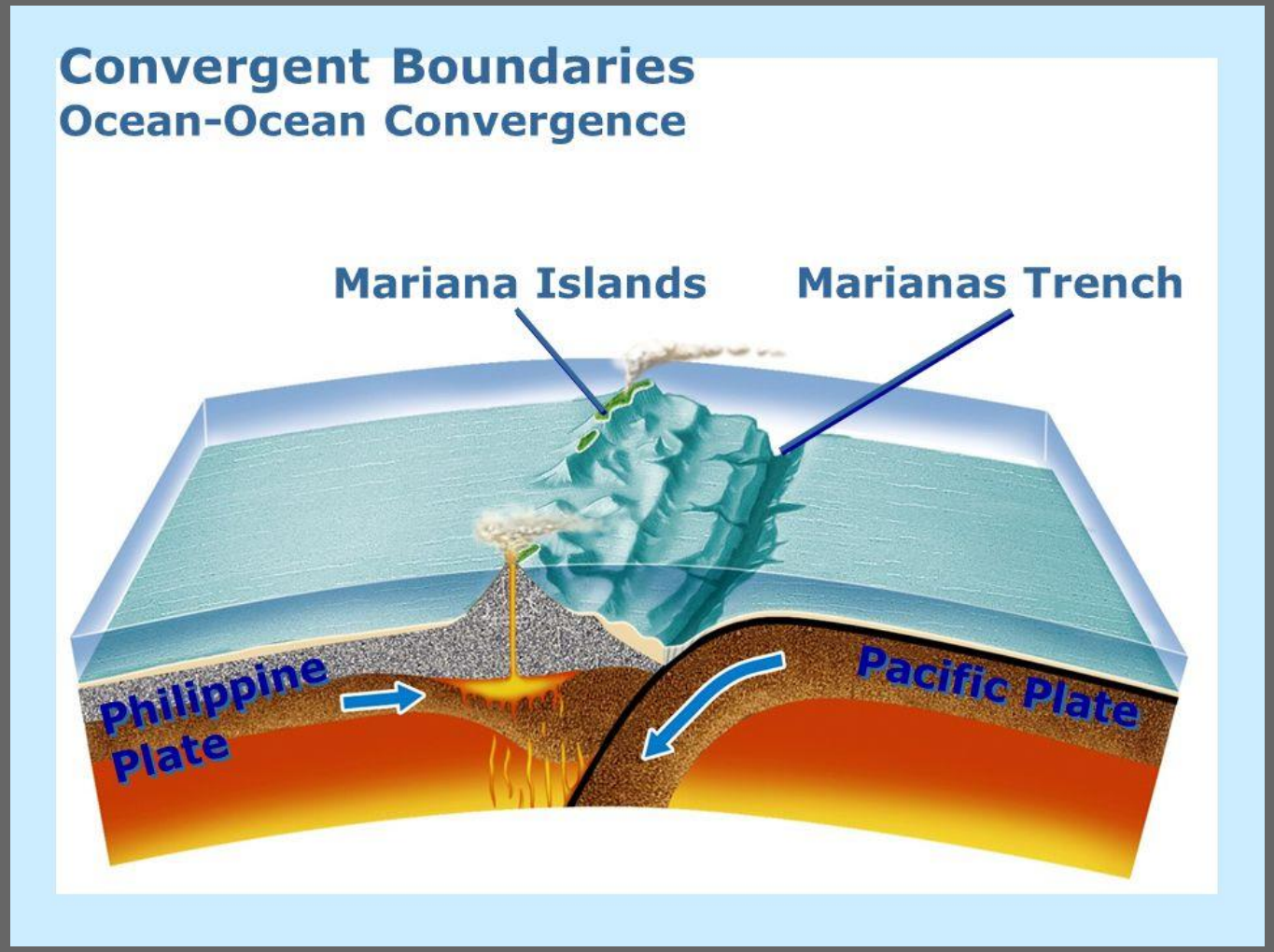
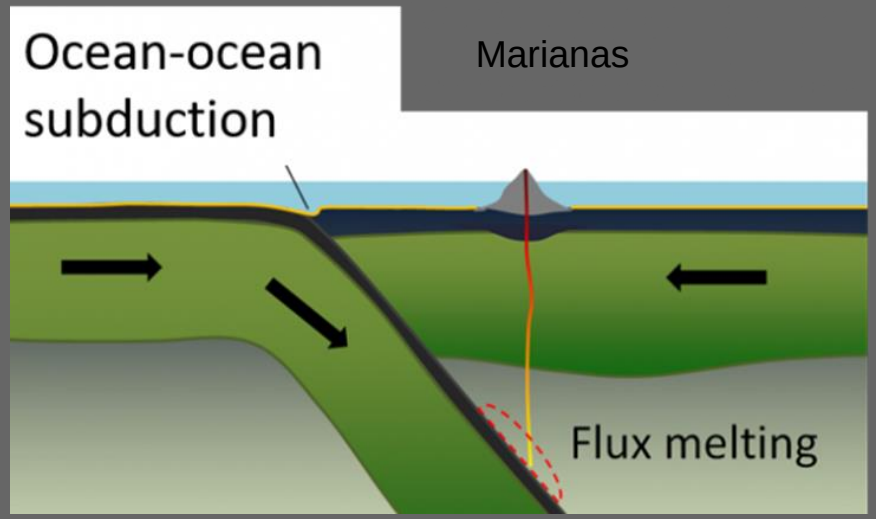
Convergence





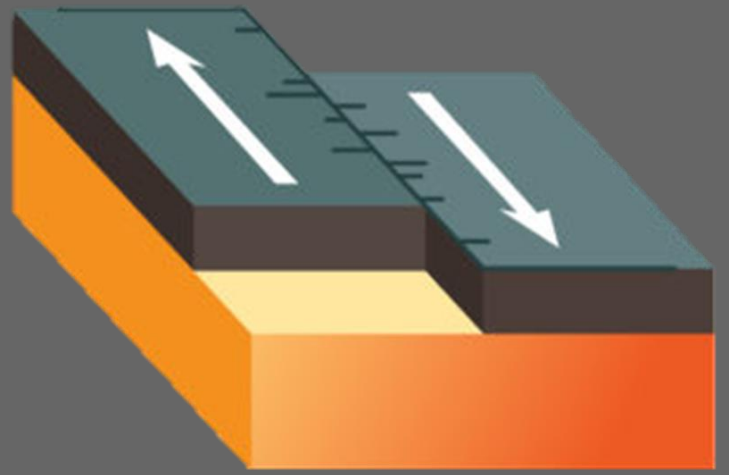
Convergence





Transform

Transform



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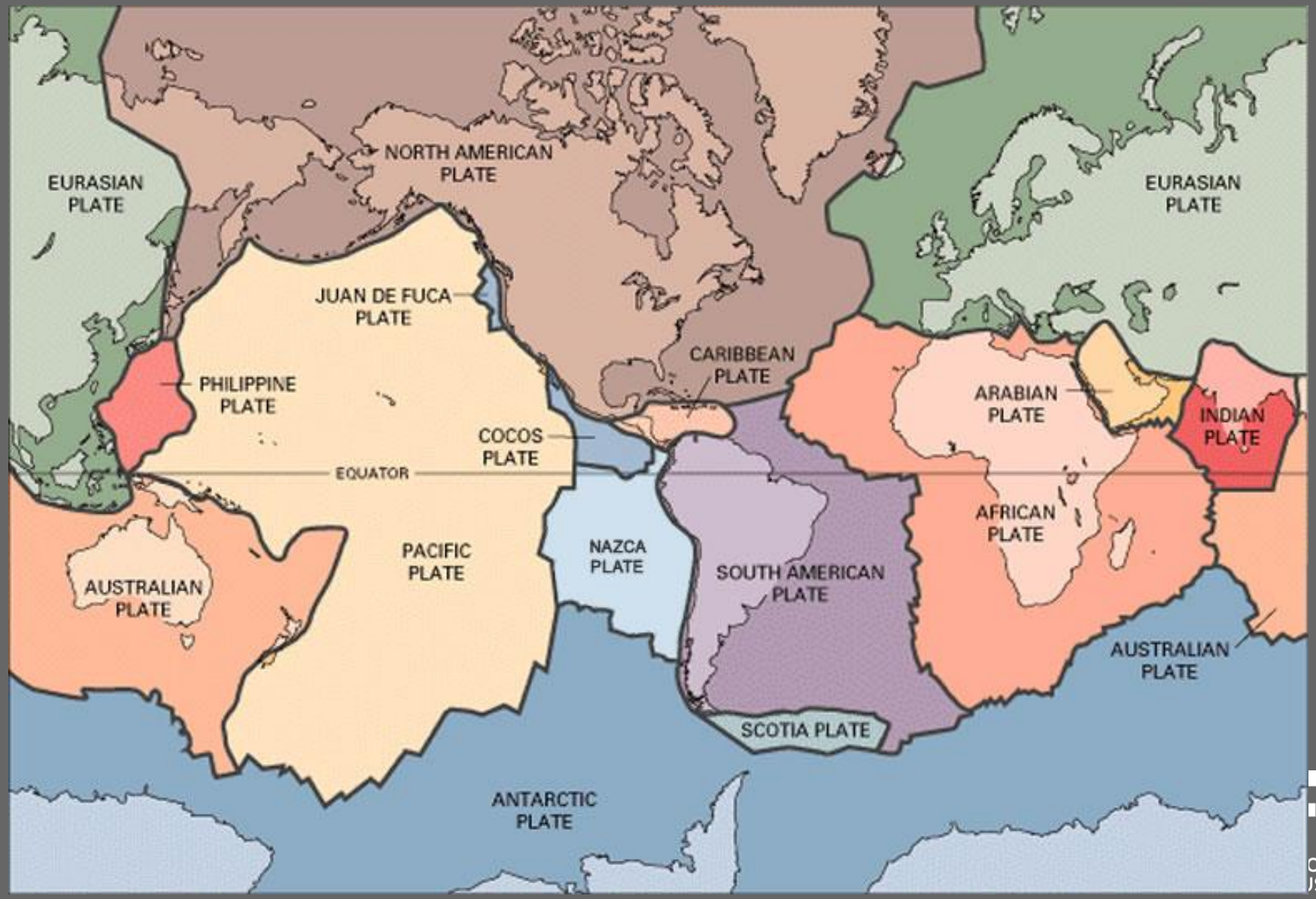
What happens at plate boundaries?



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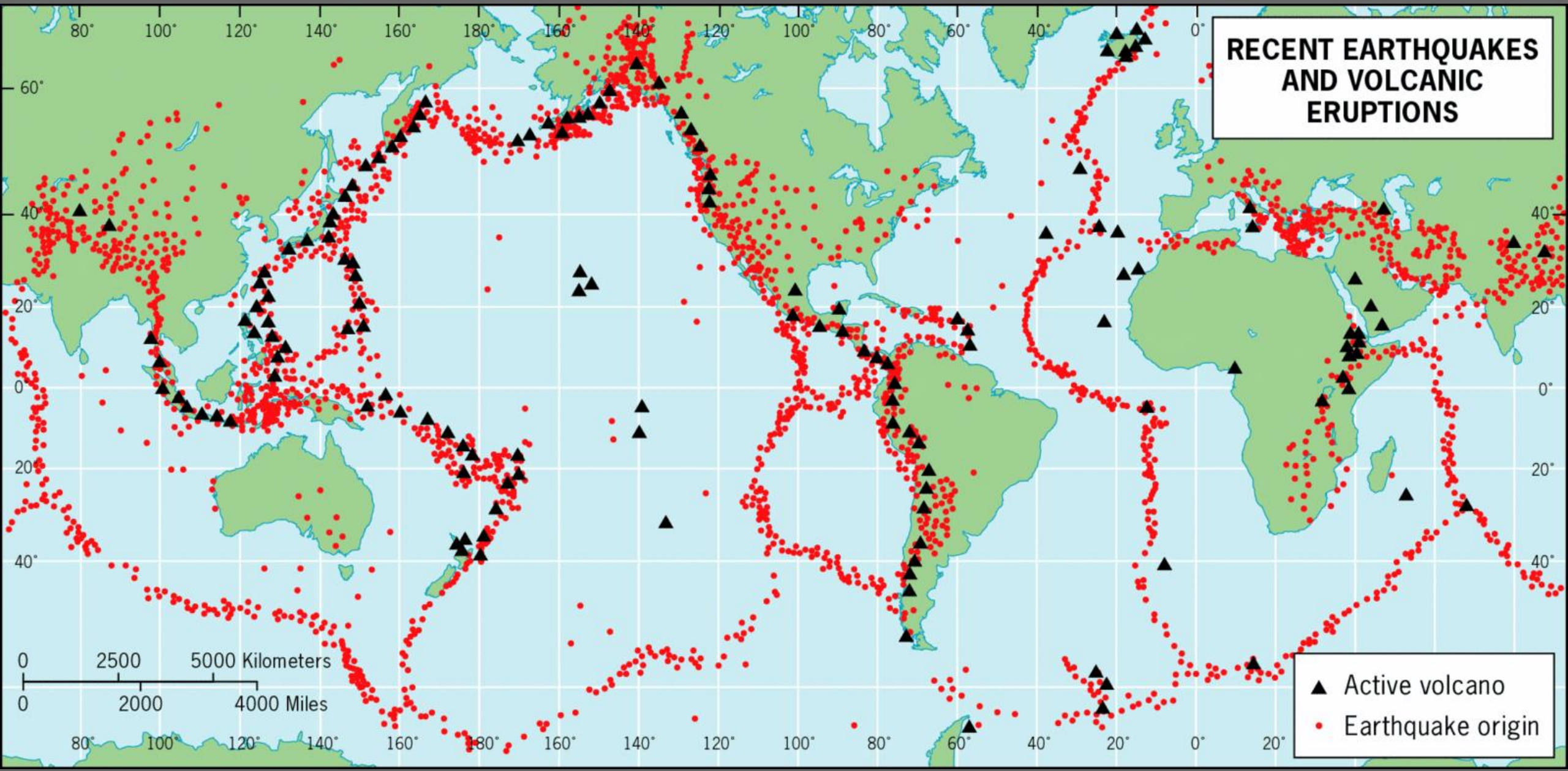
Casual Patterns?



LET'S REVISE TOGETHER!

The outermost layer of the Earth is the ???

The thickest layer of the Earth is the ???

The Earth's magnetic field is generated in the ???

A tectonic plate comprises ??? and ???

There are three types of plate margins: ???, ??? and ???

New rocks are generated at ???

And mountains are generated at ??? margins

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Learn More: bit.ly/SEFSsite

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Ask me any question, or find out more about sciences at **martinamonaco@ufl.edu**

THANK YOU