PLATE TECTONICS

BEGIN

VIDEO #1: INTRODUCTION

1. *Go to the "built-in apps" folder*
2. *Open the "Videos" app*
3. *View the video Entitled "Introduction"*
4. *Answer the questions on your sheet*

PLATE TECTONICS

1. The ***lithosphere*** is broken into large pieces called ***tectonic plates***.

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PLATE TECTONICS

1. The ***lithosphere*** is broken into large pieces called ***tectonic plates***.

2. These plates "float" on top of the ***asthenosphere***.

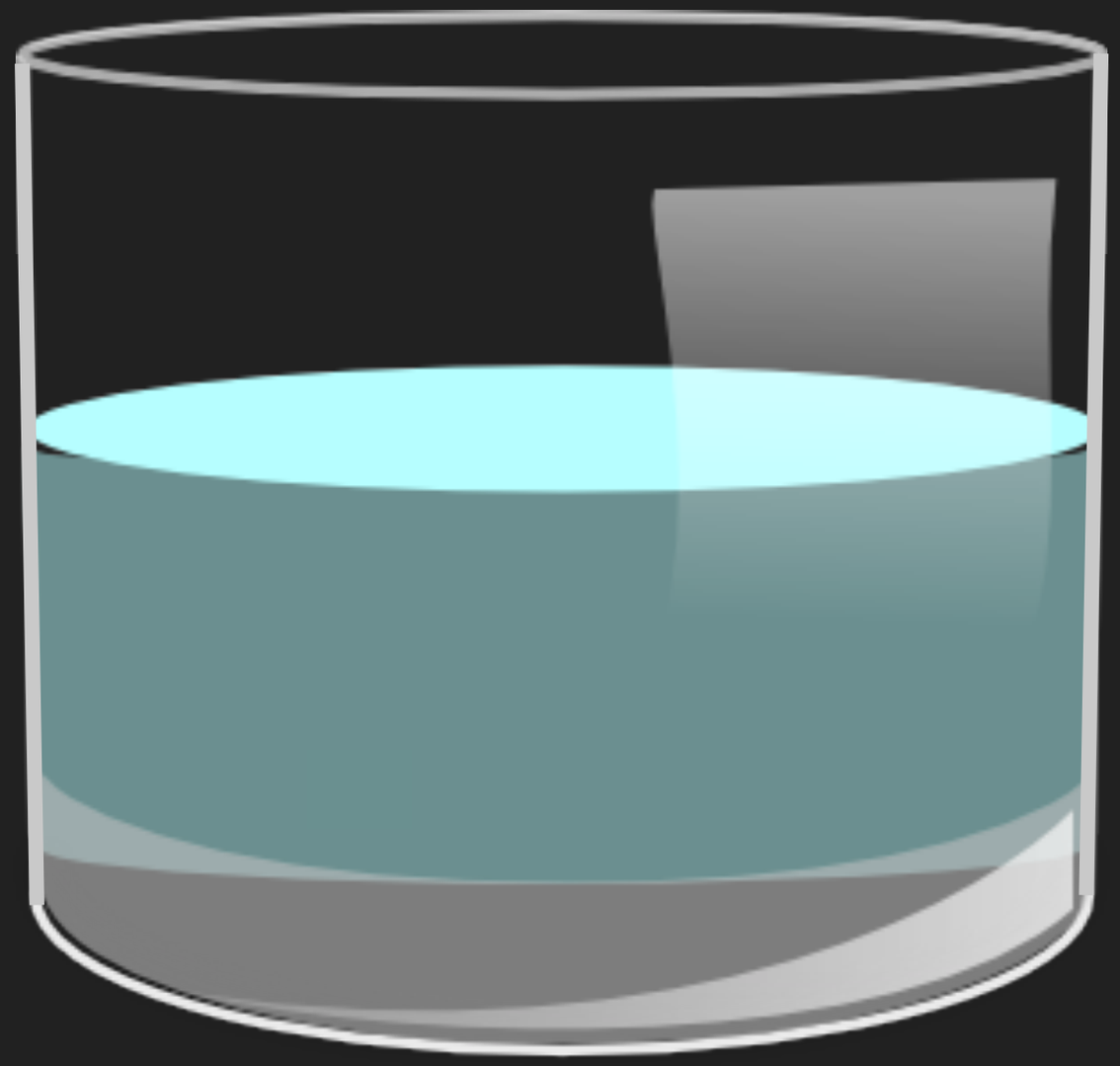
3. Plates are moved by ***convection currents*** in the asthenosphere.

4. Wherever plates meet, ***seismic activity*** occurs. This includes earthquakes, volcanoes, mountain building and trench formation.

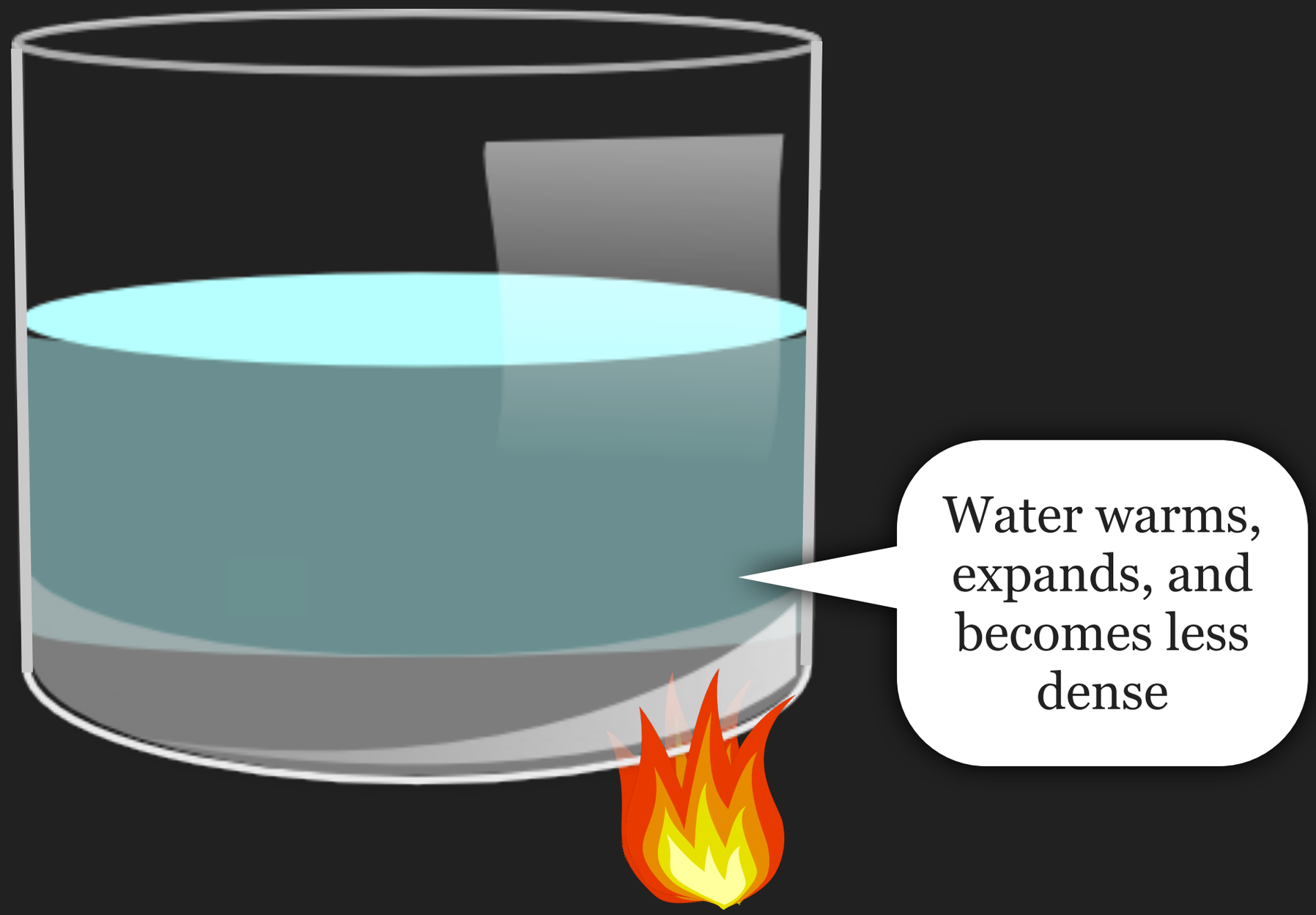
THE KEY TO THIS THEORY IS

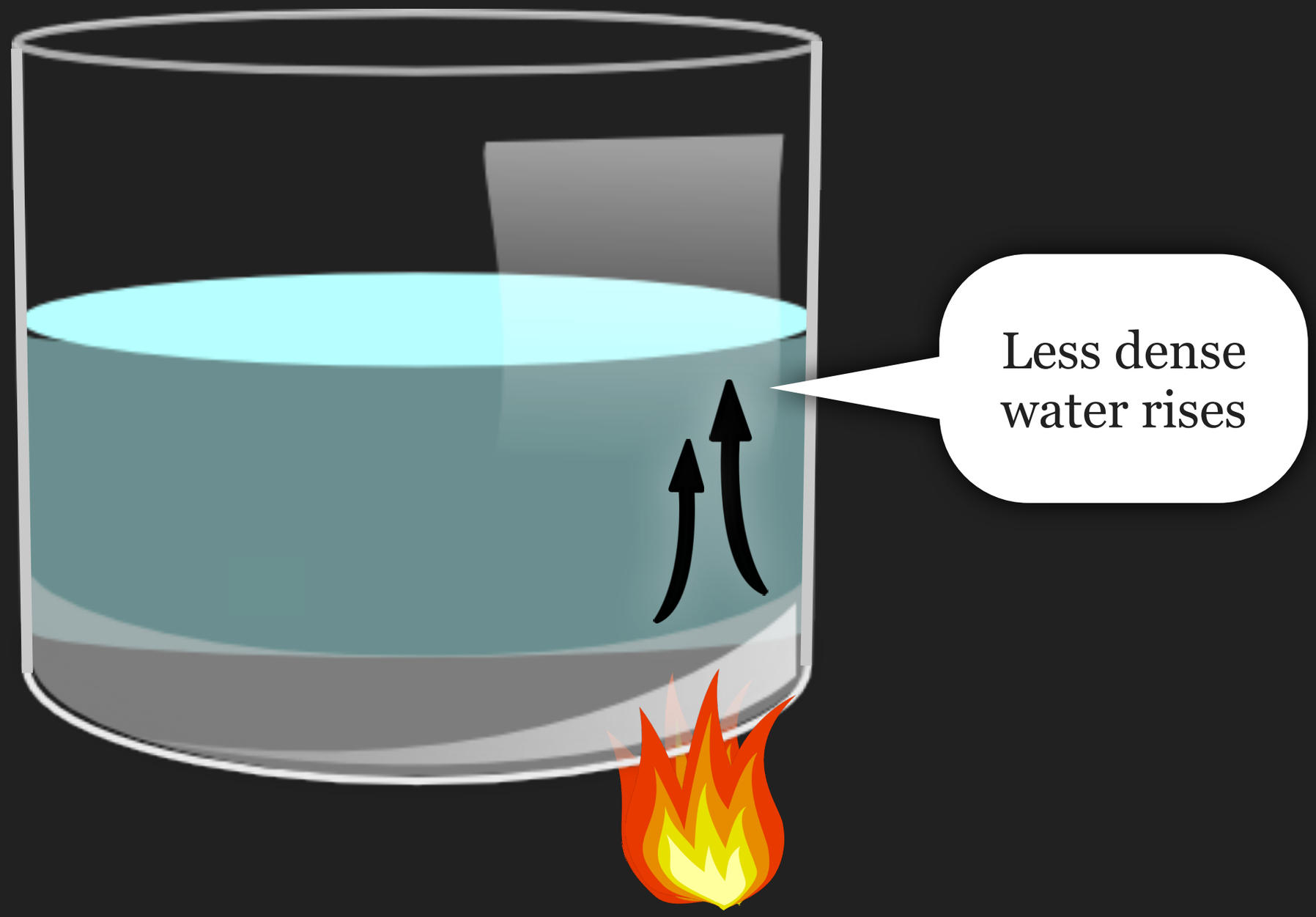
CONVECTION

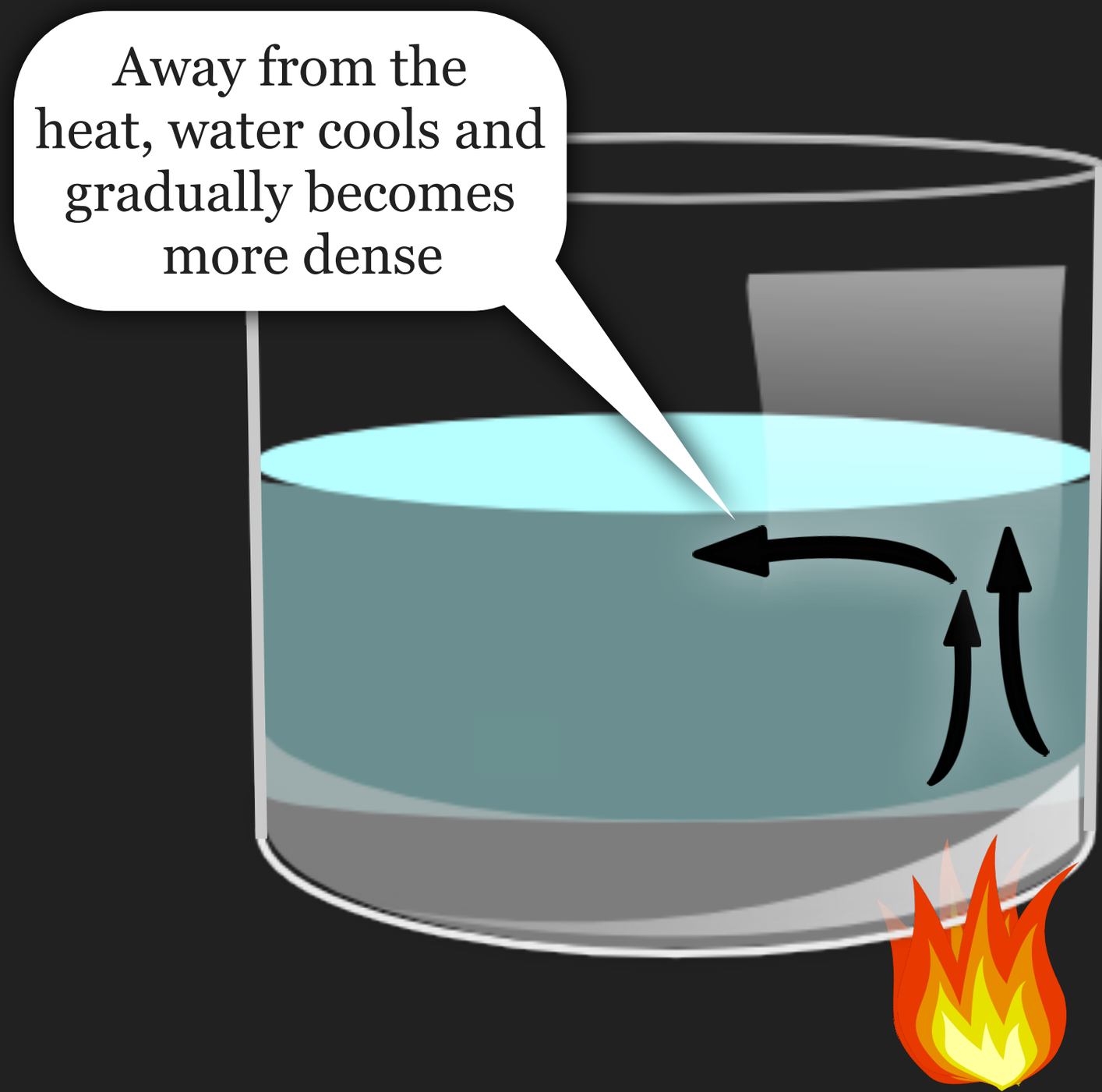
HERE IS A GLASS OF WATER

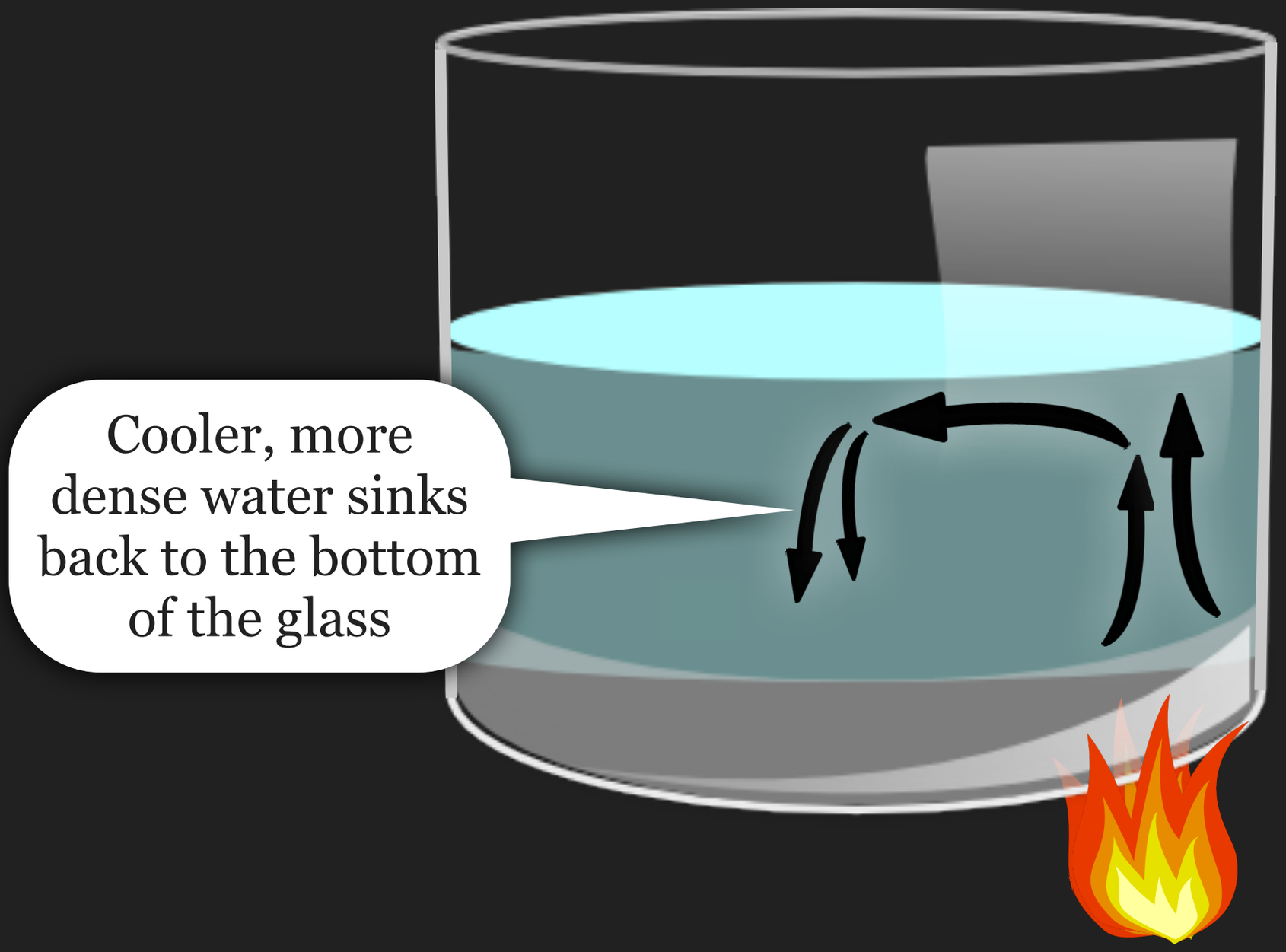


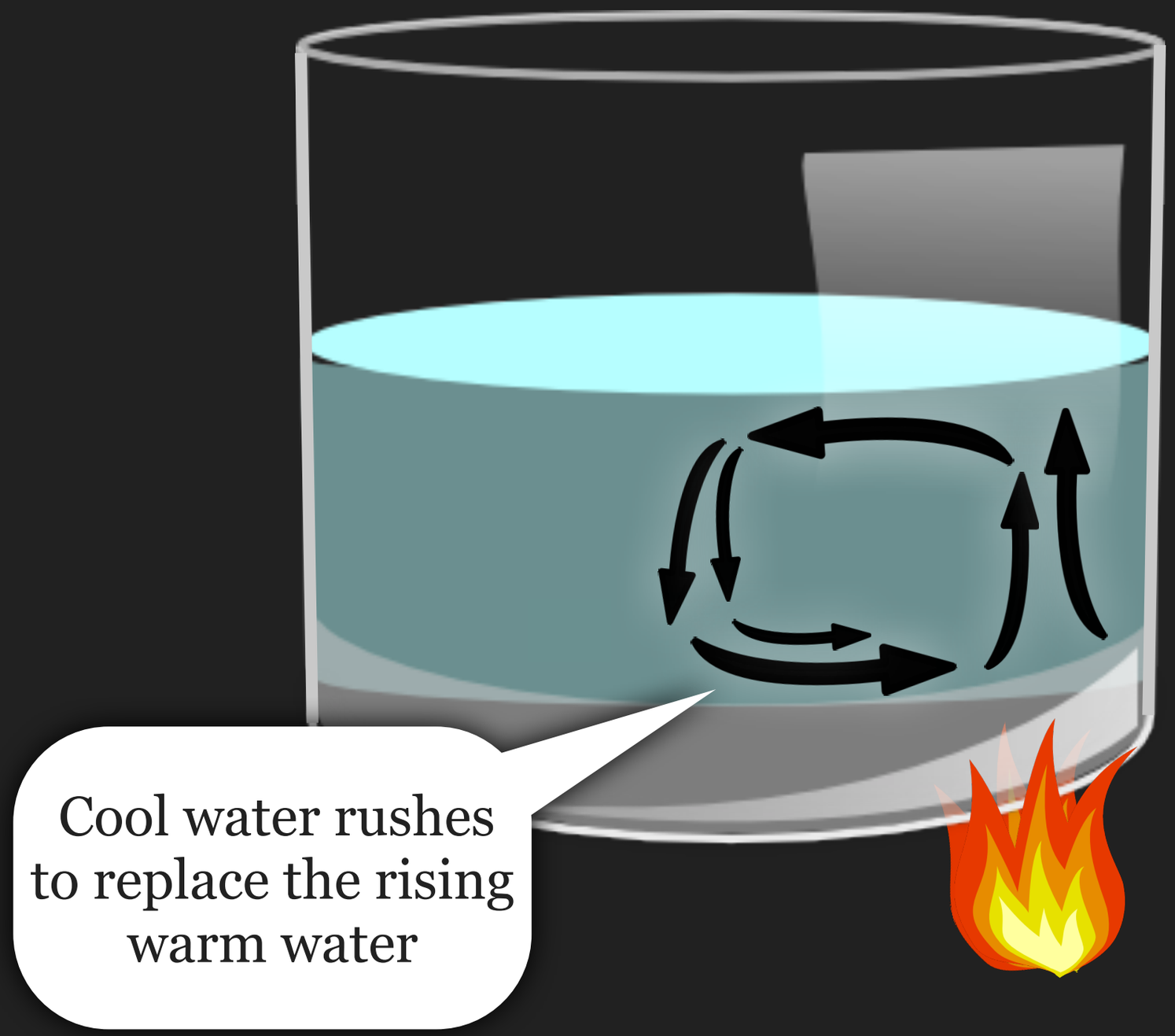
LET’S ADD SOME HEAT...

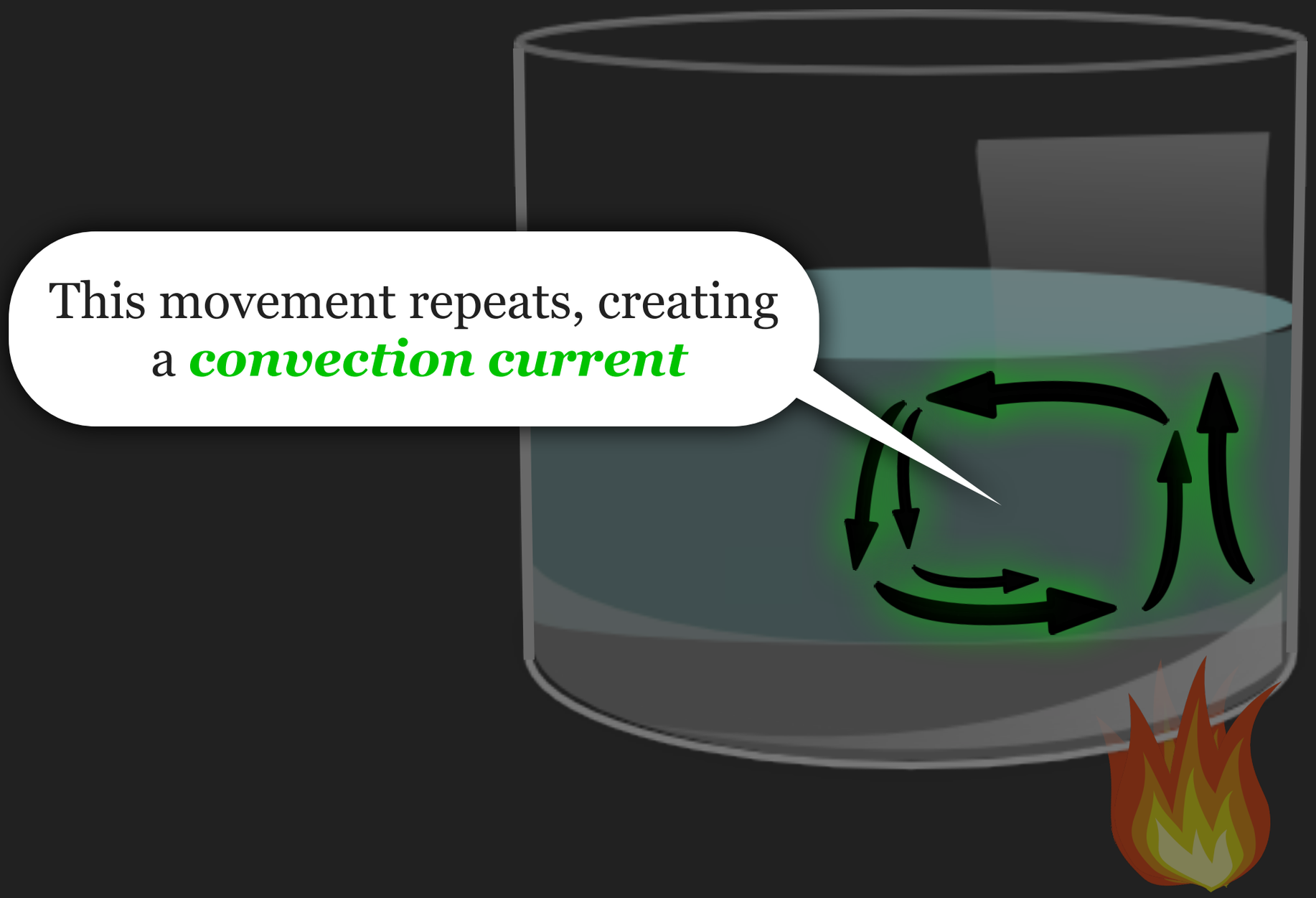

Water warms, expands, and becomes less dense


Less dense
water rises

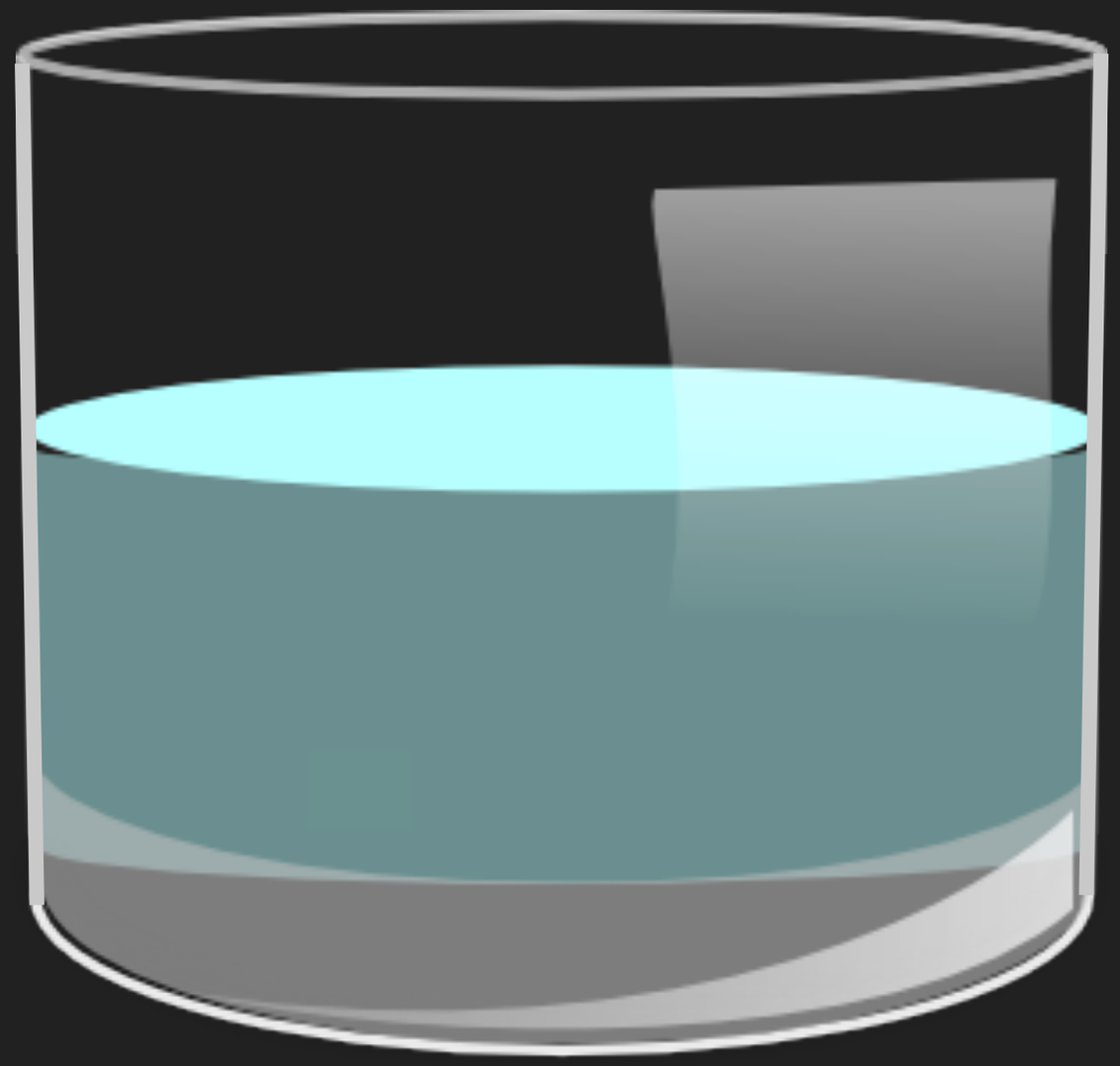

Away from the heat, water cools and gradually becomes more dense


Cooler, more dense water sinks back to the bottom of the glass


Cool water rushes to replace the rising warm water


This movement repeats, creating a *convection current*

WHAT IF WE MOVE THE HEAT TO THE MIDDLE?



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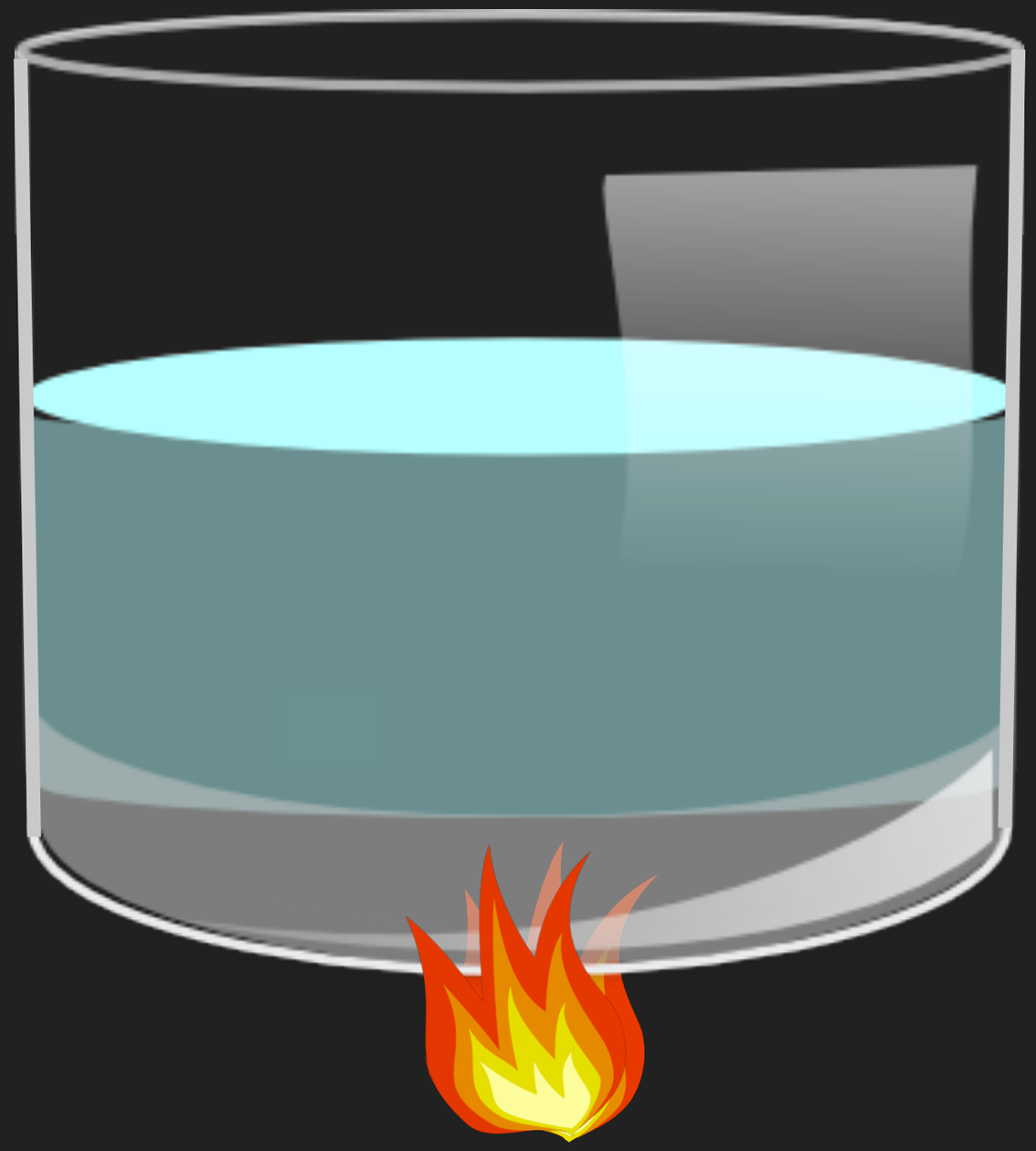

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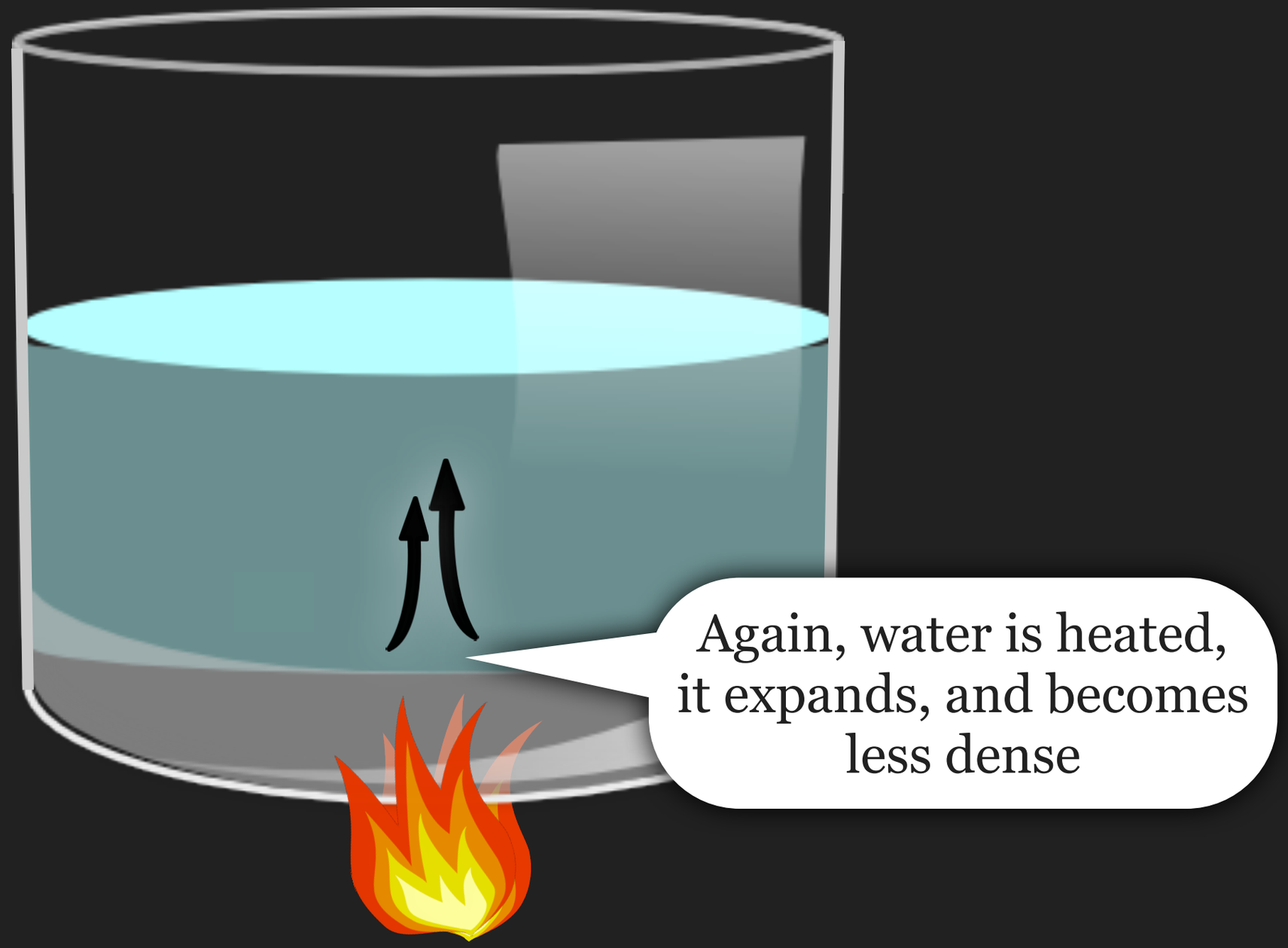

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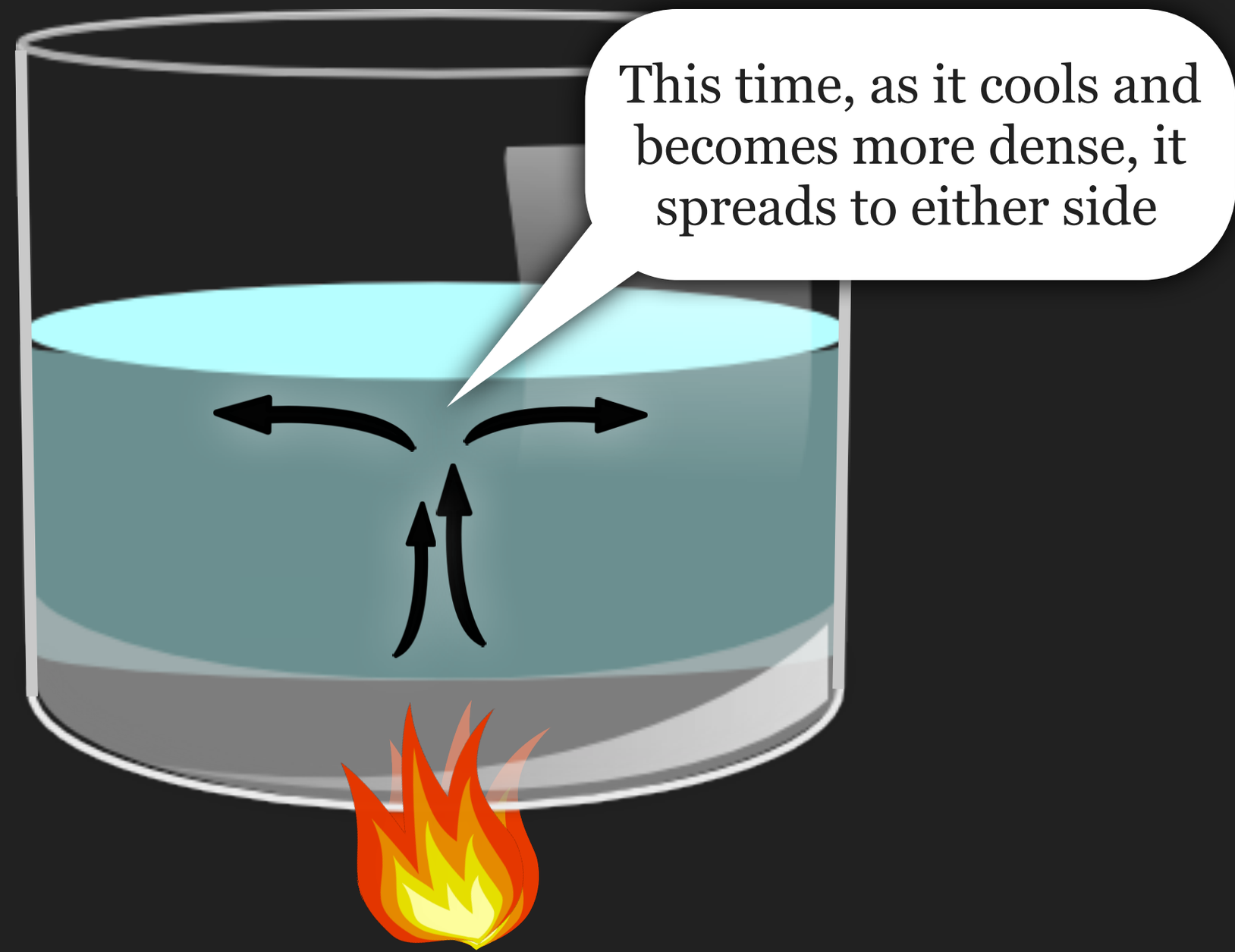

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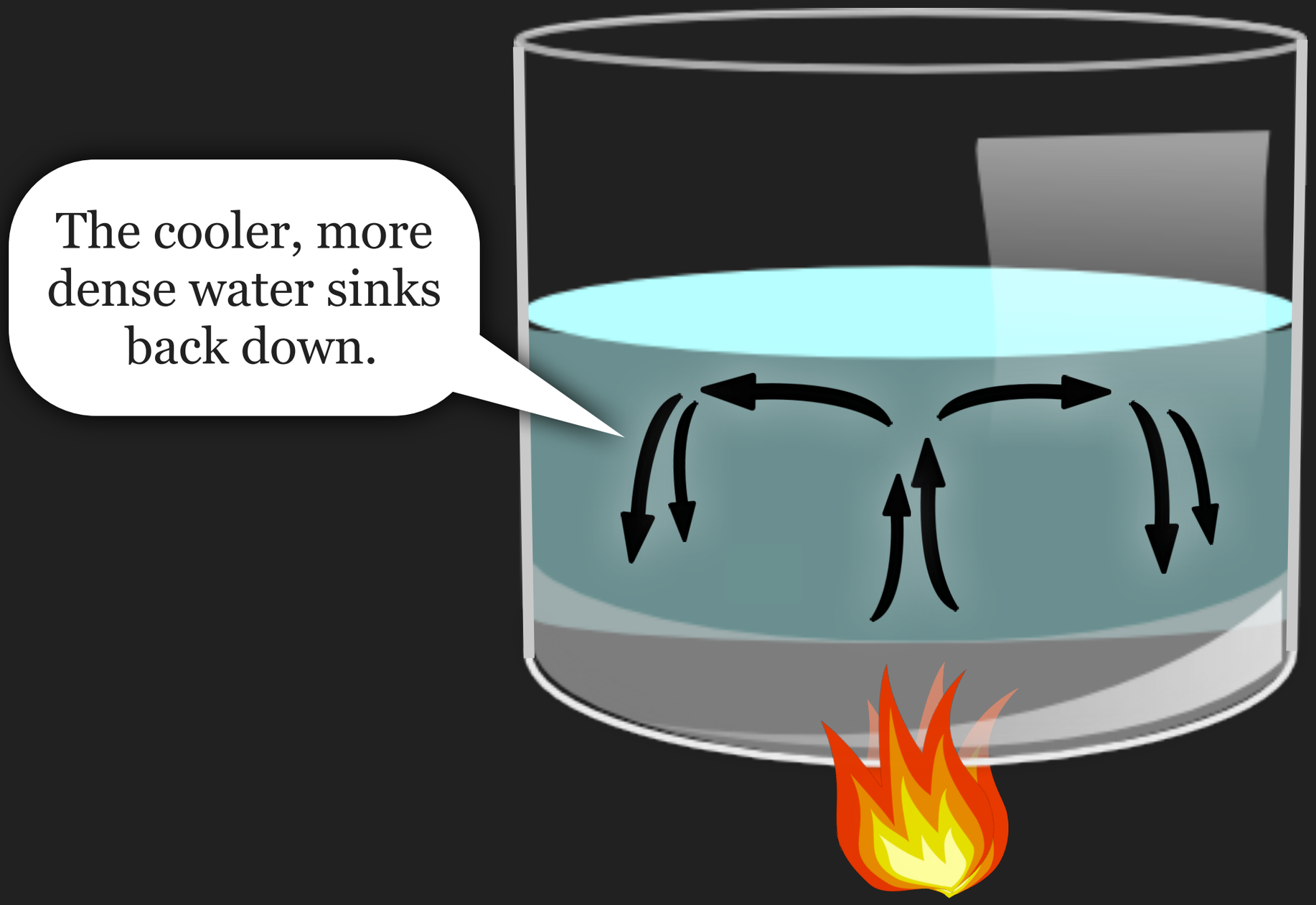

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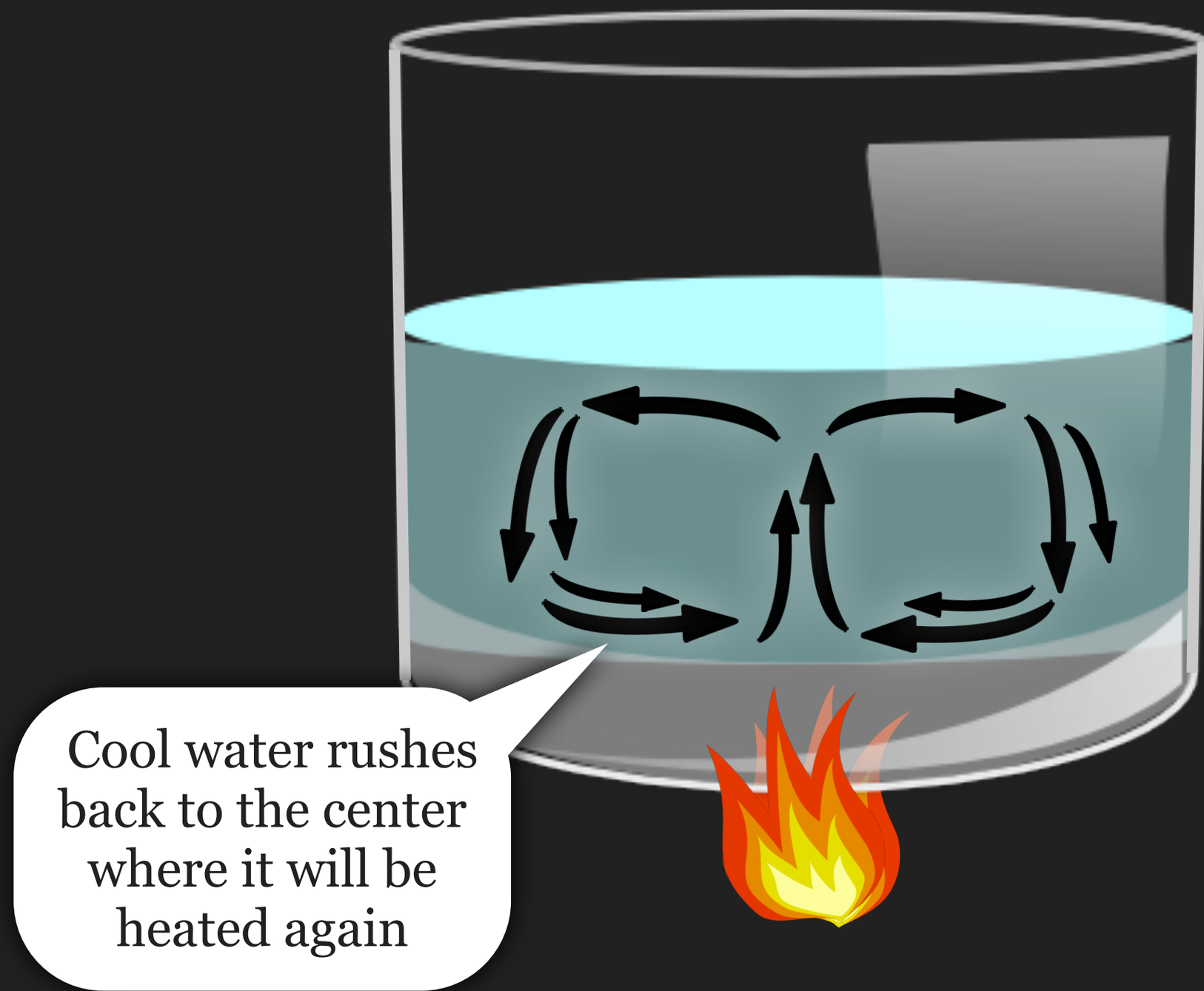

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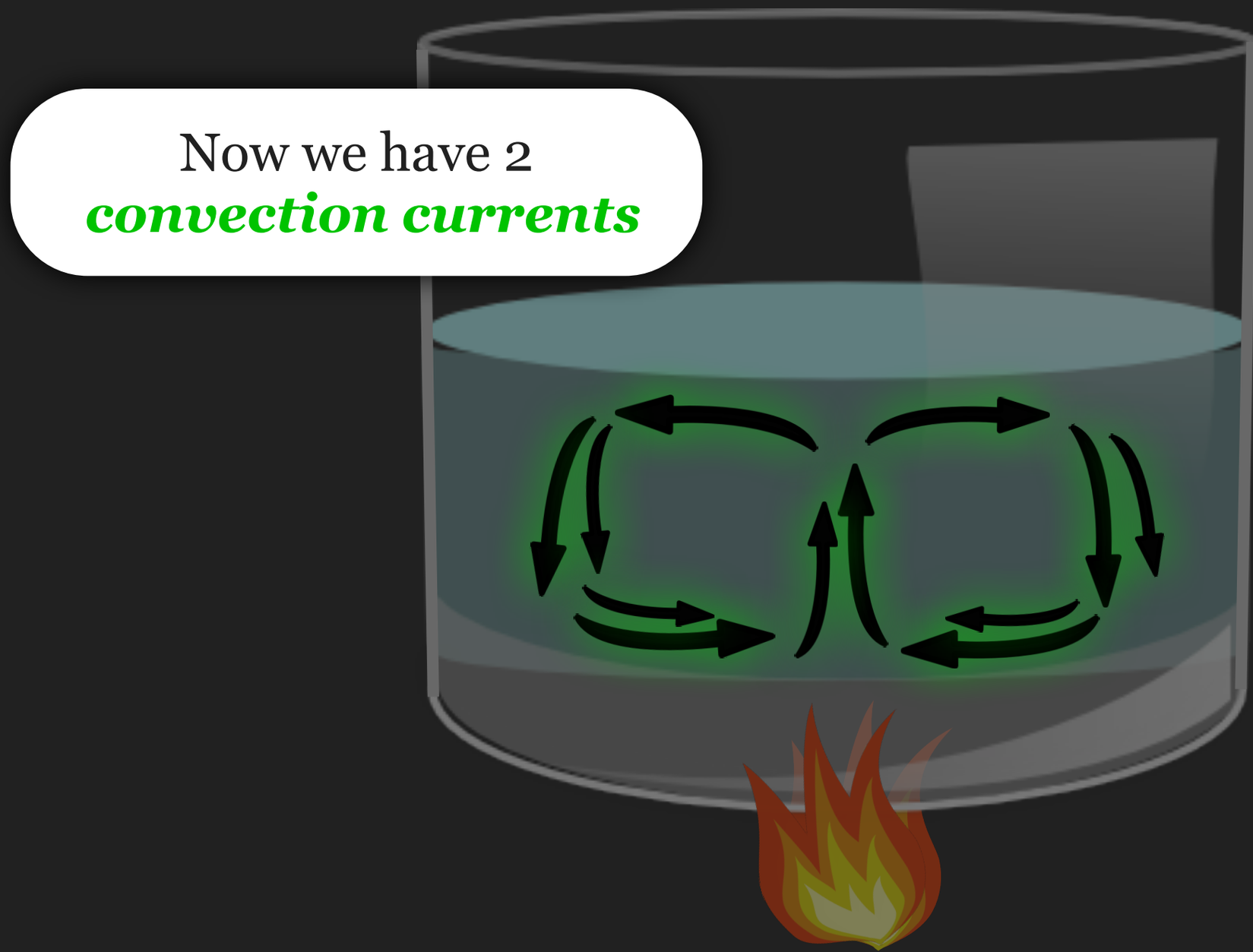

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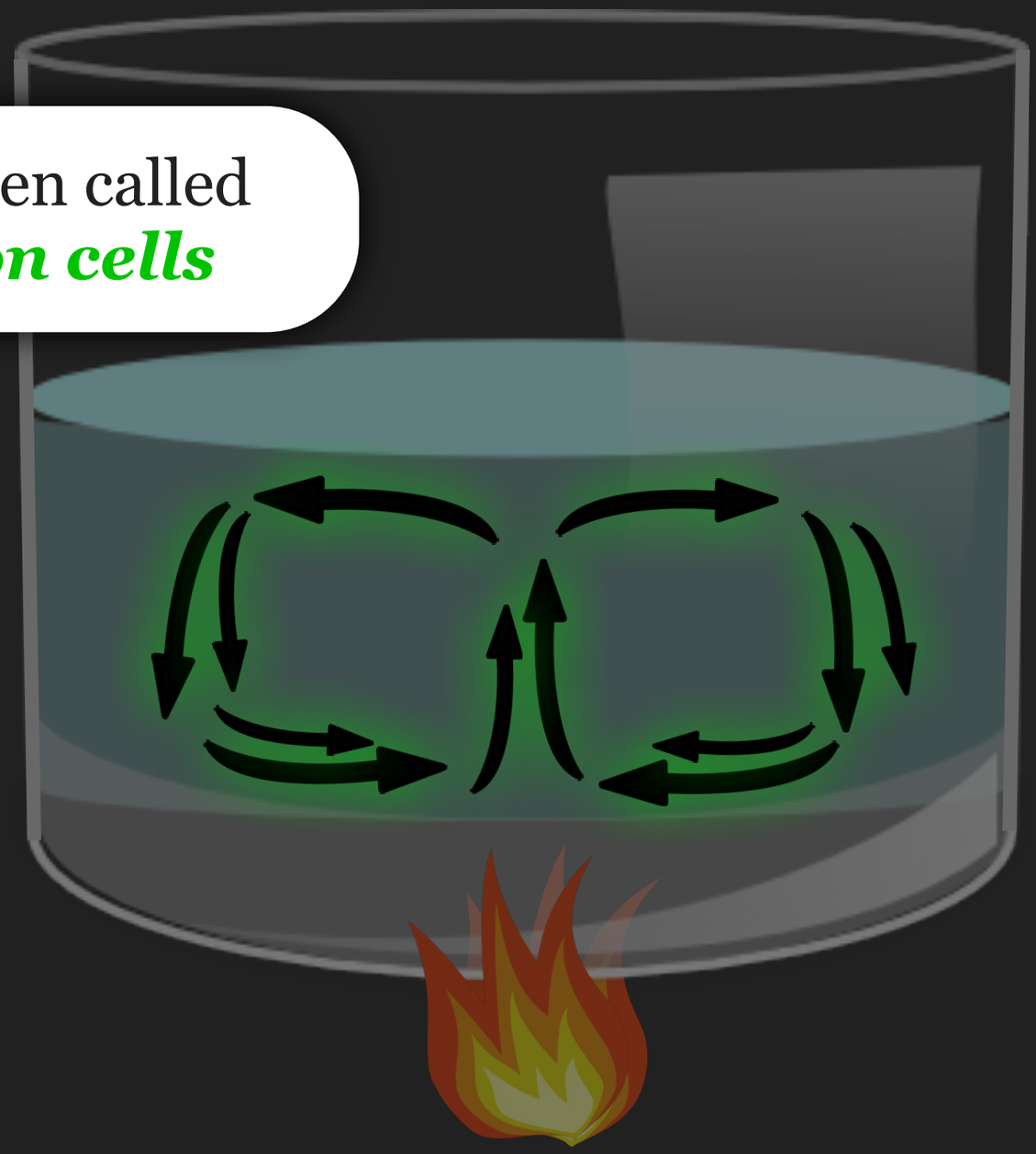


These are often called
convection cells

SO WHAT DOES CONVECTION HAVE TO DO WITH PLATE TECTONICS?

THE PARTIALLY MELTED ROCK IN THE ASTHENOSPHERE SLOWLY FLOWS IN CONVECTION CURRENTS, DRAGGING ALONG THE LITHOSPHERE ABOVE...

THE PARTIALLY MELTED ROCK IN THE ASTHENOSPHERE SLOWLY FLOWS IN CONVECTION CURRENTS, DRAGGING ALONG THE LITHOSPHERE ABOVE...

THIS IS WHAT MAKES THE PLATES MOVE.

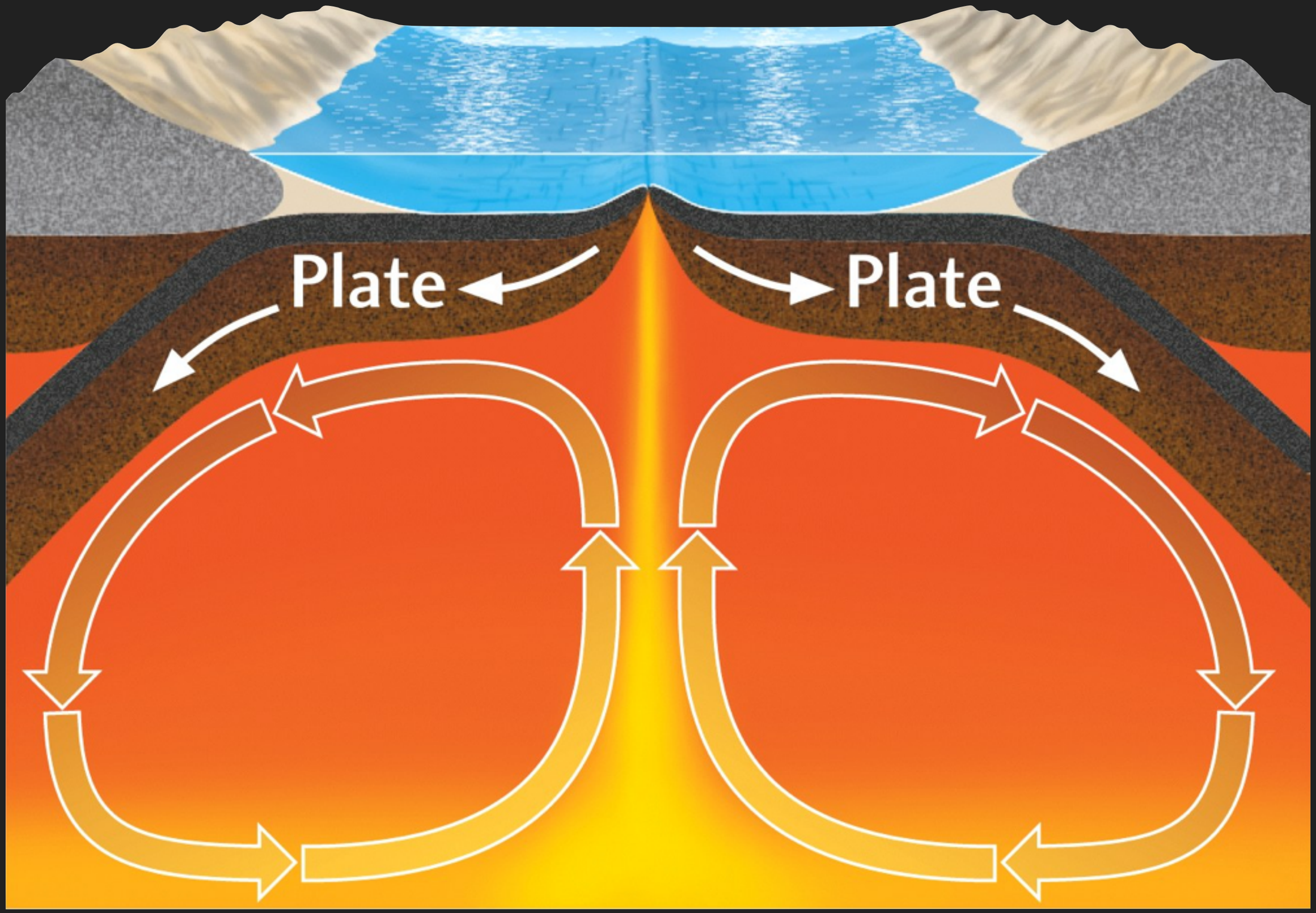
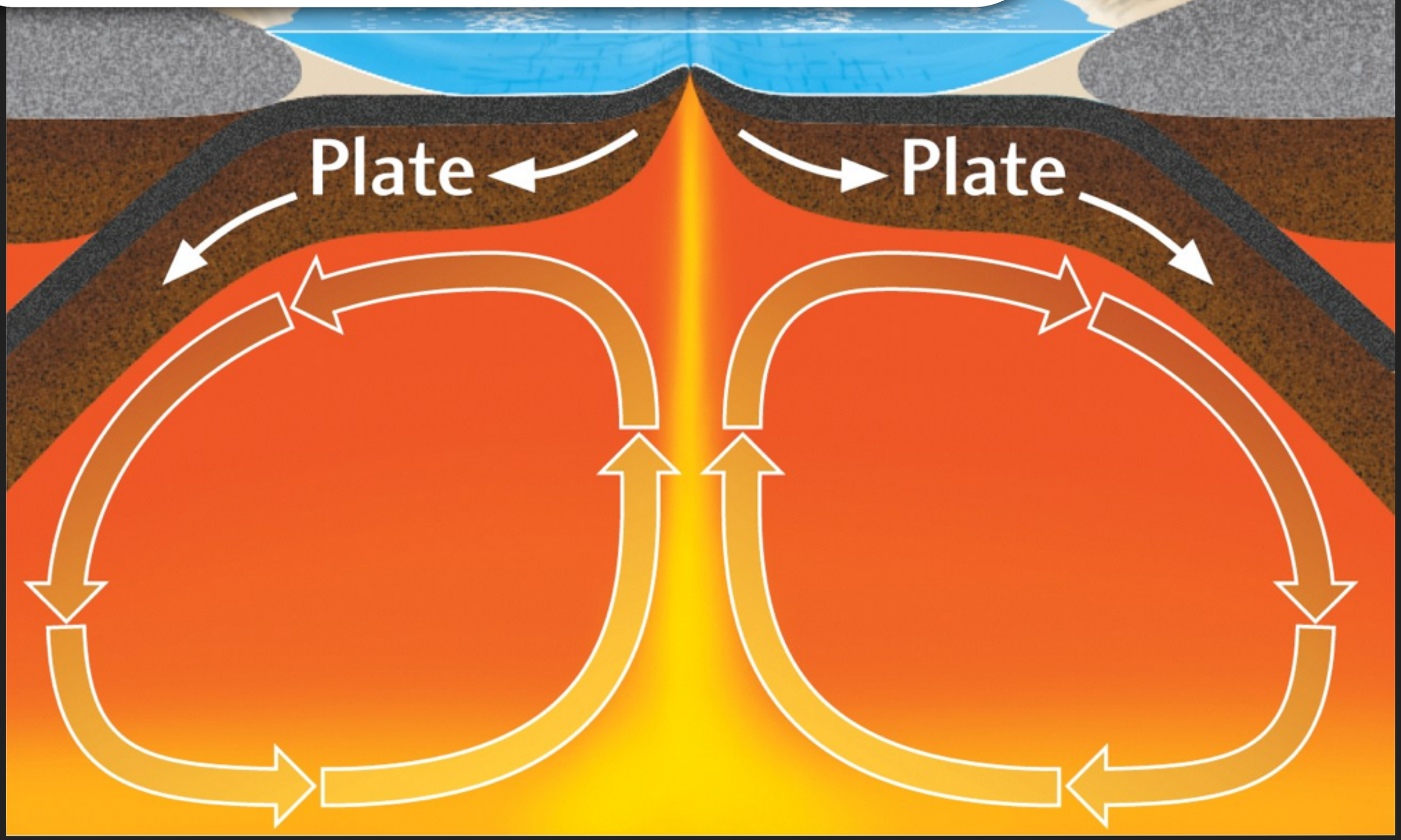


Plate
Plate

Notice how the plates are moving in the same direction as the top of the convection currents beneath.



VIDEO #2: CONVECTION

1. *Go to the "built-in apps" folder*
2. *Open the "Videos" app*
3. *View the video Entitled "Convection"*
4. *Answer the questions on your sheet*

OK, SO NOW THAT WE KNOW HOW THE PLATES MOVE...

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LET'S SEE WHAT HAPPENS WHEN TWO PLATES MEET.

THERE ARE THREE WAYS IN WHICH PLATES MAY INTERACT...

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which are also known as the...

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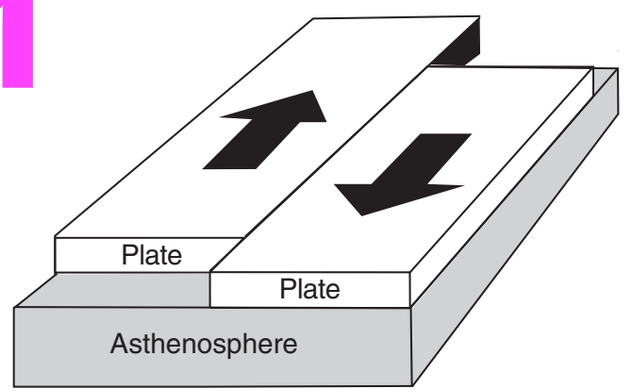
which are also known as the...

THREE TYPES OF PLATE BOUNDARIES

PLATE BOUNDARIES

1

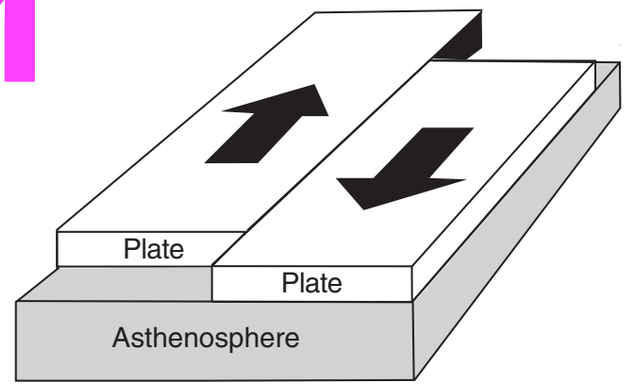


TRANSFORM

Plates move past one another

PLATE BOUNDARIES

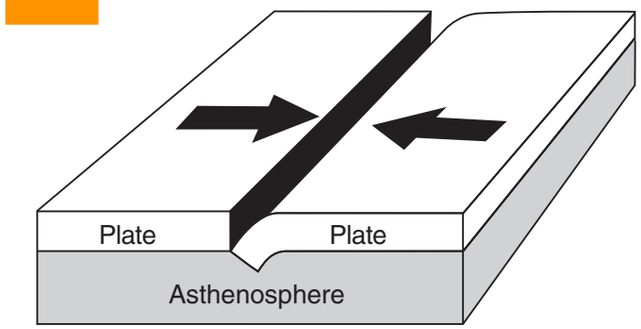
1



TRANSFORM

Plates move past one another

2

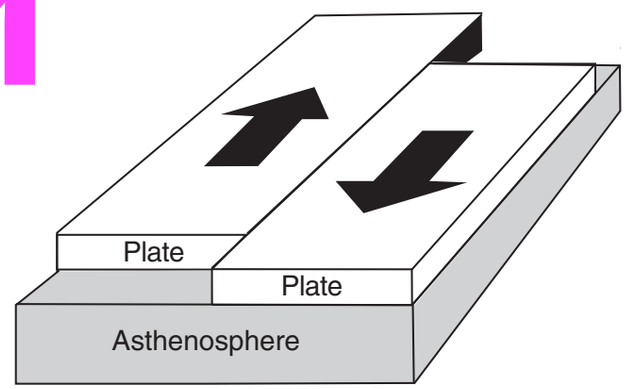


CONVERGENT

Plates move towards each other

PLATE BOUNDARIES

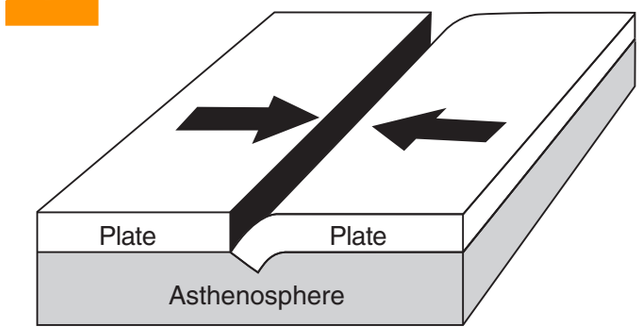
1



TRANSFORM

Plates move past one another

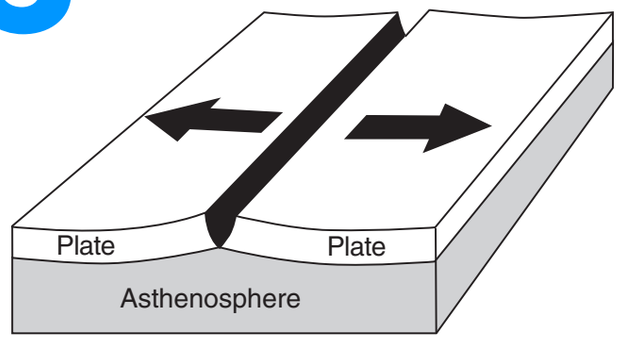
2



CONVERGENT

Plates move towards each other

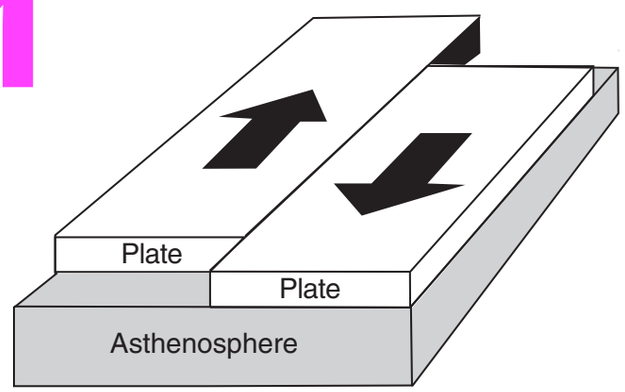
3



DIVERGENT

Plates move away from each other

1

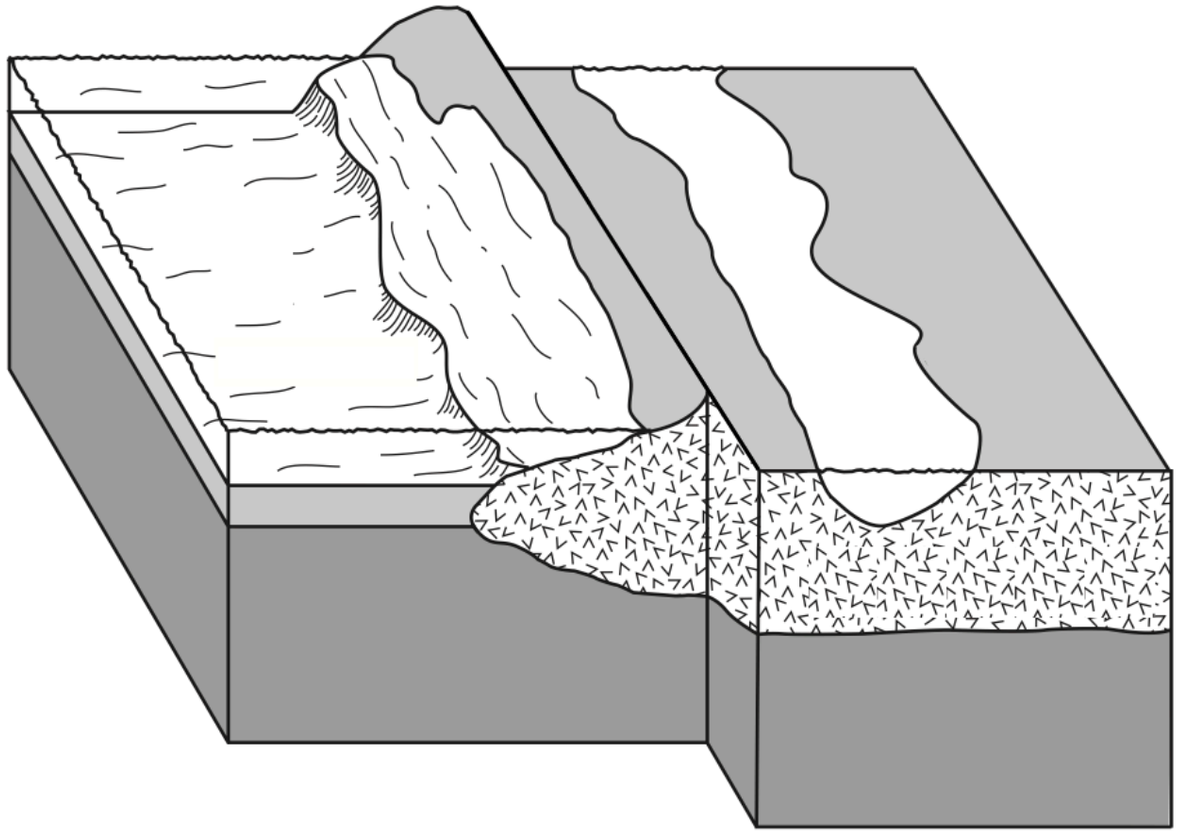


TRANSFORM

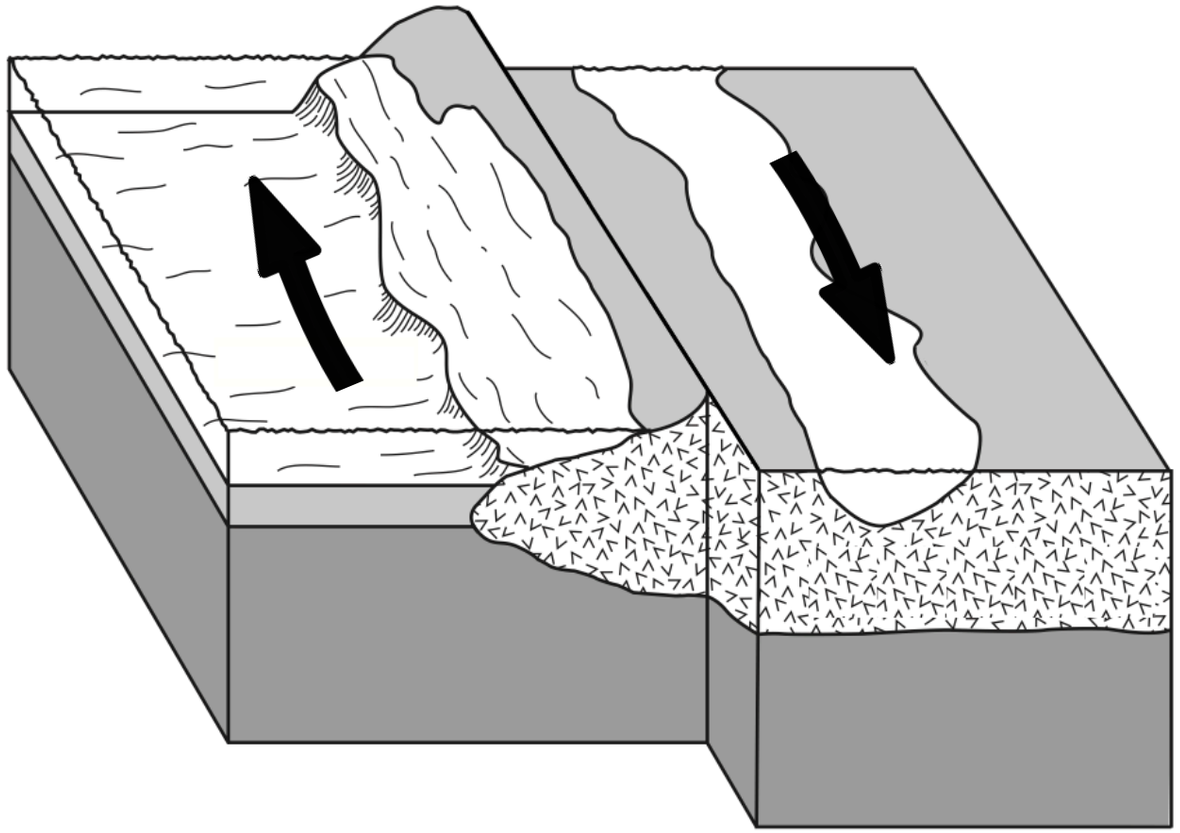
Plates move past one another

LET'S BEGIN WITH TRANSFORM PLATE BOUNDARIES

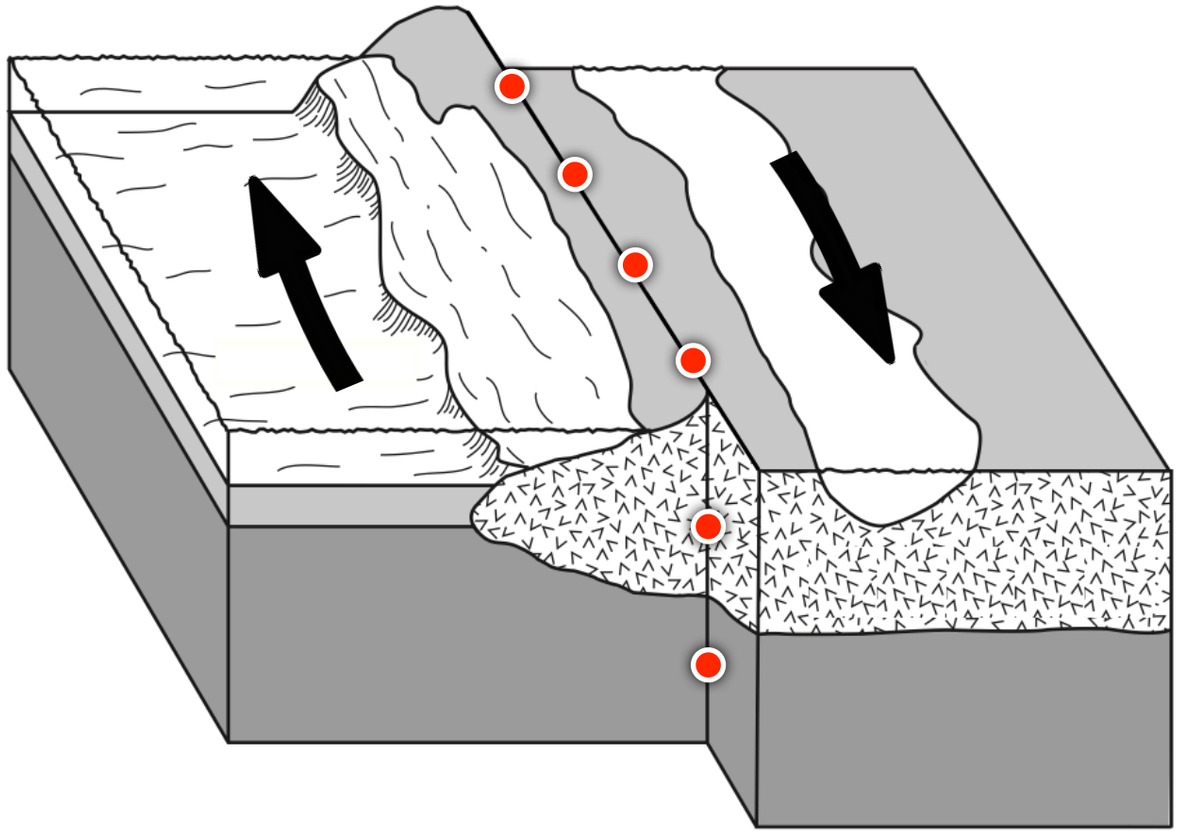
TRANSFORM PLATE BOUNDARIES

DESCRIPTION	DIAGRAM
	

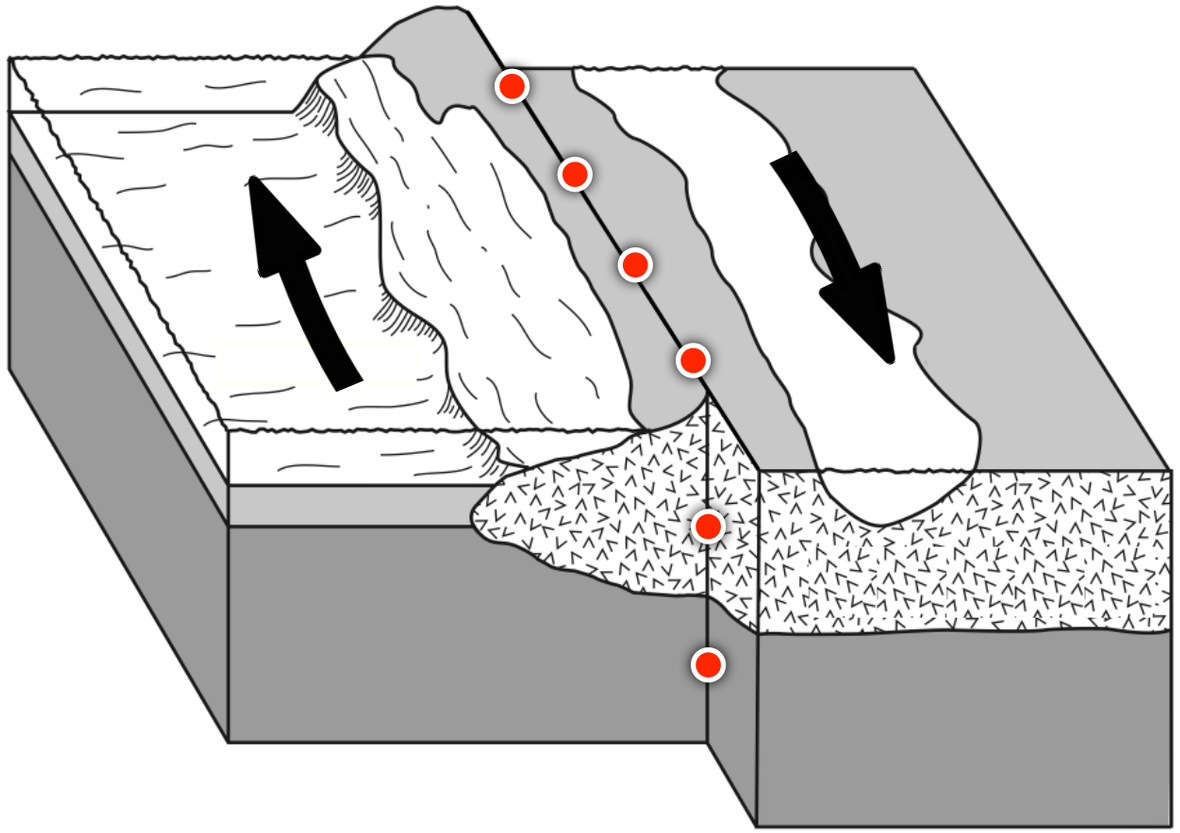
TRANSFORM PLATE BOUNDARIES

DESCRIPTION	DIAGRAM
1. Plates slide past one another	

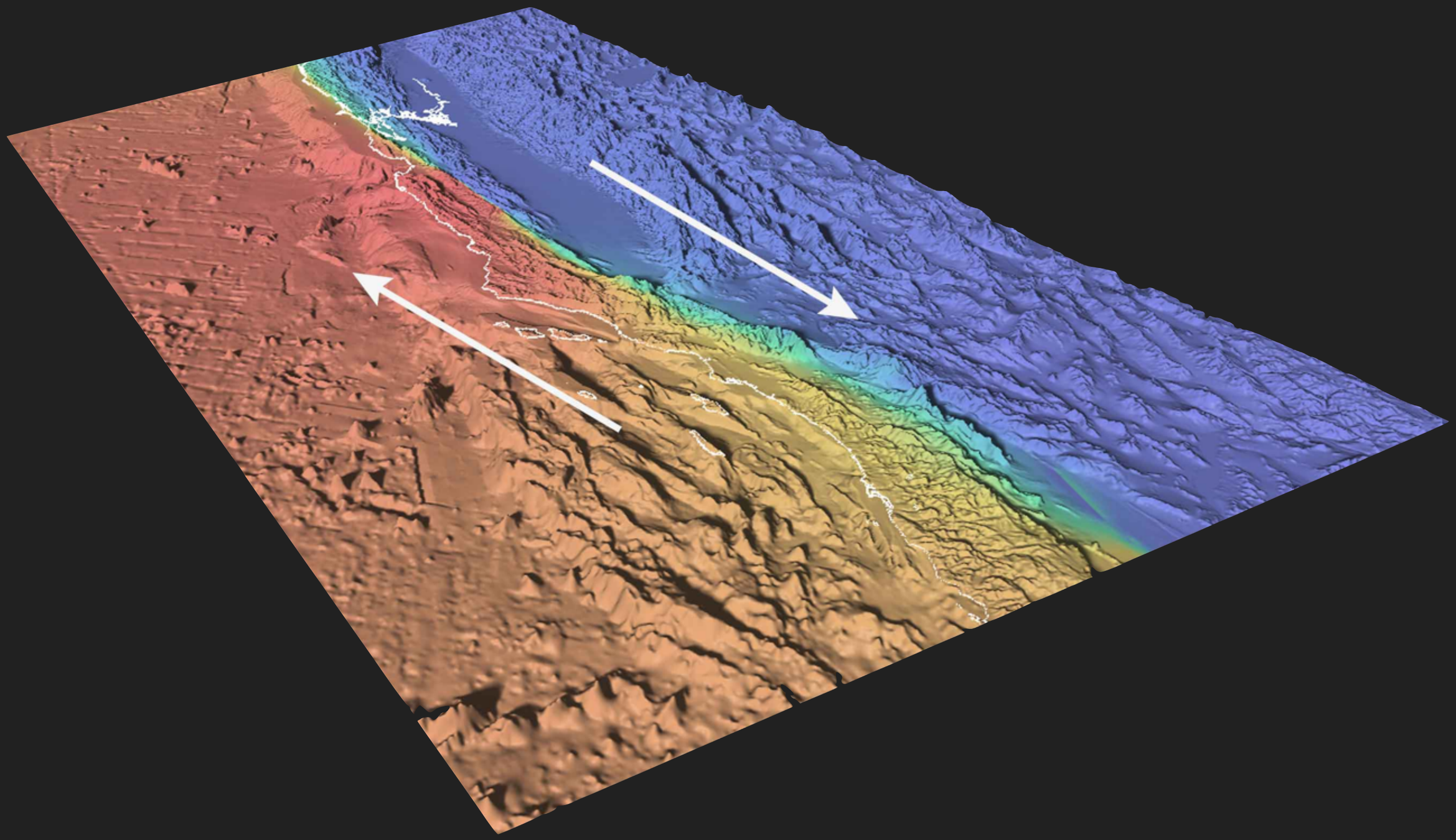
TRANSFORM PLATE BOUNDARIES

DESCRIPTION	DIAGRAM
1. Plates slide past one another 2. Earthquakes are common on or near the plate boundary (fault)	

TRANSFORM PLATE BOUNDARIES

DESCRIPTION	DIAGRAM
1. Plates slide past one another 2. Earthquakes are common on or near the plate boundary (fault) 3. Example: San Andreas Fault	

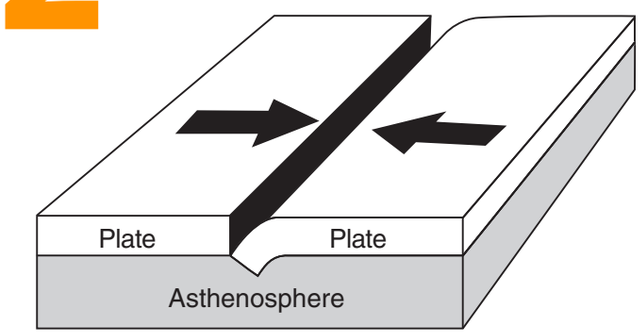
TRANSFORM PLATE BOUNDARIES



VIDEO #3: TRANSFORM

1. *Go to the "built-in apps" folder*
2. *Open the "Videos" app*
3. *View the video Entitled "Transform"*
4. *Answer the questions on your sheet*

2



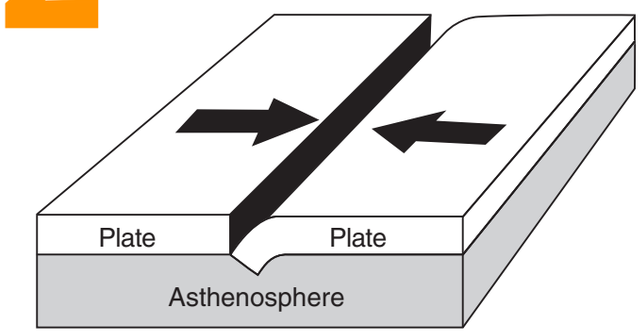
CONVERGENT

Plates move towards each other

NOW, LET'S LOOK AT CONVERGENT PLATE BOUNDARIES

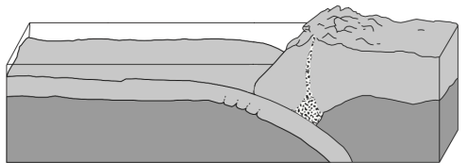
THERE ARE THREE TYPES OF CONVERGENT PLATE BOUNDARIES

2

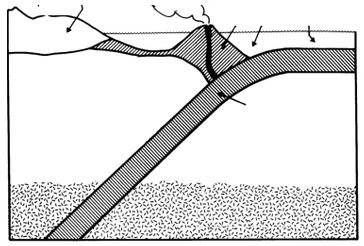


CONVERGENT

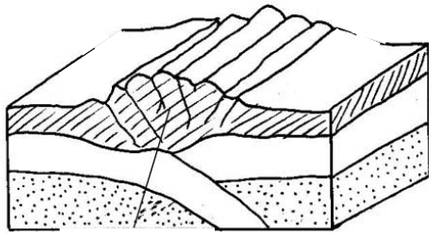
Plates move towards each other



SUBDUCTION ZONE
(Oceanic-Continental)



ISLAND ARC
(Oceanic-Oceanic)

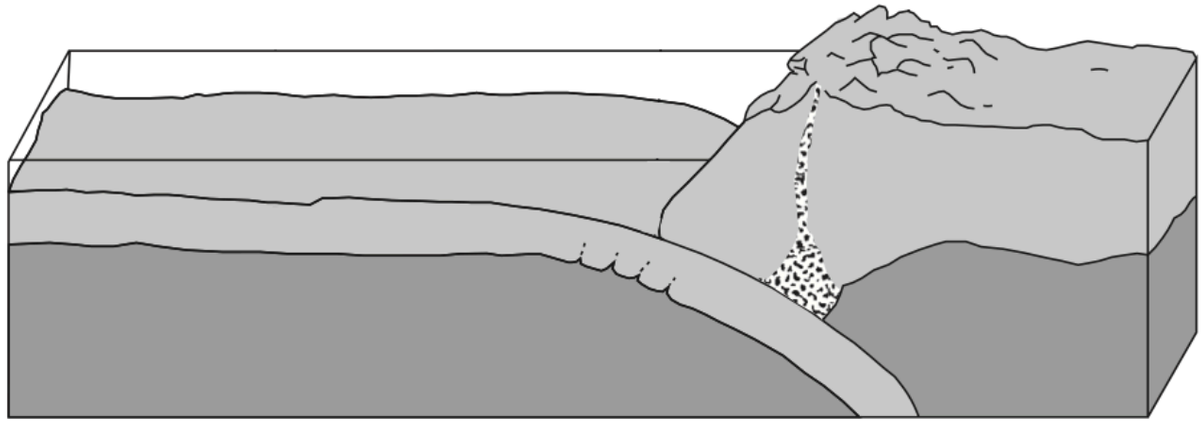


COLLISION ZONE
(Continental-Continental)

CONVERGENT PLATE BOUNDARIES
SUBDUCTION ZONE

DESCRIPTION

DIAGRAM

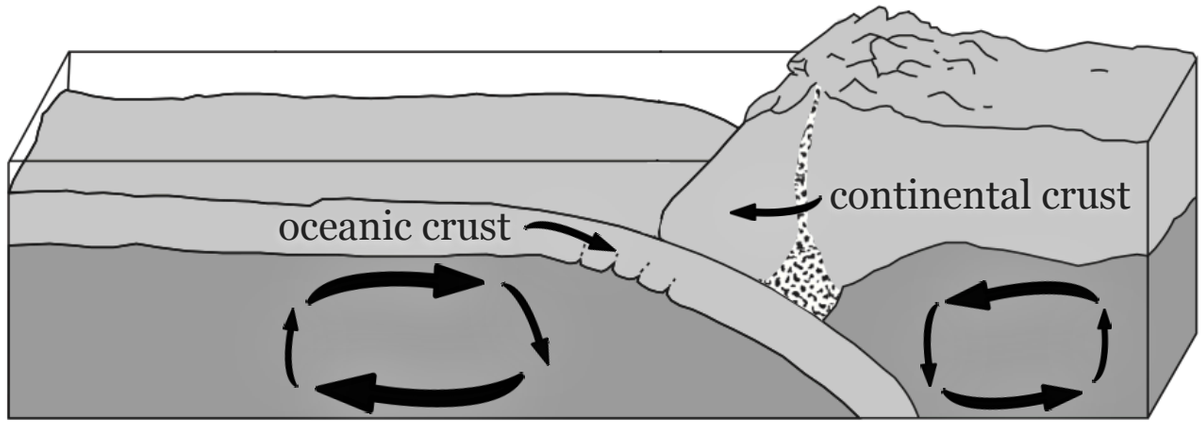


CONVERGENT PLATE BOUNDARIES
SUBDUCTION ZONE

DESCRIPTION

1. Oceanic crust sinks (subducts) under continental crust due to its higher density, basaltic composition. Plate motion is driven by convection currents.

DIAGRAM

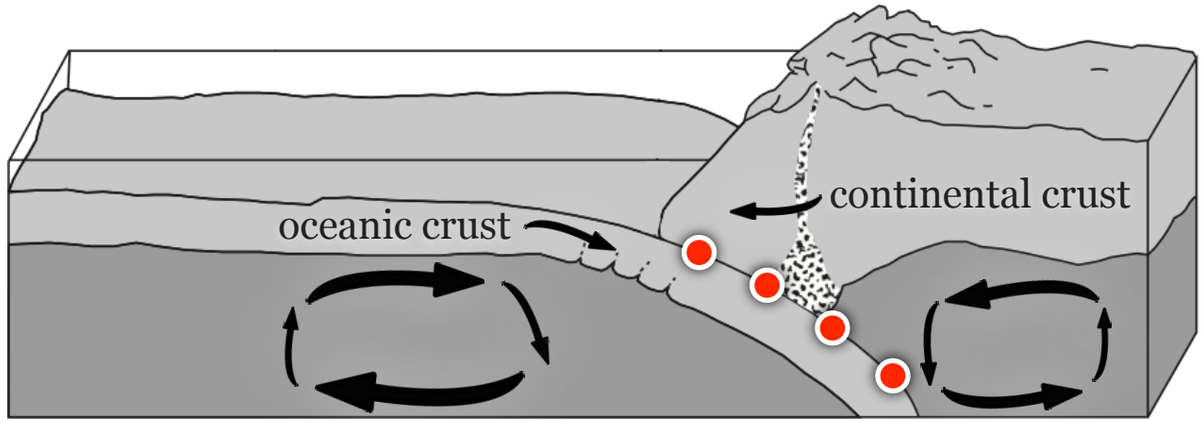


CONVERGENT PLATE BOUNDARIES
SUBDUCTION ZONE

DESCRIPTION

1. Oceanic crust sinks (subducts) under continental crust due to its higher density, basaltic composition. Plate motion is driven by convection currents.
2. Earthquakes are common along the subducting plate.

DIAGRAM



CONVERGENT PLATE BOUNDARIES
SUBDUCTION ZONE

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1. Oceanic crust sinks (subducts) under continental crust due to its higher density, basaltic composition. Plate motion is driven by convection currents.
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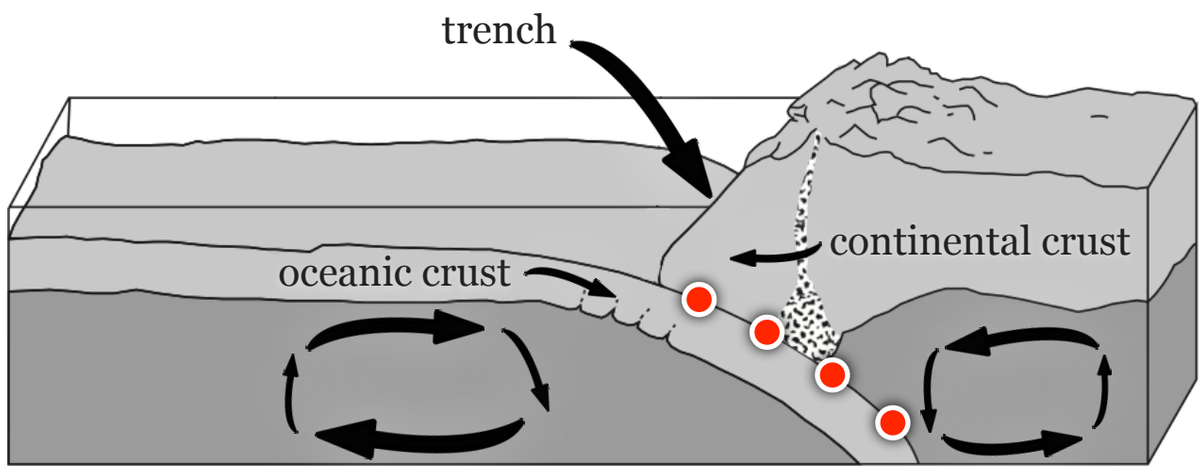
3. Trenches (deep underwater valleys) form where the plates meet.

DIAGRAM



CONVERGENT PLATE BOUNDARIES
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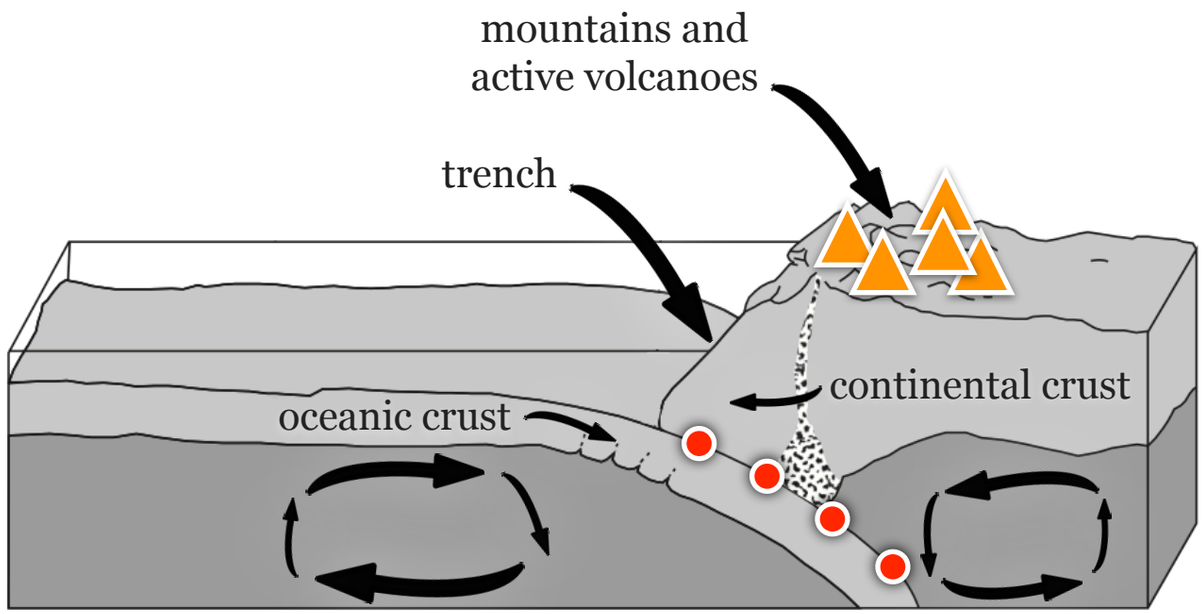
4. Tall mountains and active volcanoes form above the subducting plate.

DIAGRAM



CONVERGENT PLATE BOUNDARIES
SUBDUCTION ZONE

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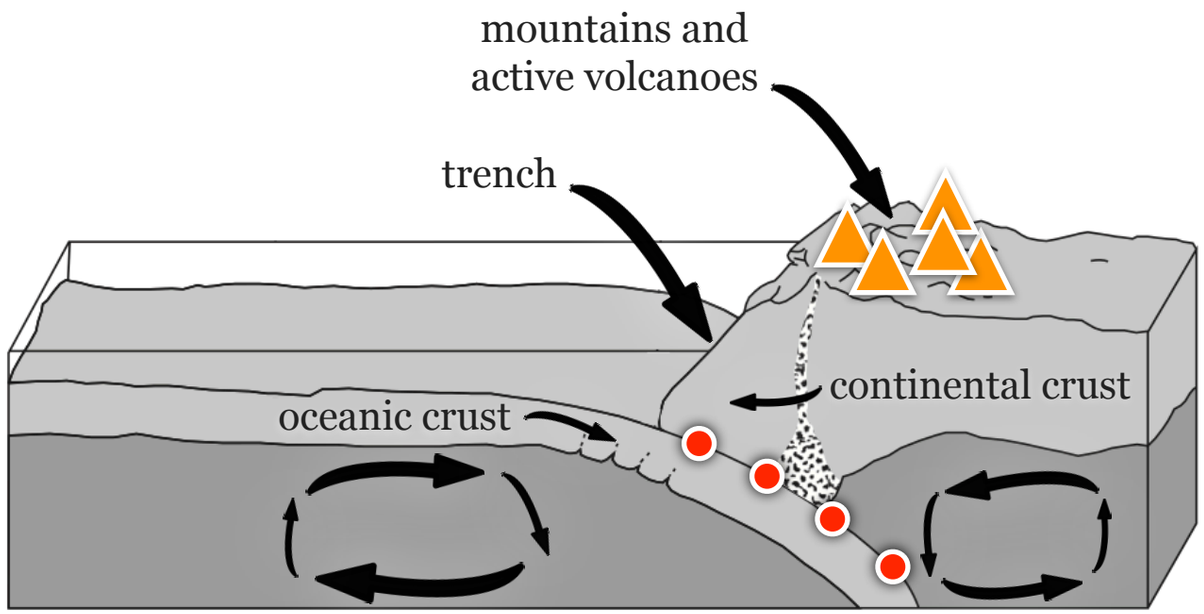
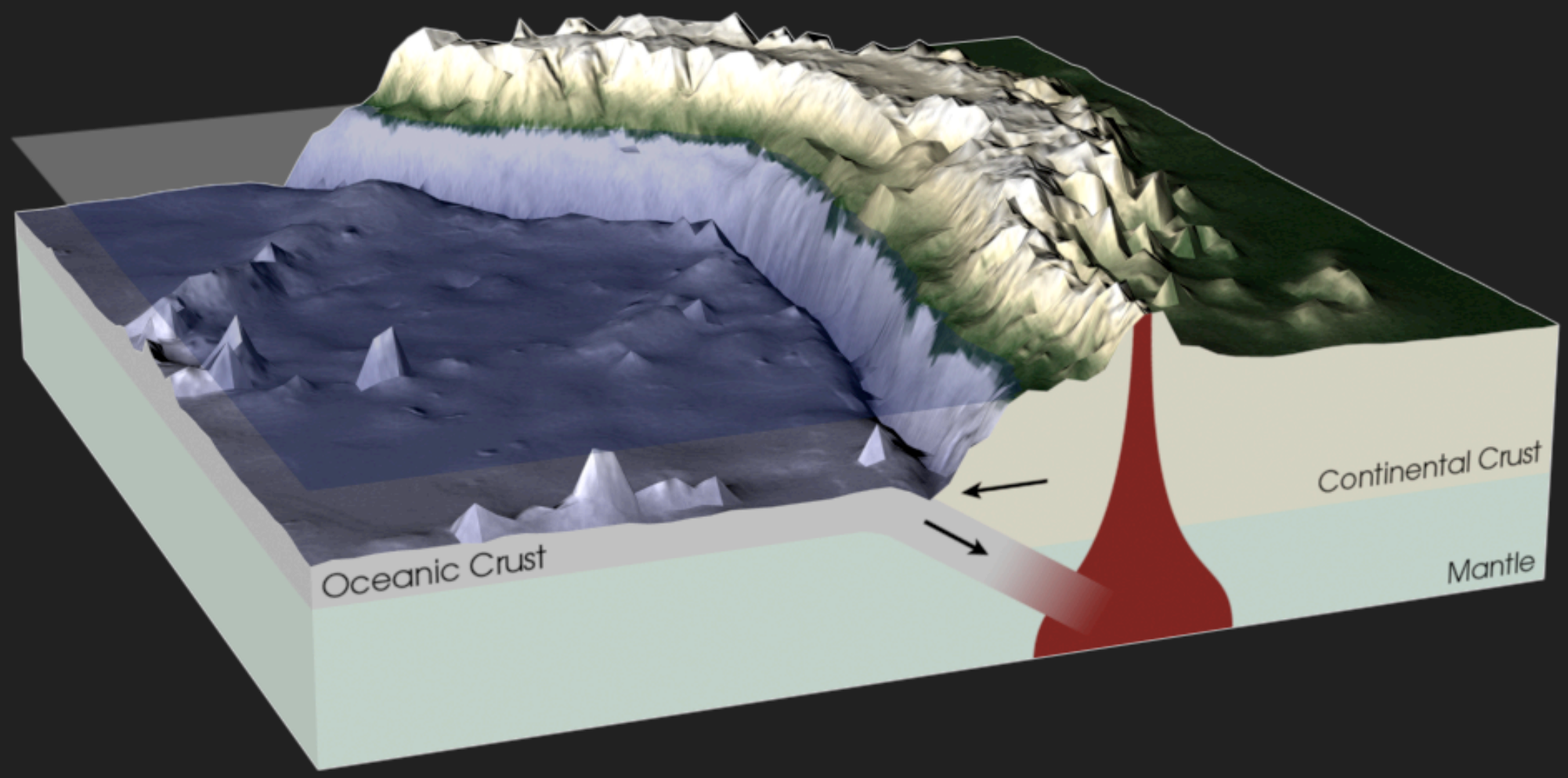
2. Earthquakes are common along the subducting plate.
3. Trenches (deep underwater valleys) form where the plates meet.
4. Tall mountains and active volcanoes form above the subducting plate.
5. Example: Peru-Chile Trench

DIAGRAM



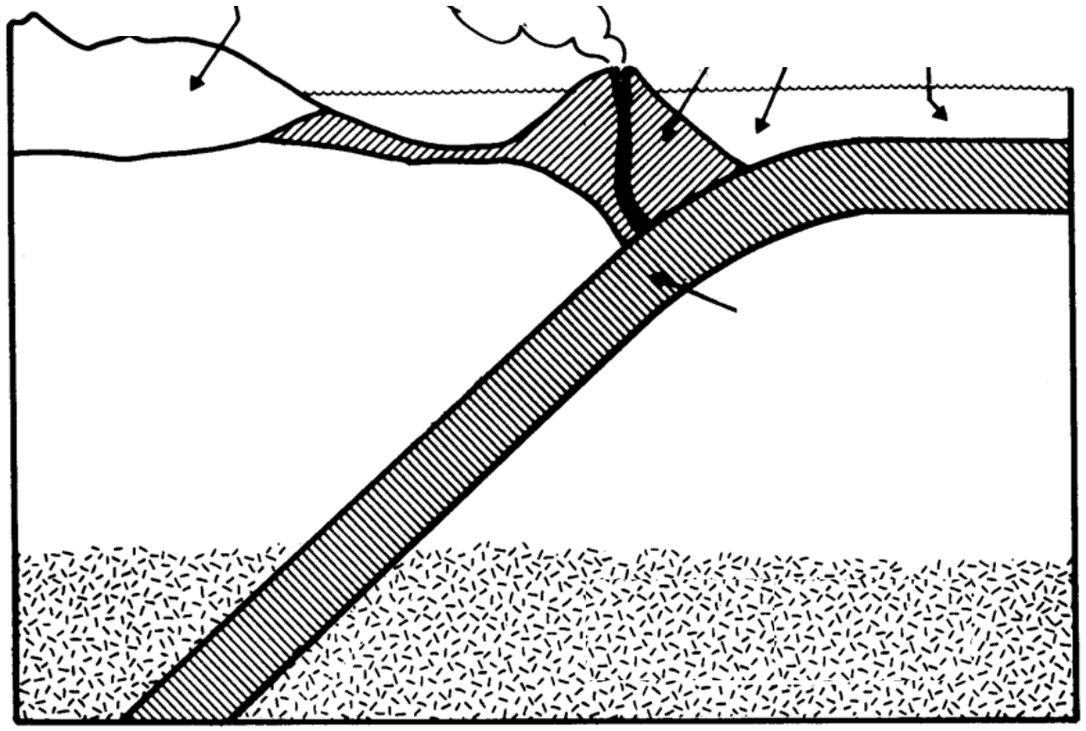
CONVERGENT PLATE BOUNDARIES
SUBDUCTION ZONE



VIDEO #4: SUBDUCTION

1. *Go to the "built-in apps" folder*
2. *Open the "Videos" app*
3. *View the video Entitled "Subduction"*
4. *Answer the questions on your sheet*

CONVERGENT PLATE BOUNDARIES
ISLAND ARC

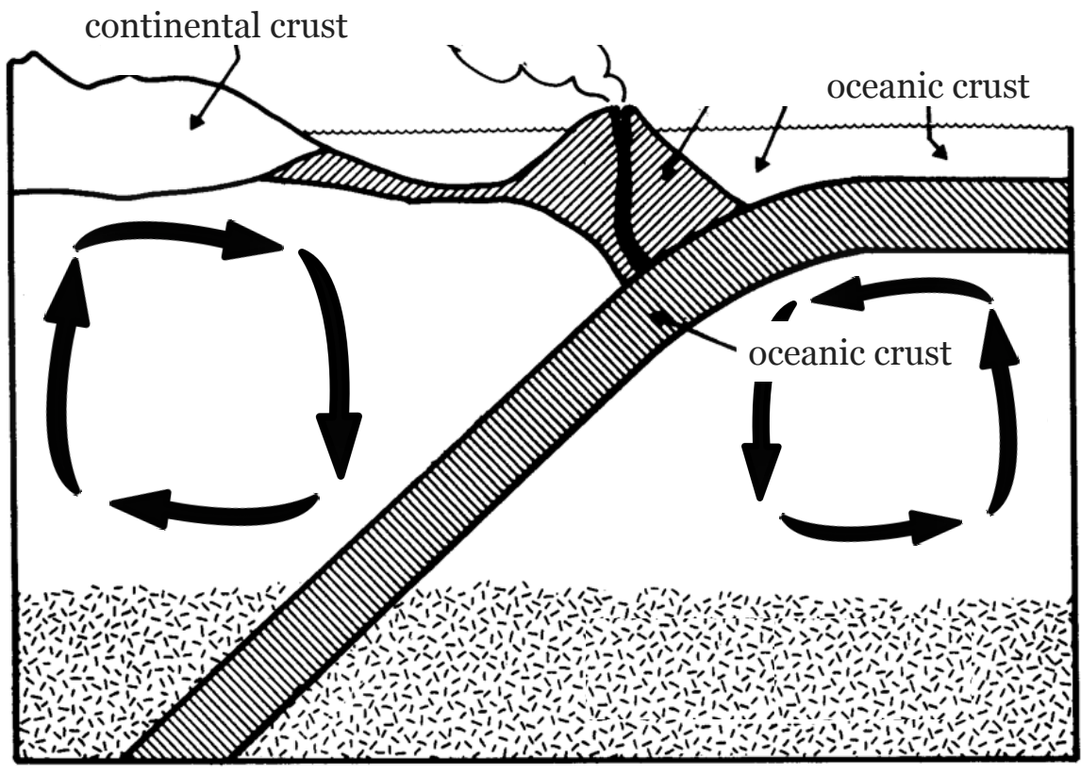
DESCRIPTION	DIAGRAM
	

CONVERGENT PLATE BOUNDARIES
ISLAND ARC

DESCRIPTION

1. Oceanic crust sinks (subducts) under other oceanic crust. Generally, whichever plate is older will subduct. Plate motion driven by convection currents.

DIAGRAM

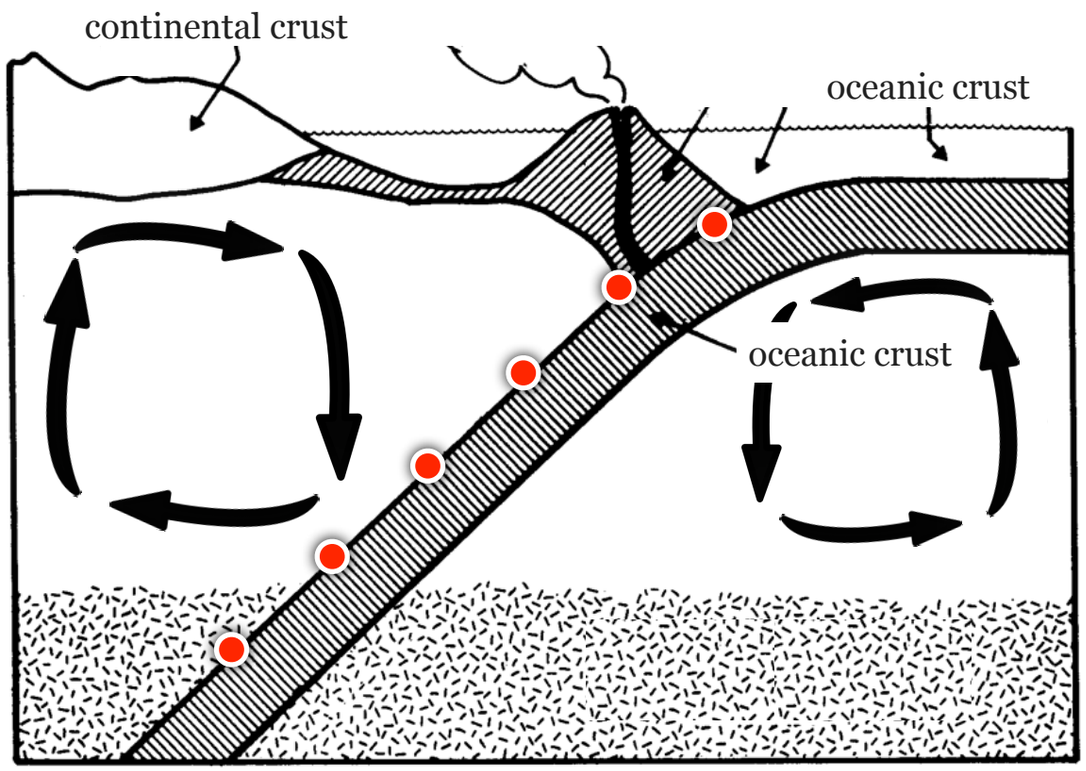


CONVERGENT PLATE BOUNDARIES
ISLAND ARC

DESCRIPTION

1. Oceanic crust sinks (subducts) under other oceanic crust. Generally, whichever plate is older will subduct. Plate motion driven by convection currents.
2. Earthquakes are common along the subducting plate.

DIAGRAM



CONVERGENT PLATE BOUNDARIES
ISLAND ARC

DESCRIPTION

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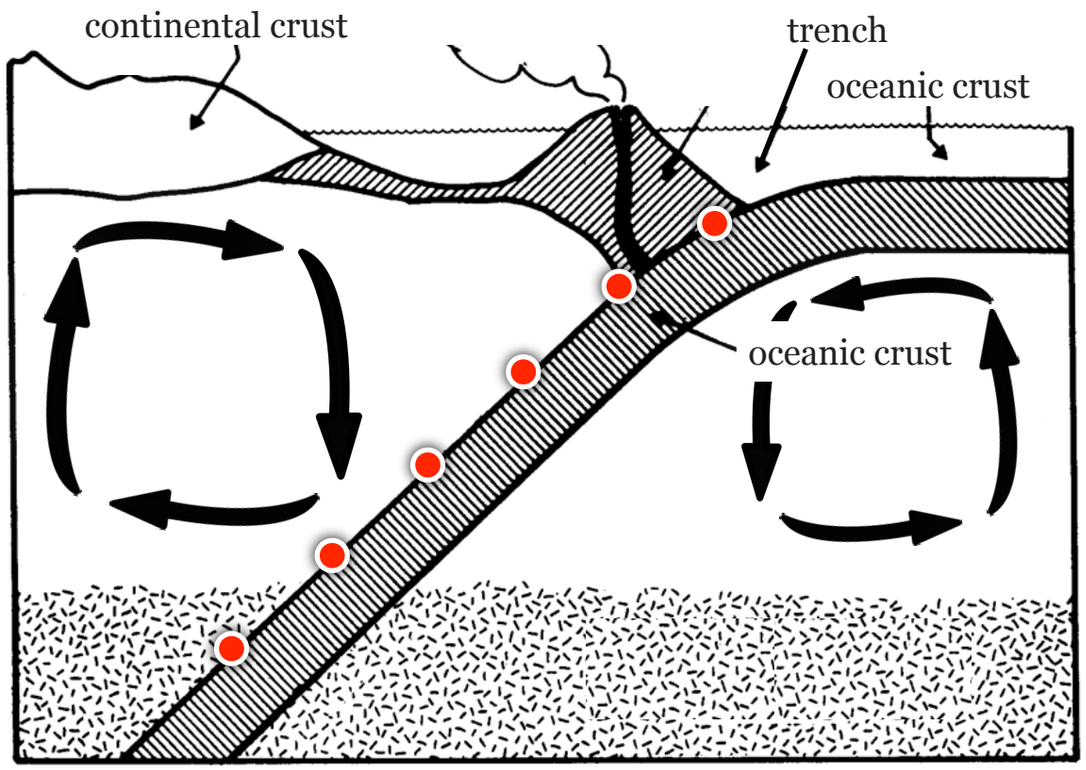
DIAGRAM



CONVERGENT PLATE BOUNDARIES
ISLAND ARC

DESCRIPTION

1. Oceanic crust sinks (subducts) under other oceanic crust. Generally, whichever plate is older will subduct. Plate motion driven by convection currents.
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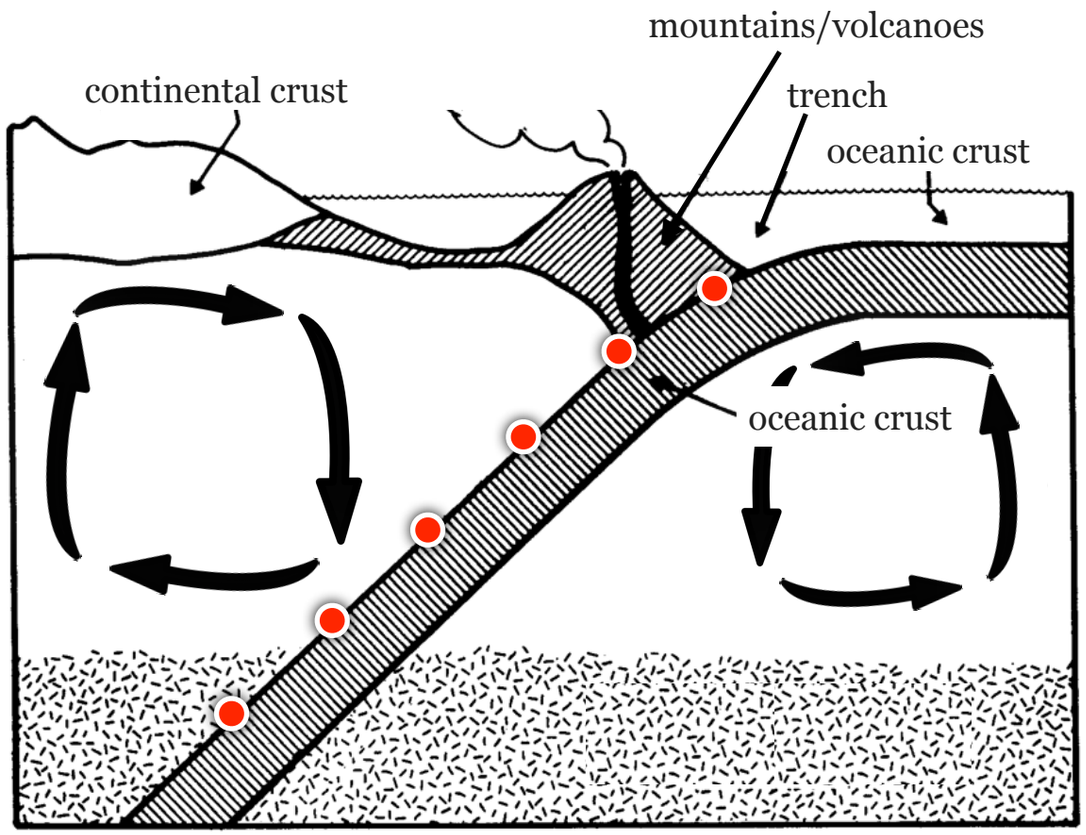
4. Tall mountains and active volcanoes form above the subducting plate.

DIAGRAM

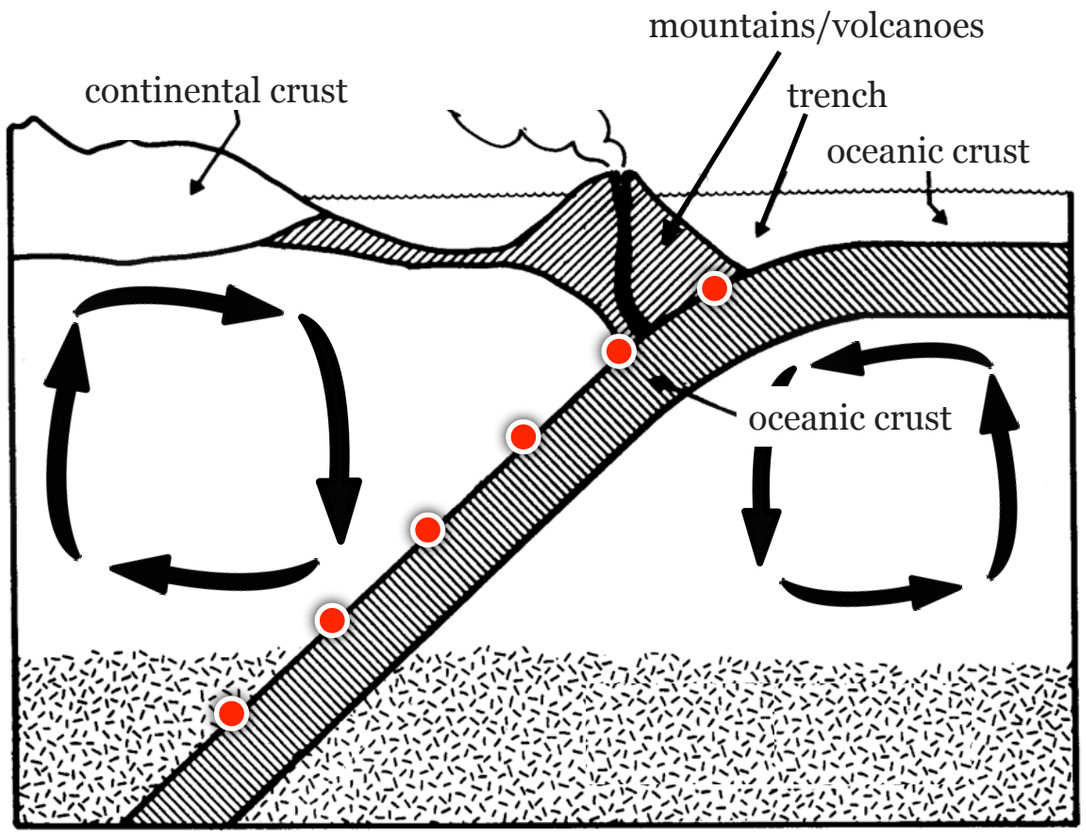


CONVERGENT PLATE BOUNDARIES
ISLAND ARC

DESCRIPTION

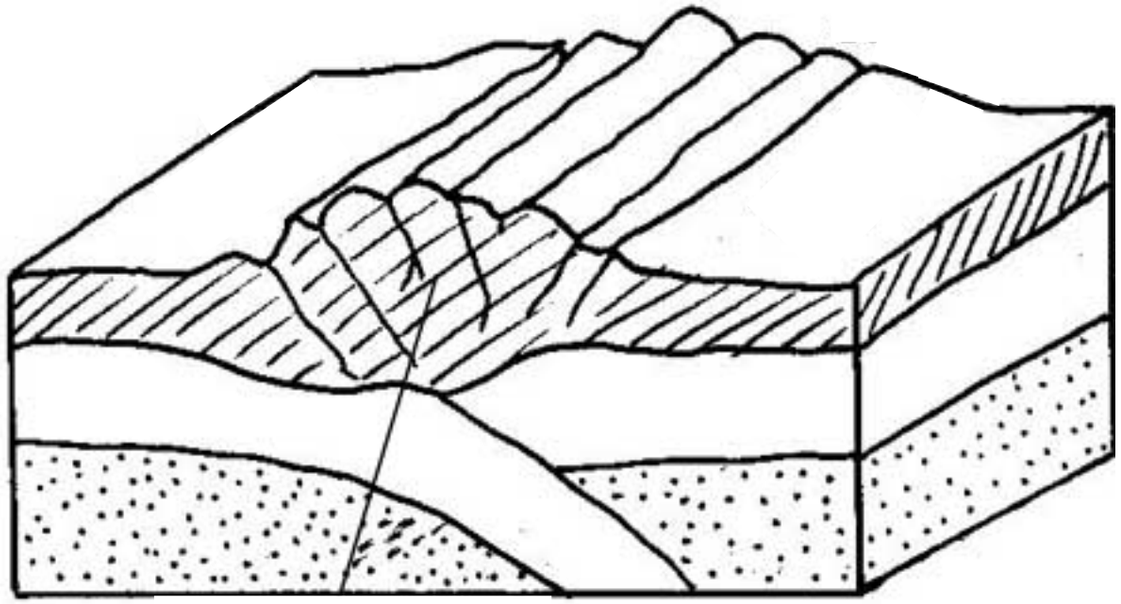
1. Oceanic crust sinks (subducts) under other oceanic crust. Generally, whichever plate is older will subduct. Plate motion driven by convection currents.
2. Earthquakes are common along the subducting plate.
3. Trenches (deep underwater valleys) form where the plates meet.
4. Tall mountains and active volcanoes form above the subducting plate.
5. Example: Aleutian Trench

DIAGRAM

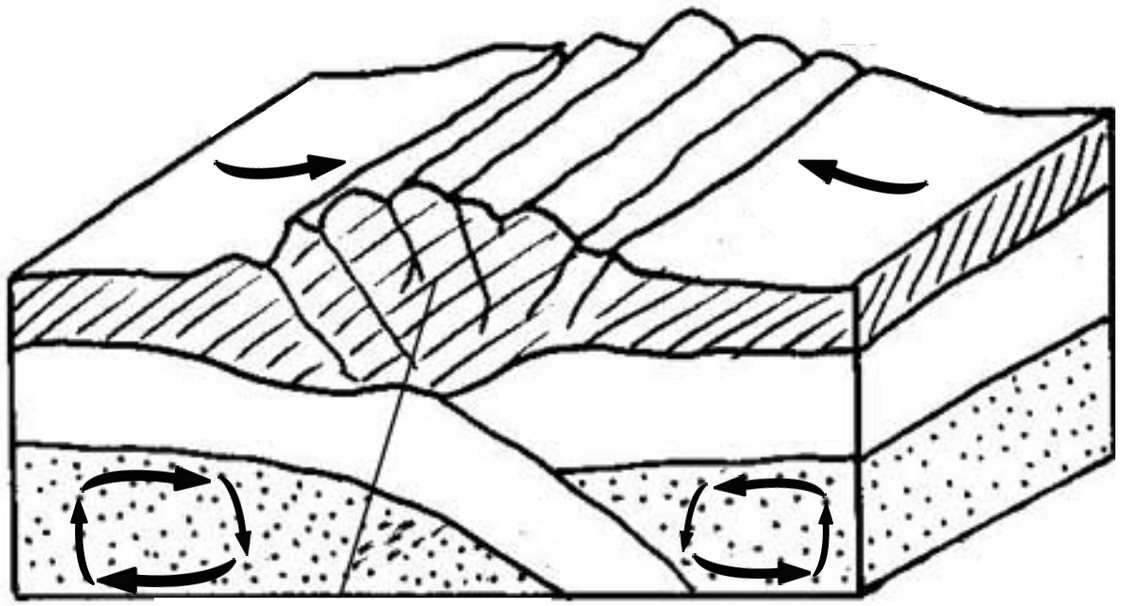


CONVERGENT PLATE BOUNDARIES
ISLAND ARC

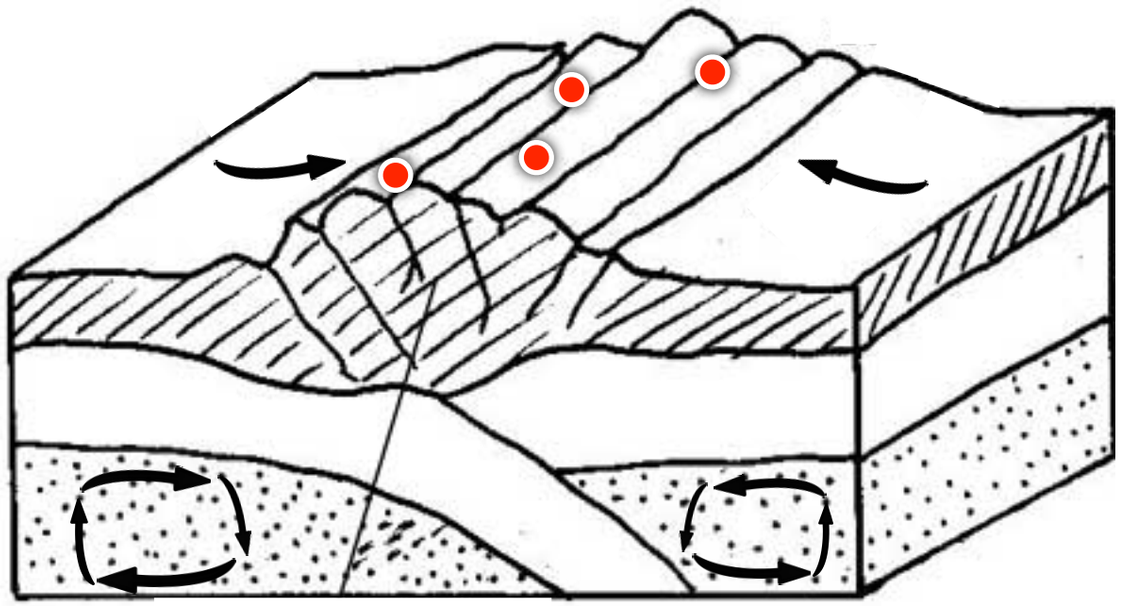
CONVERGENT PLATE BOUNDARIES
COLLISION ZONE

DESCRIPTION	DIAGRAM
	

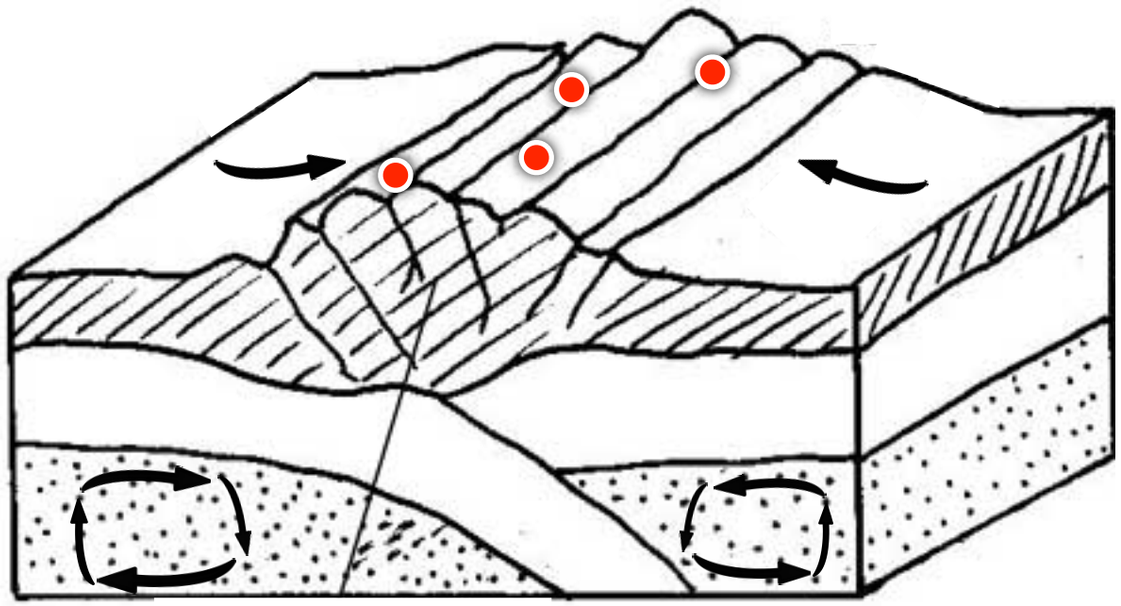
CONVERGENT PLATE BOUNDARIES
COLLISION ZONE

DESCRIPTION	DIAGRAM
1. Continental crust collides with continental crust. The thick, less dense land crumples upward. Plate motion is driven by convection currents.	

CONVERGENT PLATE BOUNDARIES
COLLISION ZONE

DESCRIPTION	DIAGRAM
1. Continental crust collides with continental crust. The thick, less dense land crumples upward. Plate motion is driven by convection currents. 2. Earthquakes are common along the collision zone.	

CONVERGENT PLATE BOUNDARIES
COLLISION ZONE

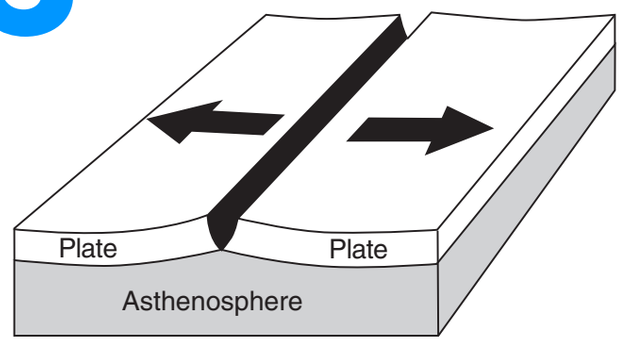
DESCRIPTION	DIAGRAM
1. Continental crust collides with continental crust. The thick, less dense land crumples upward. Plate motion is driven by convection currents. 2. Earthquakes are common along the collision zone. 3. Example: The Himalayas	

CONVERGENT PLATE BOUNDARIES
COLLISION ZONE

VIDEO #5: COLLISION

1. *Go to the "built-in apps" folder*
2. *Open the "Videos" app*
3. *View the video Entitled "Collision"*
4. *Answer the questions on your sheet*

3



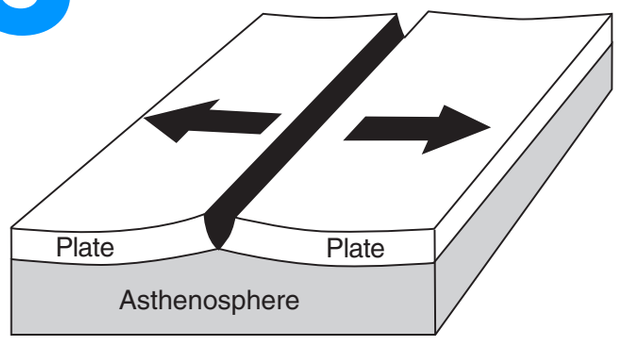
DIVERGENT

Plates move away from each other

AND, NOW DIVERGENT PLATE BOUNDARIES

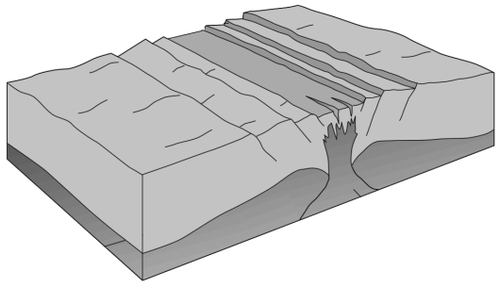
THERE ARE TWO TYPES OF DIVERGENT PLATE BOUNDARIES

3

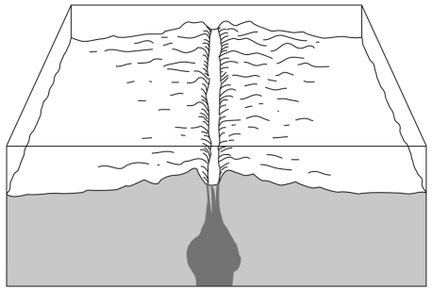


DIVERGENT

Plates move away from each other



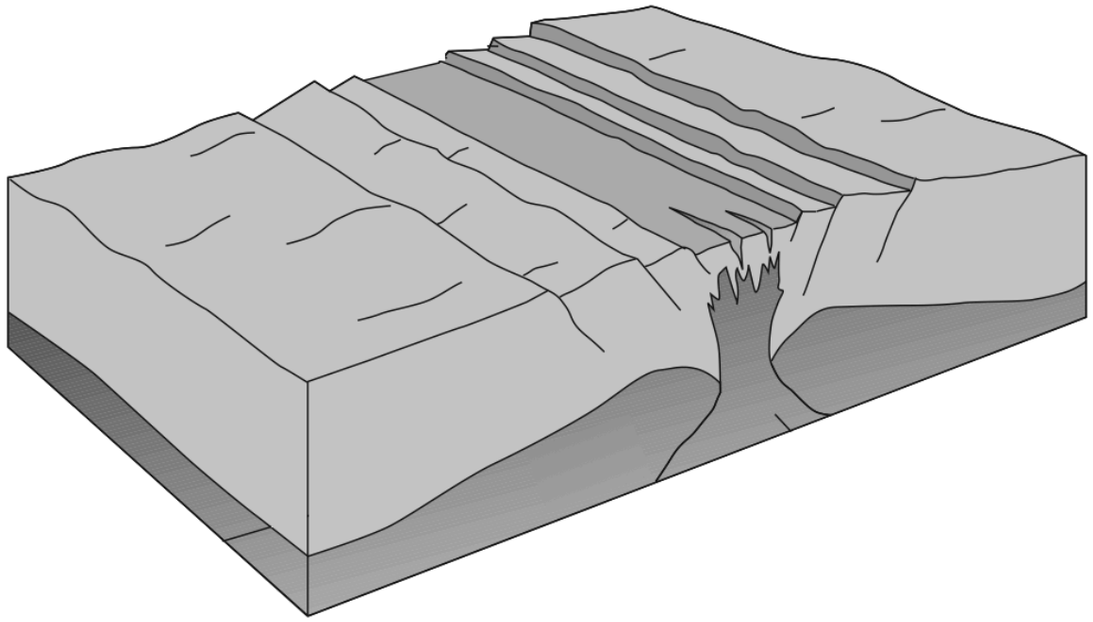
RIFT ZONE
(Continental-Continental)



MID-OCEAN RIDGE
(Oceanic-Oceanic)

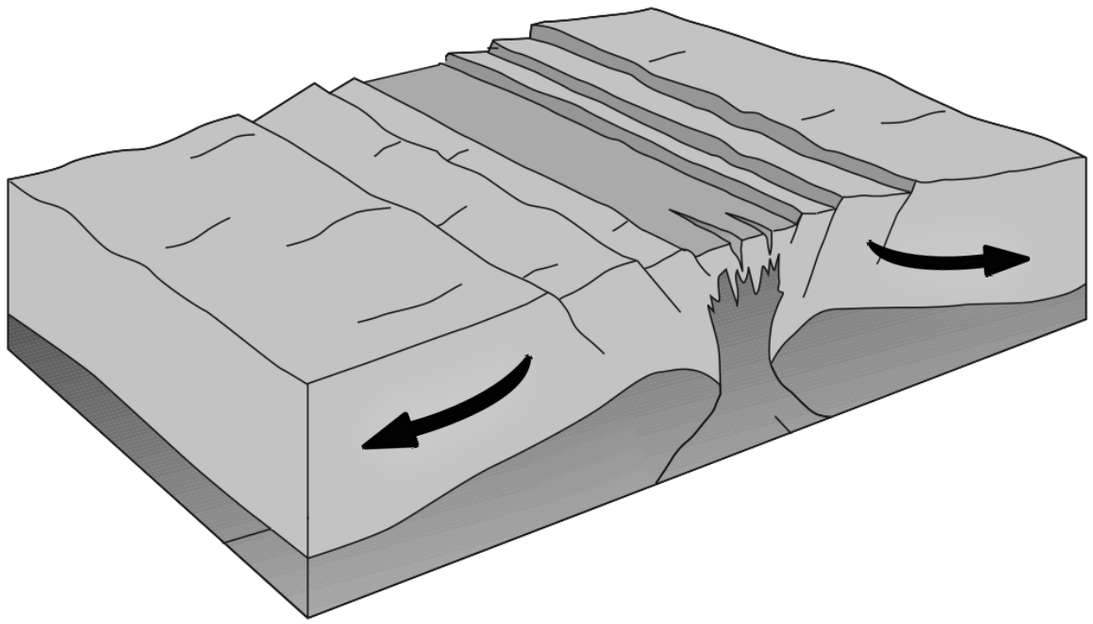
DIVERGENT PLATE BOUNDARIES

RIFT ZONE

DESCRIPTION	DIAGRAM
	

DIVERGENT PLATE BOUNDARIES

RIFT ZONE

DESCRIPTION	DIAGRAM
1. Thick, granitic continental crust splits apart	

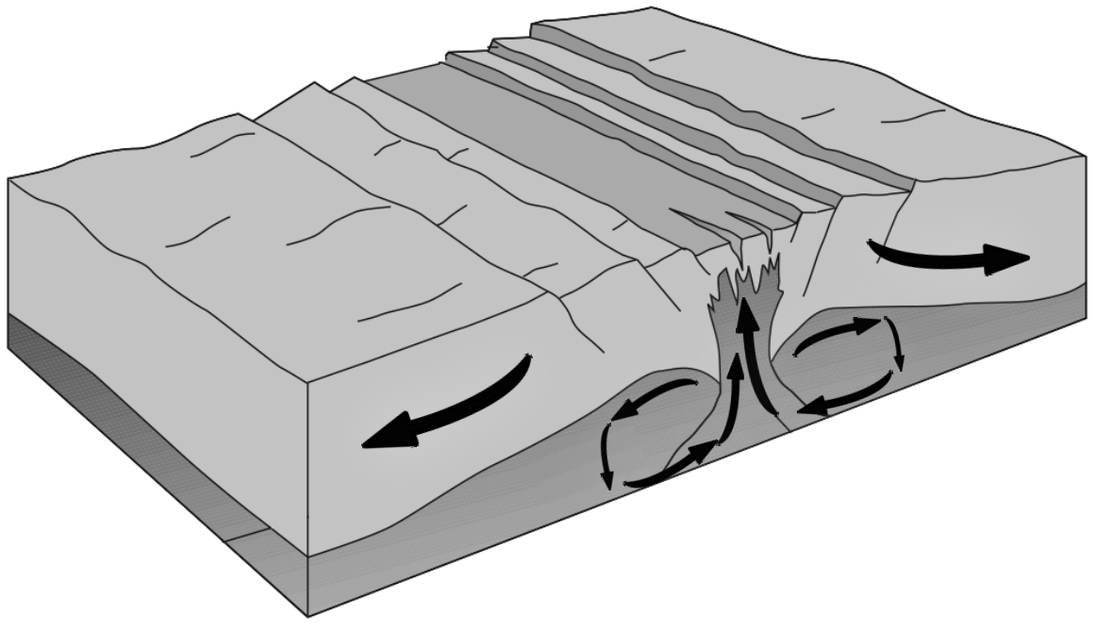
DIVERGENT PLATE BOUNDARIES

RIFT ZONE

DESCRIPTION

1. Thick, granitic continental crust splits apart
2. Plate motion is driven by convection currents

DIAGRAM



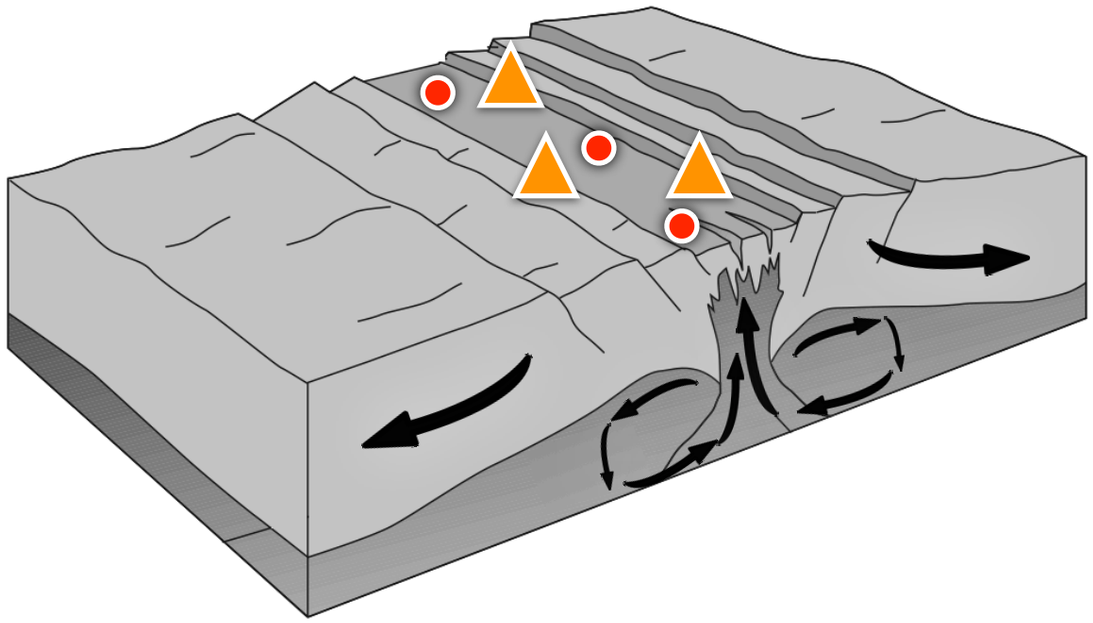
DIVERGENT PLATE BOUNDARIES

RIFT ZONE

DESCRIPTION

1. Thick, granitic continental crust splits apart
2. Plate motion is driven by convection currents
3. Minor earthquakes and volcanoes are common

DIAGRAM



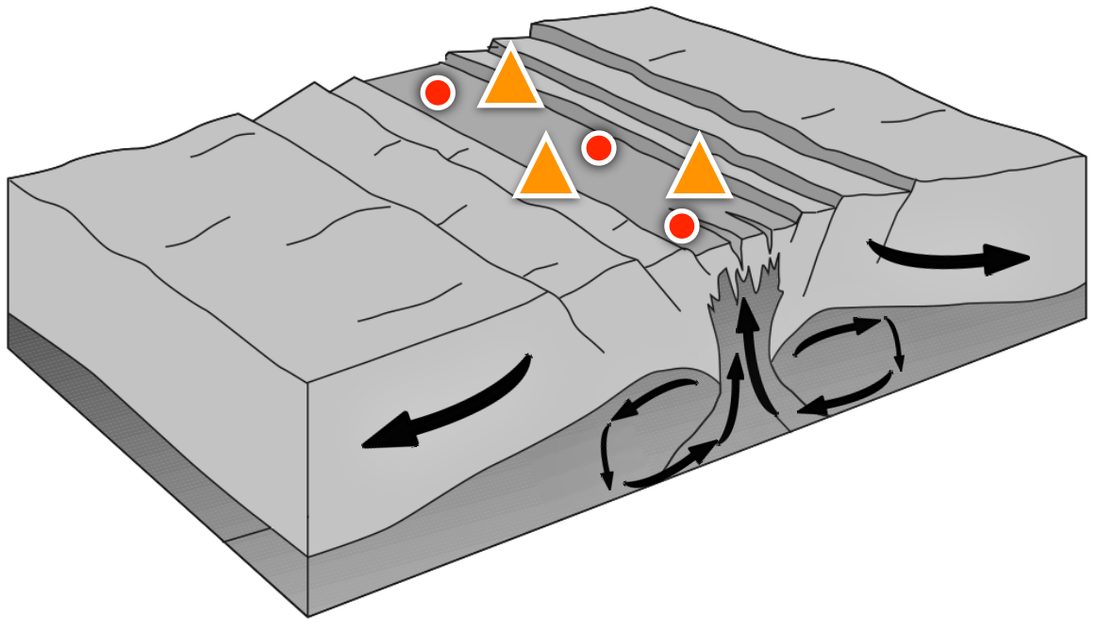
DIVERGENT PLATE BOUNDARIES

RIFT ZONE

DESCRIPTION

1. Thick, granitic continental crust splits apart
2. Plate motion is driven by convection currents
3. Minor earthquakes and volcanoes are common
4. Example: East African Rift Valley

DIAGRAM



CONVERGENT PLATE BOUNDARIES

RIFT ZONE

VIDEO #6: RIFT VALLEY

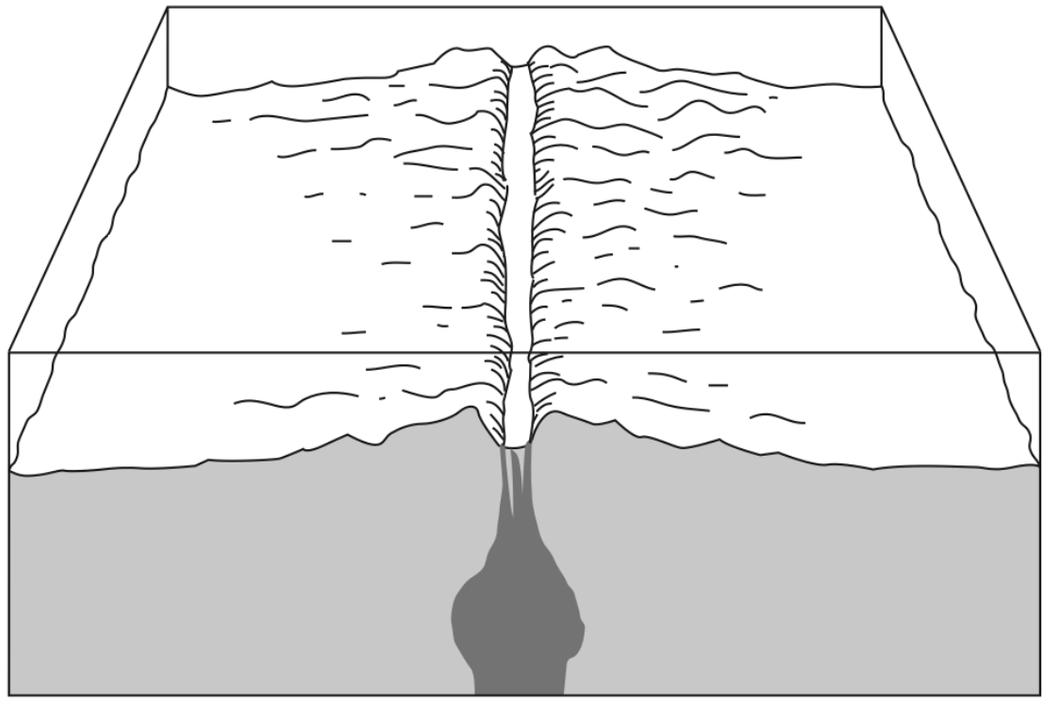
1. *Go to the "built-in apps" folder*
2. *Open the "Videos" app*
3. *View the video Entitled "Rift Valley"*
4. *Answer the questions on your sheet*

DIVERGENT PLATE BOUNDARIES

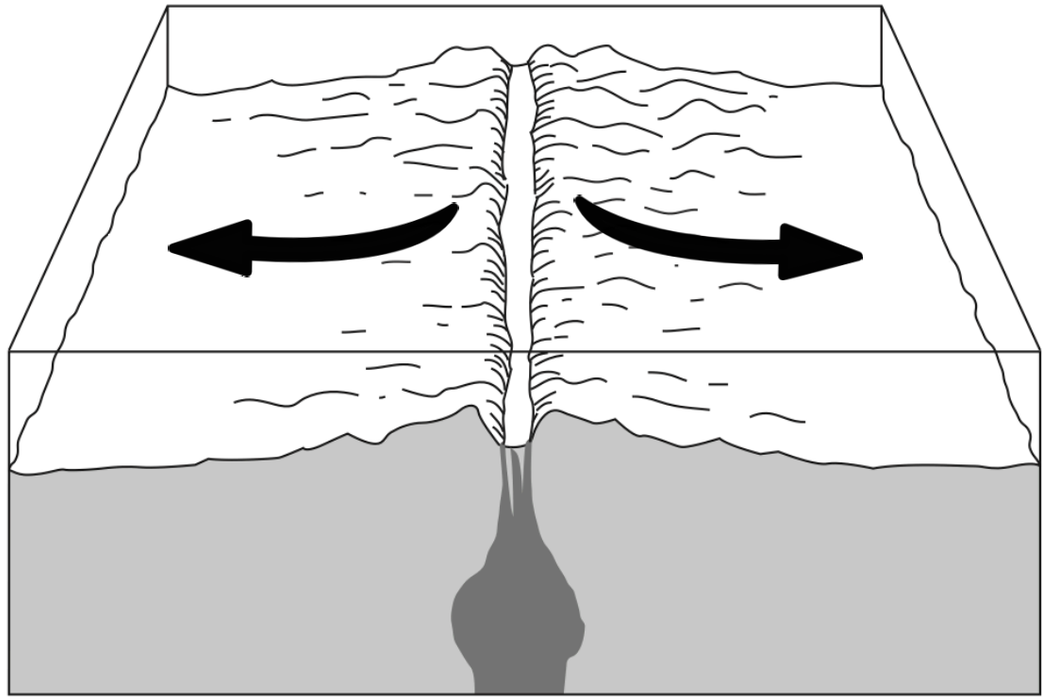
MID-OCEAN RIDGE

DESCRIPTION

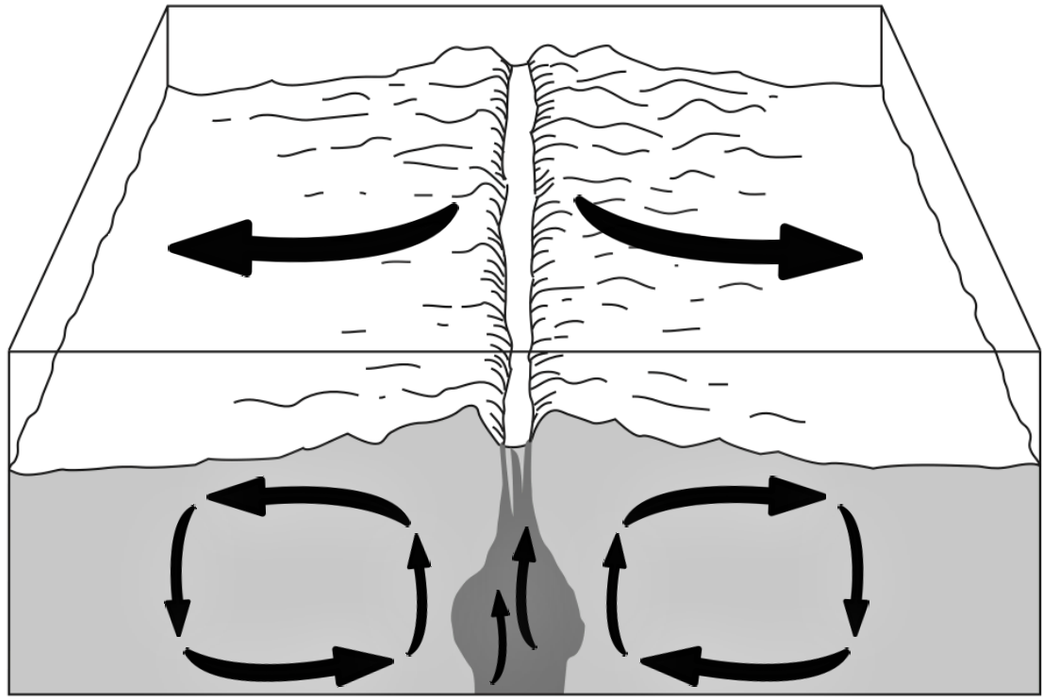
DIAGRAM



DIVERGENT PLATE BOUNDARIES
MID-OCEAN RIDGE

DESCRIPTION	DIAGRAM
1. Thin, basaltic oceanic crust splits apart	

DIVERGENT PLATE BOUNDARIES
MID-OCEAN RIDGE

DESCRIPTION	DIAGRAM
1. Thin, basaltic oceanic crust splits apart 2. Plate motion is driven by convection currents	

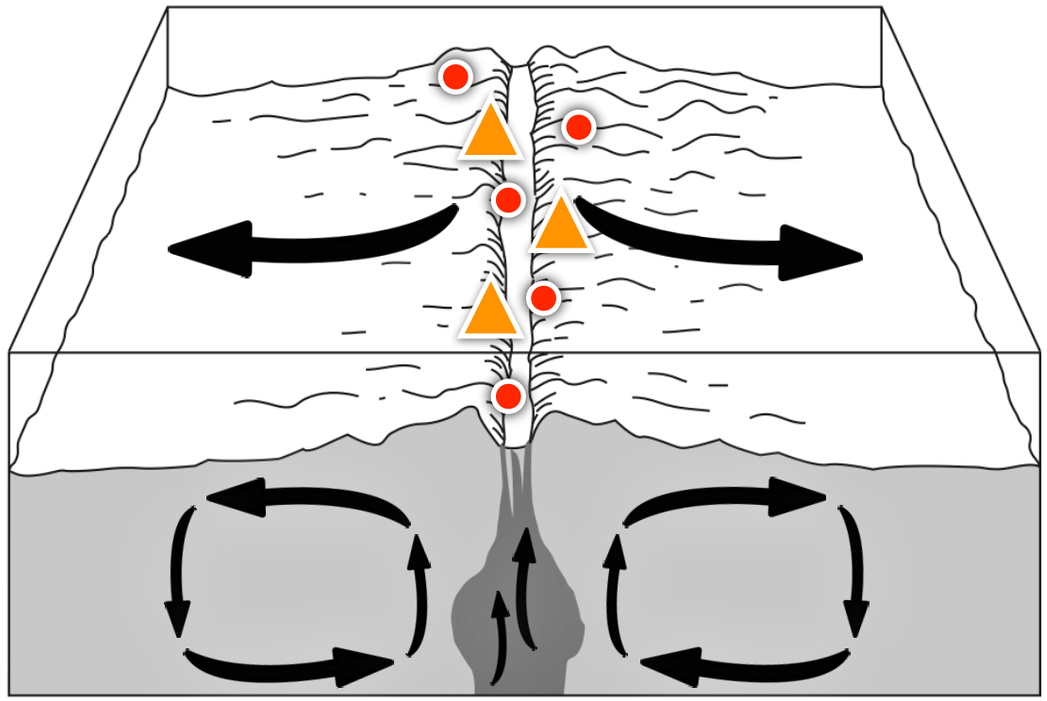
DIVERGENT PLATE BOUNDARIES

MID-OCEAN RIDGE

DESCRIPTION

1. Thin, basaltic oceanic crust splits apart
2. Plate motion is driven by convection currents
3. Minor earthquakes and volcanoes are common

DIAGRAM

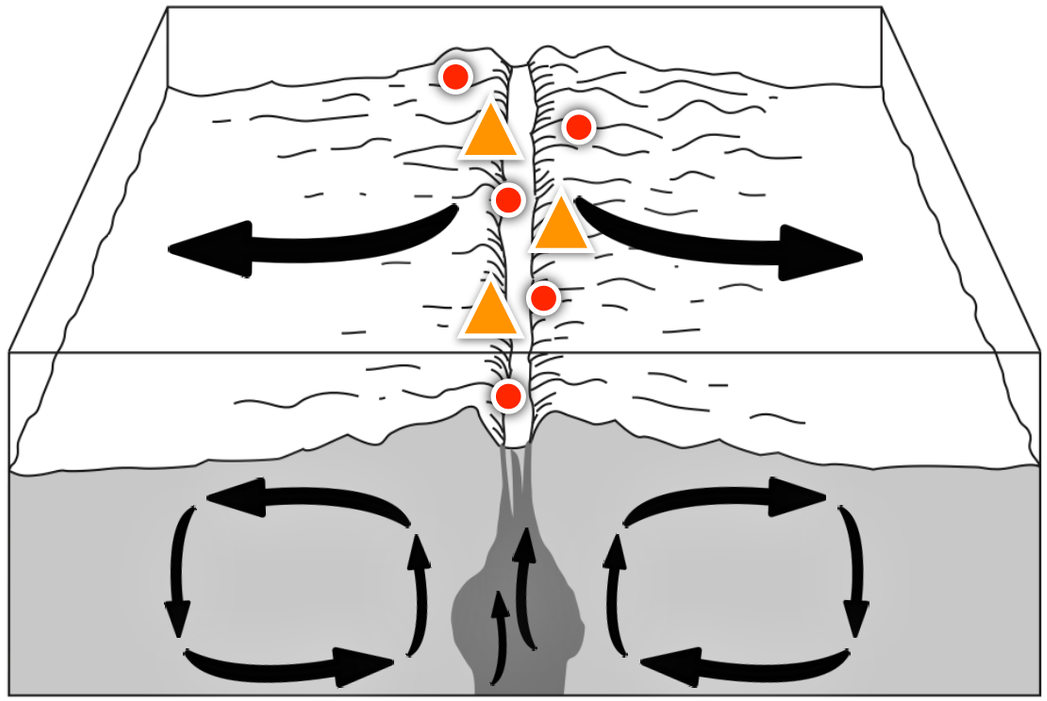


DIVERGENT PLATE BOUNDARIES
MID-OCEAN RIDGE

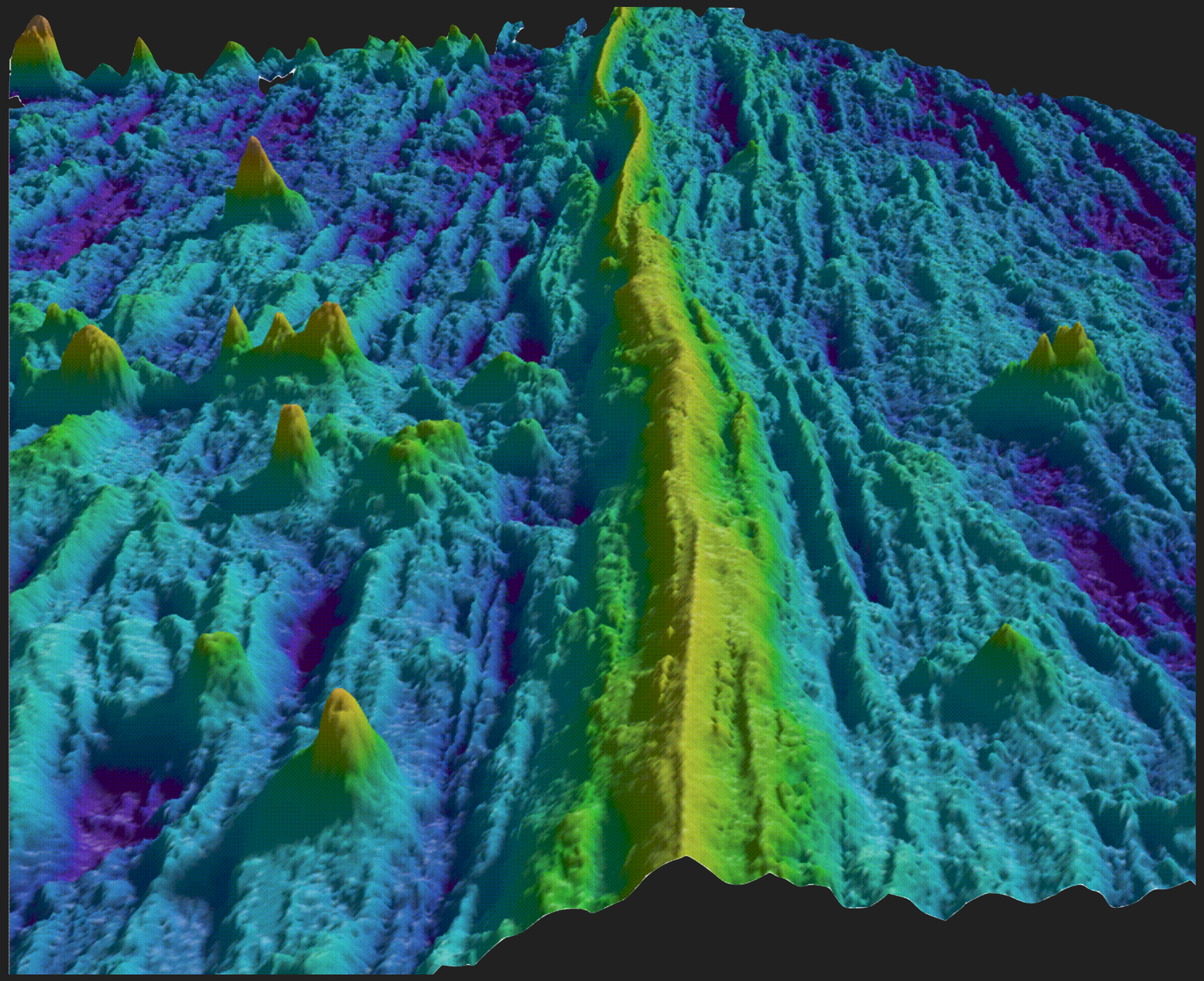
DESCRIPTION

1. Thin, basaltic oceanic crust splits apart
2. Plate motion is driven by convection currents
3. Minor earthquakes and volcanoes are common
4. Example: Mid-Atlantic Ridge

DIAGRAM



CONVERGENT PLATE BOUNDARIES
MID-OCEAN RIDGE

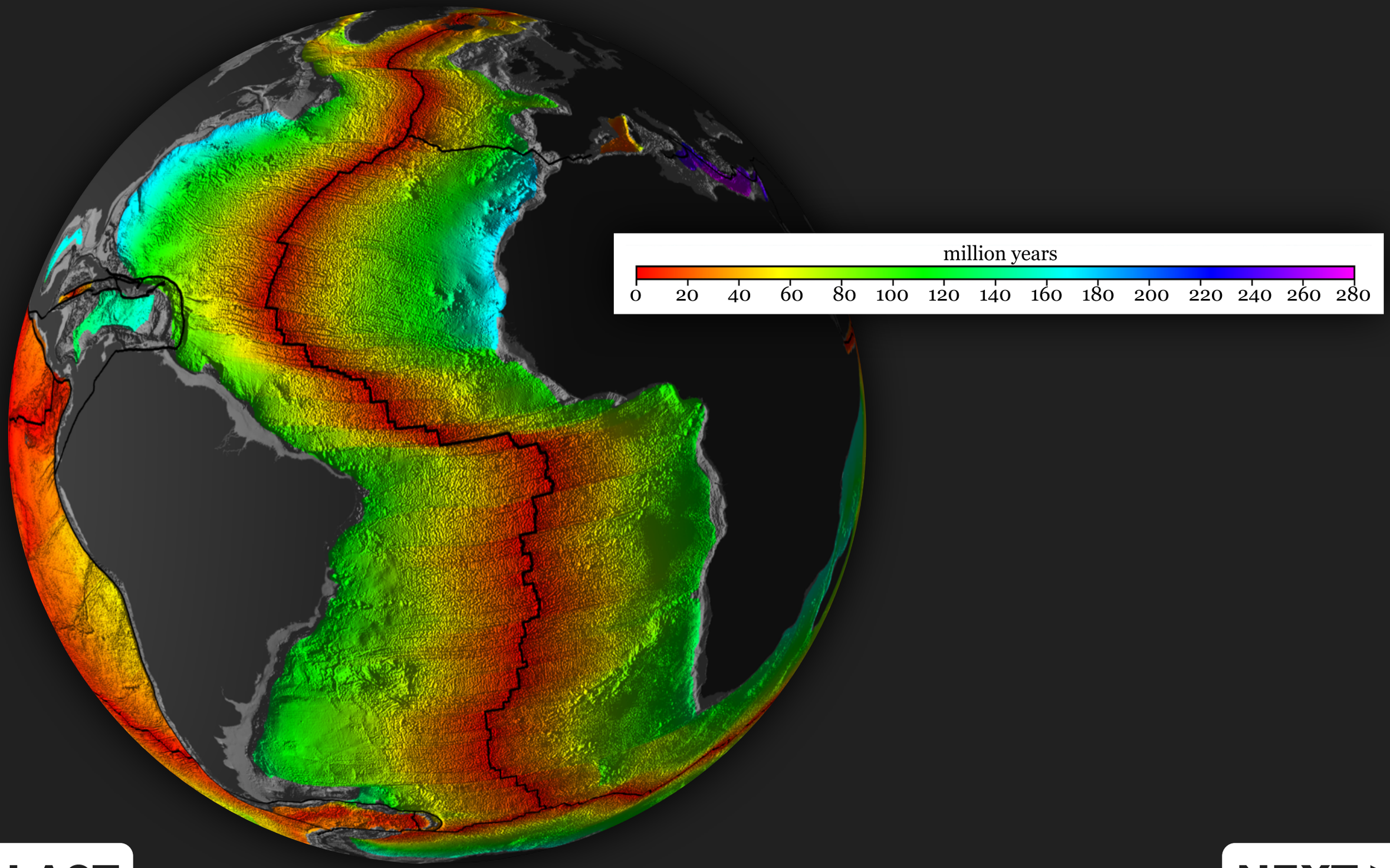


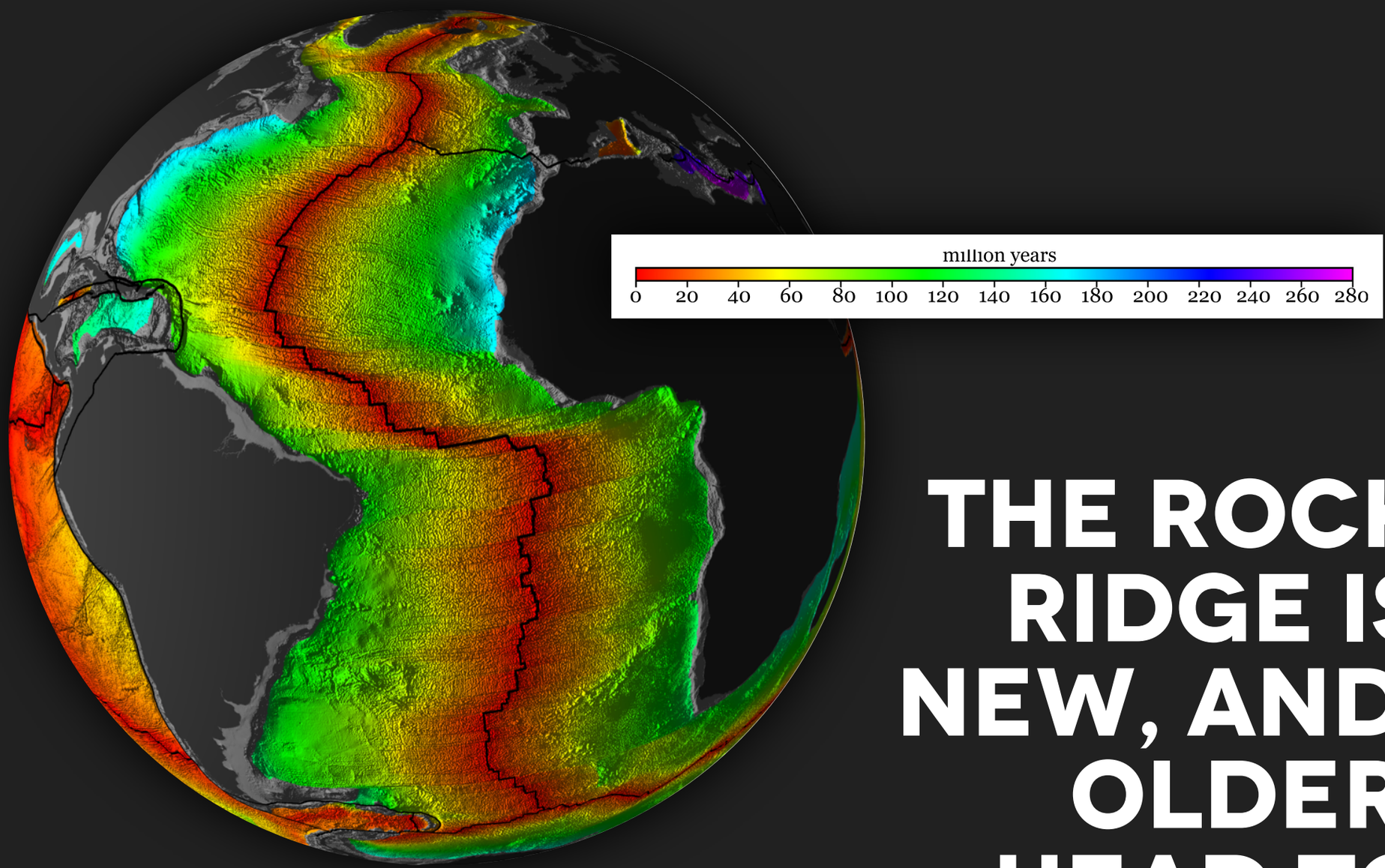
BUT WAIT, HOW DO WE KNOW THE SEAFLOOR IS REALLY SPREADING?

BUT WAIT, HOW DO WE KNOW THE SEAFLOOR IS REALLY SPREADING?

WE HAVE 2 PIECES OF STRONG EVIDENCE

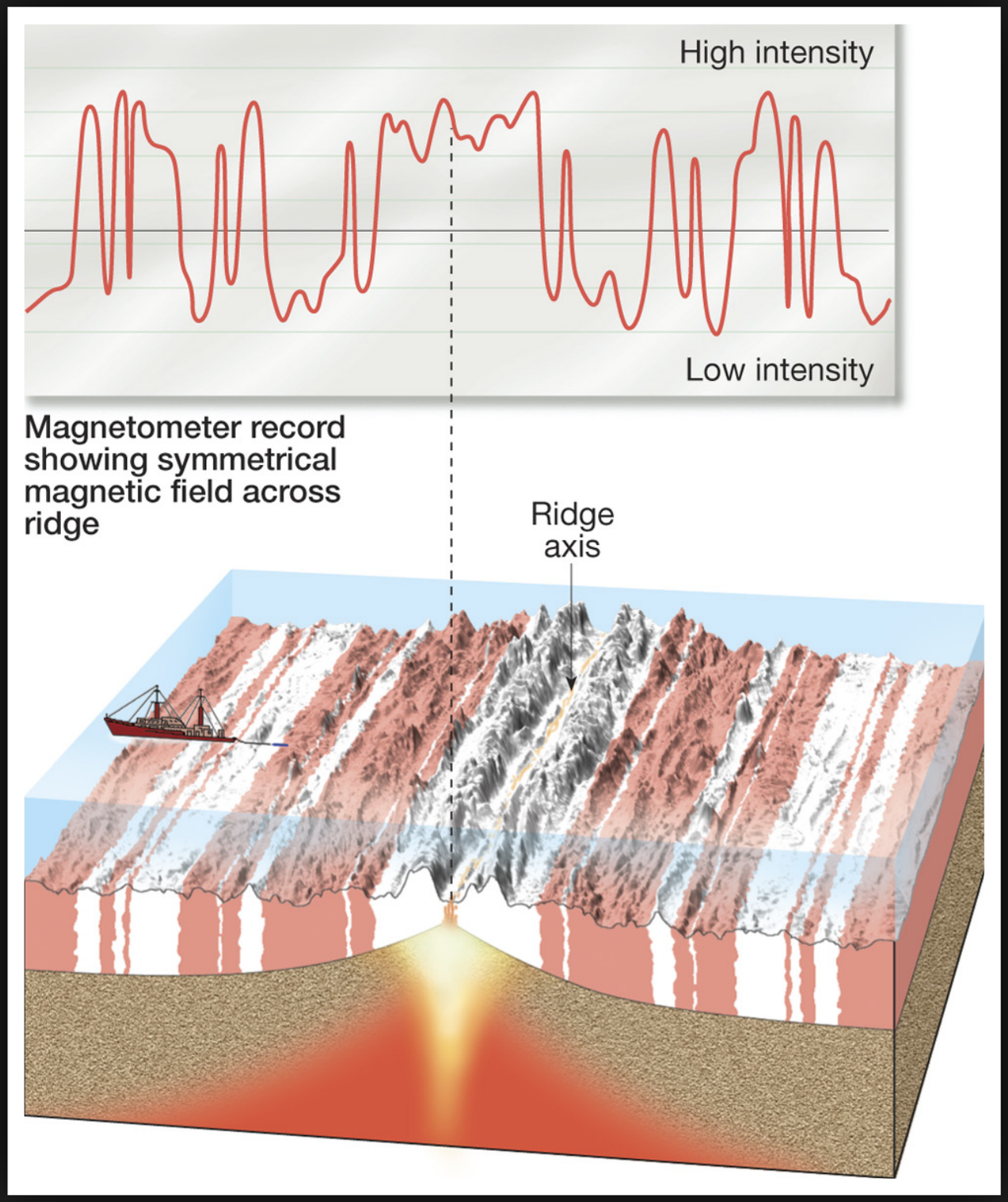
FIRST, LOOK AT THE AGE OF THE ROCK ON THE SEAFLOOR.





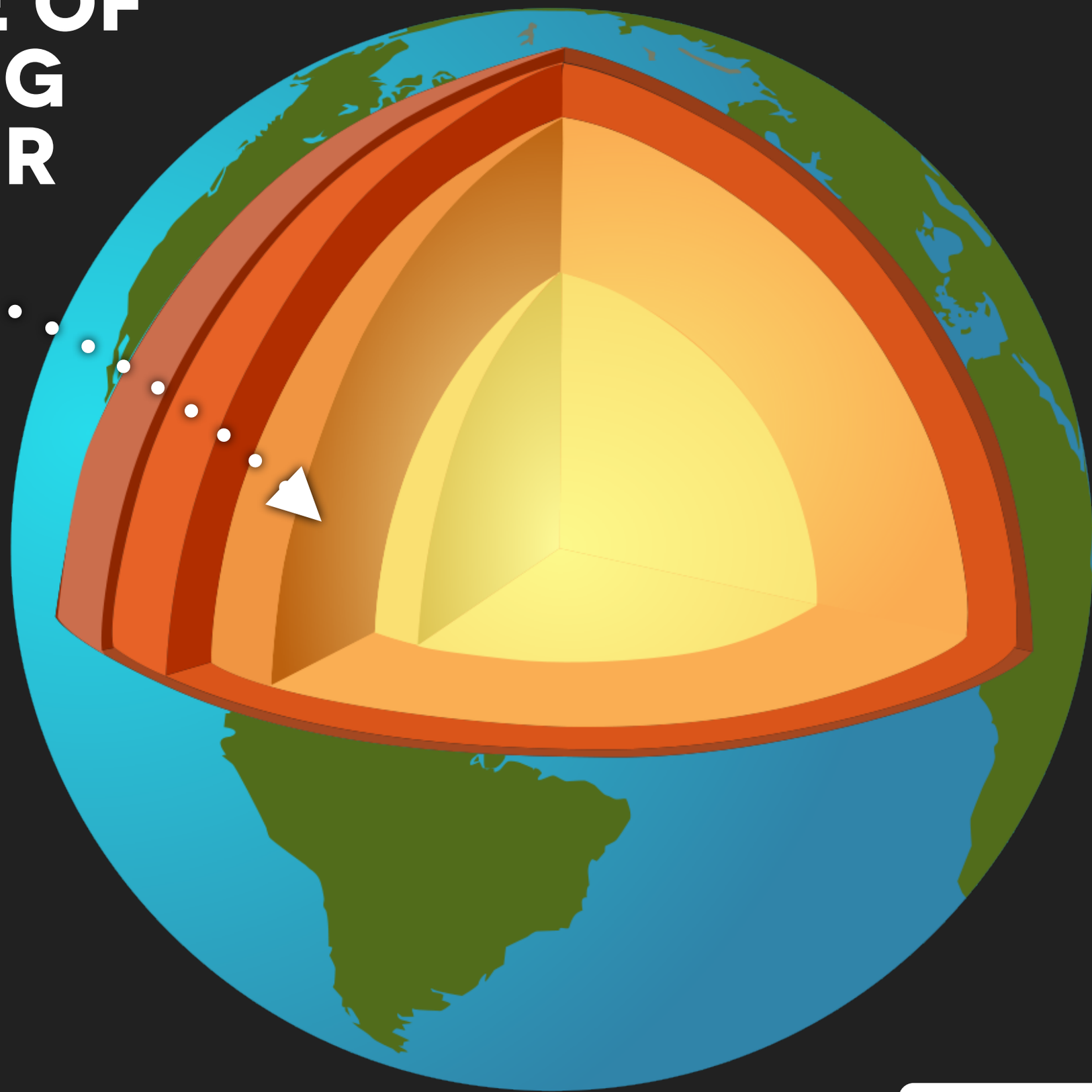
THE ROCK AT THE RIDGE IS BRAND NEW, AND IT GETS OLDER AS YOU HEAD TOWARDS THE COASTLINES.

SECOND, CHECK OUT THE MAGNETISM OF THE SEAFLOOR.

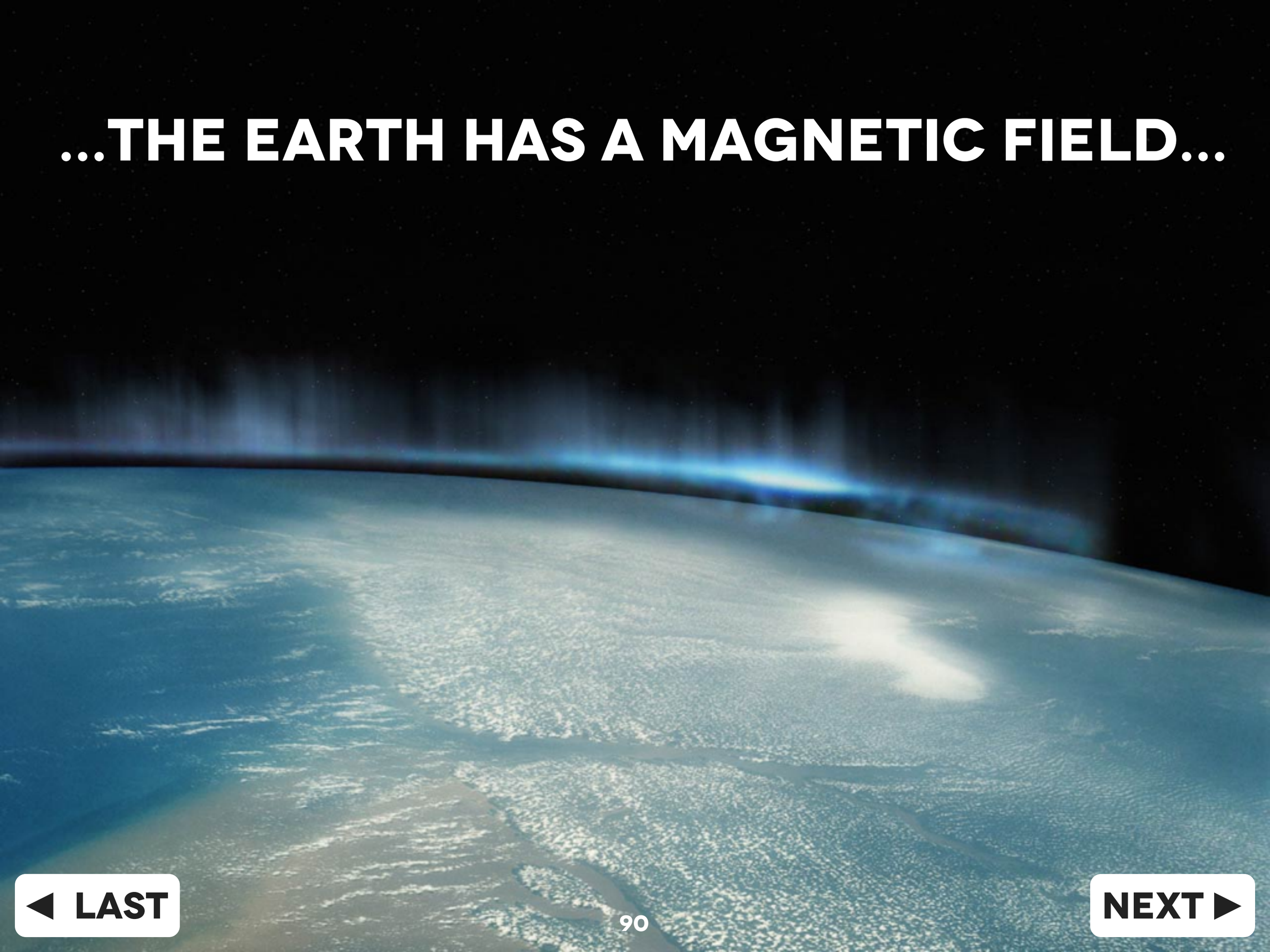


HUH?!?

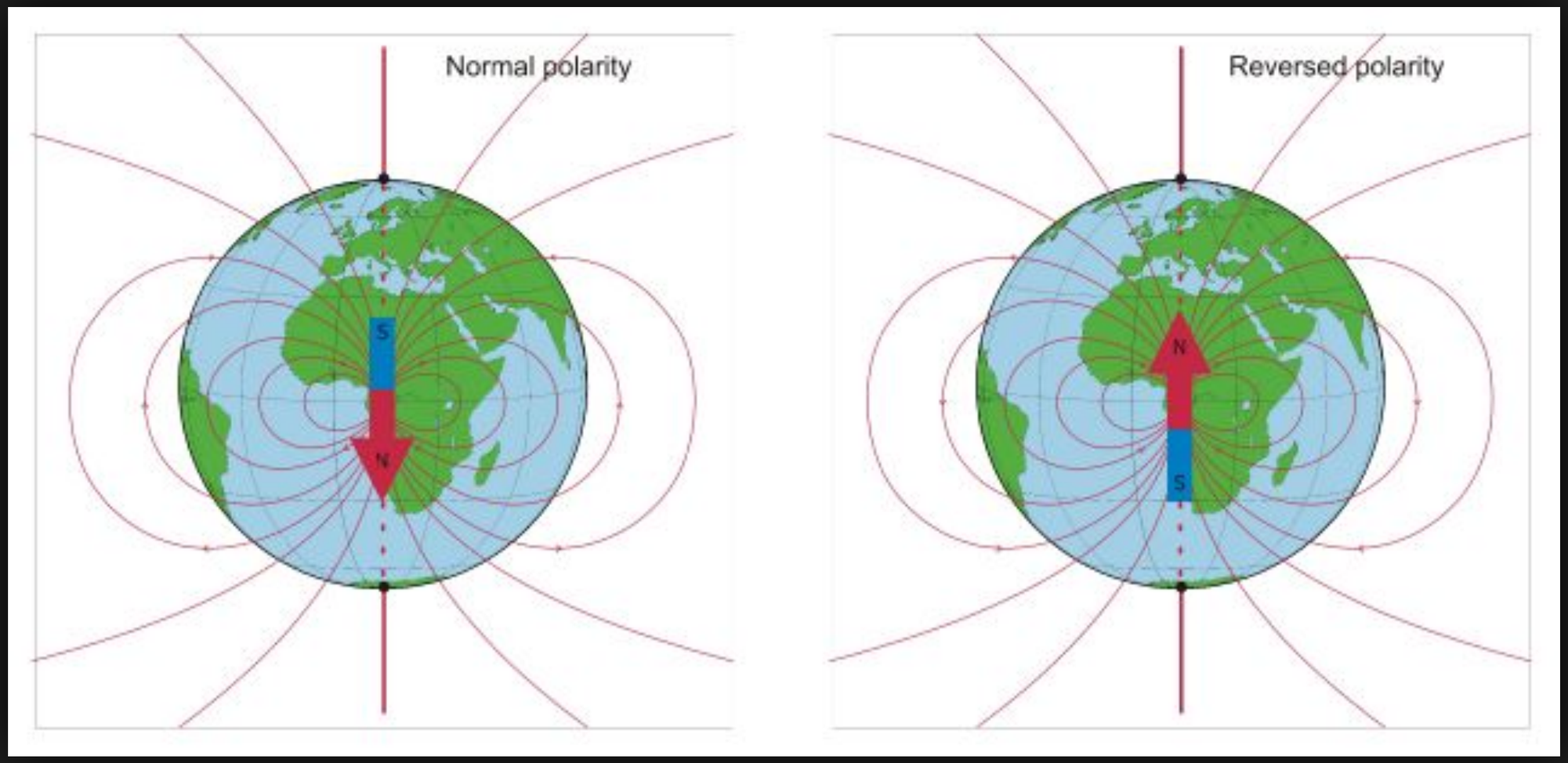
SO, BECAUSE OF OUR FLOWING LIQUID OUTER CORE....



...THE EARTH HAS A MAGNETIC FIELD...

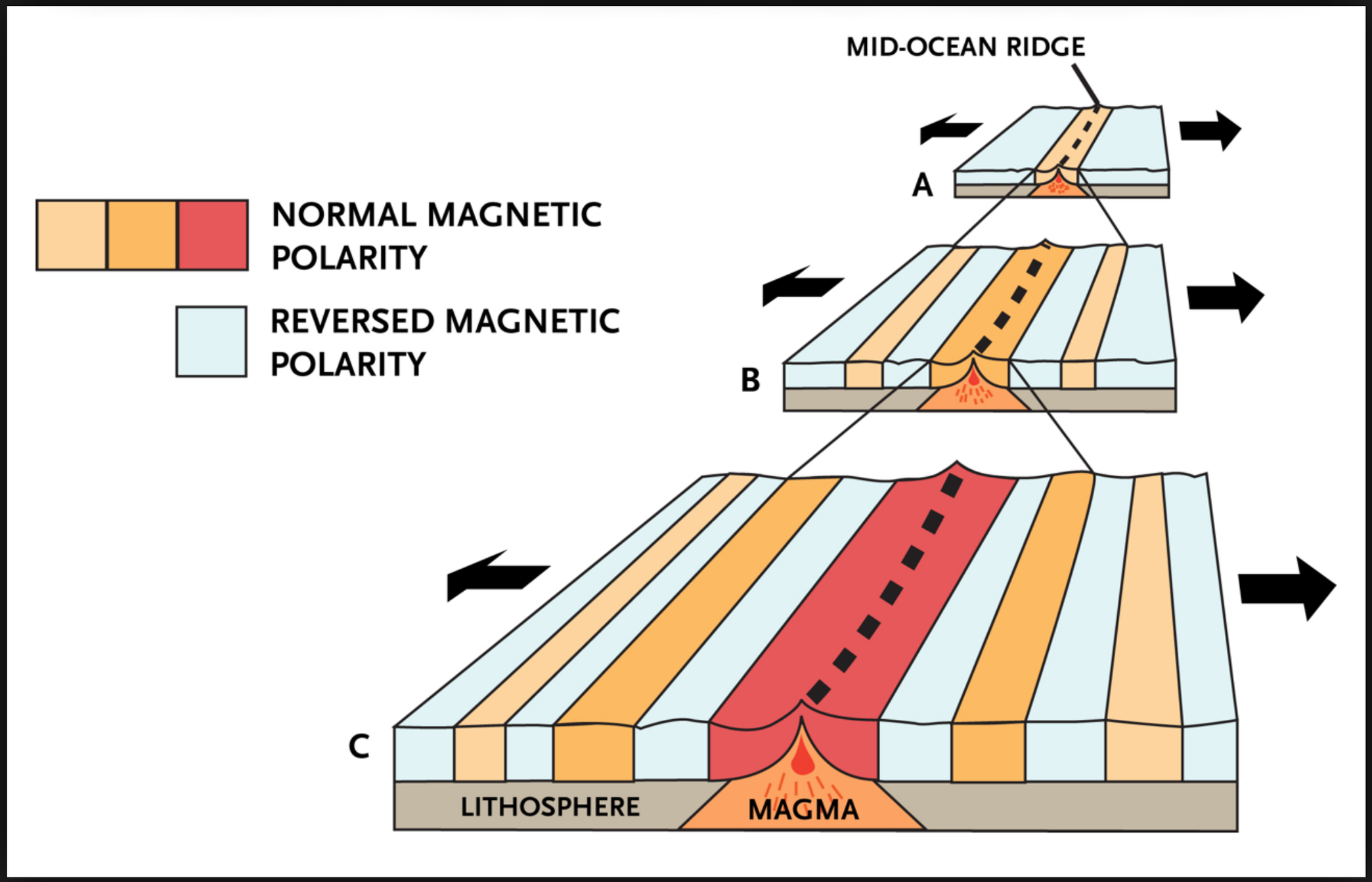


WHICH REVERSES EVERY 300,000 YEARS OR SO.



WHEN MAGMA SOLIDIFIES ALONG MID-OCEAN RIDGES, IT RECORDS THE DIRECTION OF THE MAGNETIC FIELD.

IF YOU LOOK AT THE BASALT ON EITHER SIDE OF THE MID-OCEAN RIDGE, YOU SEE MATCHING BANDS OF ALTERNATING MAGNETISM.



VIDEO #7: MAGNETISM

1. *Go to the "built-in apps" folder*
2. *Open the "Videos" app*
3. *View the video Entitled "Magnetism"*
4. *Answer the questions on your sheet*

THE AGE OF THE SEAFLOOR AND MATCHING PATTERNS OF MAGNETISM...

THE AGE OF THE SEAFLOOR AND MATCHING PATTERNS OF MAGNETISM...

...ARE PROOF OF SEAFLOOR SPREADING.

OK, SO LET'S RECAP...

1. The ***lithosphere*** is broken into large pieces called ***tectonic plates***.

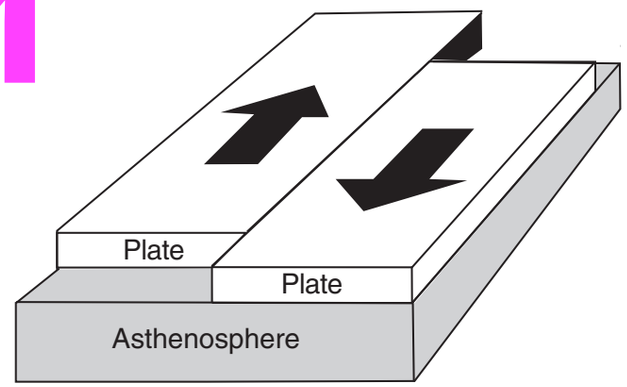
2. These plates "float" on top of the ***asthenosphere***.

3. Plates are moved by ***convection currents*** in the asthenosphere.

4. Wherever plates meet, ***seismic activity*** occurs. This includes earthquakes, volcanoes, mountain building and trench formation.

AND THERE ARE 3 TYPES OF PLATE BOUNDARIES...

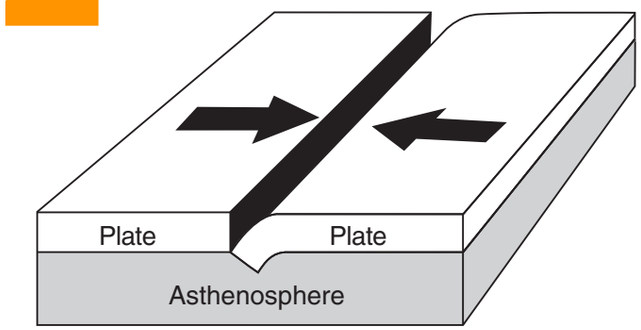
1



TRANSFORM

Plates move past one another

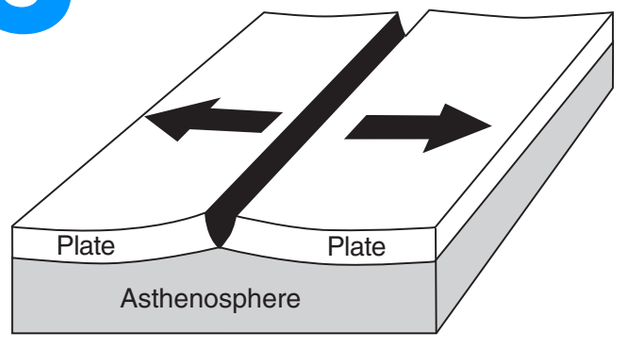
2



CONVERGENT

Plates move towards each other

3

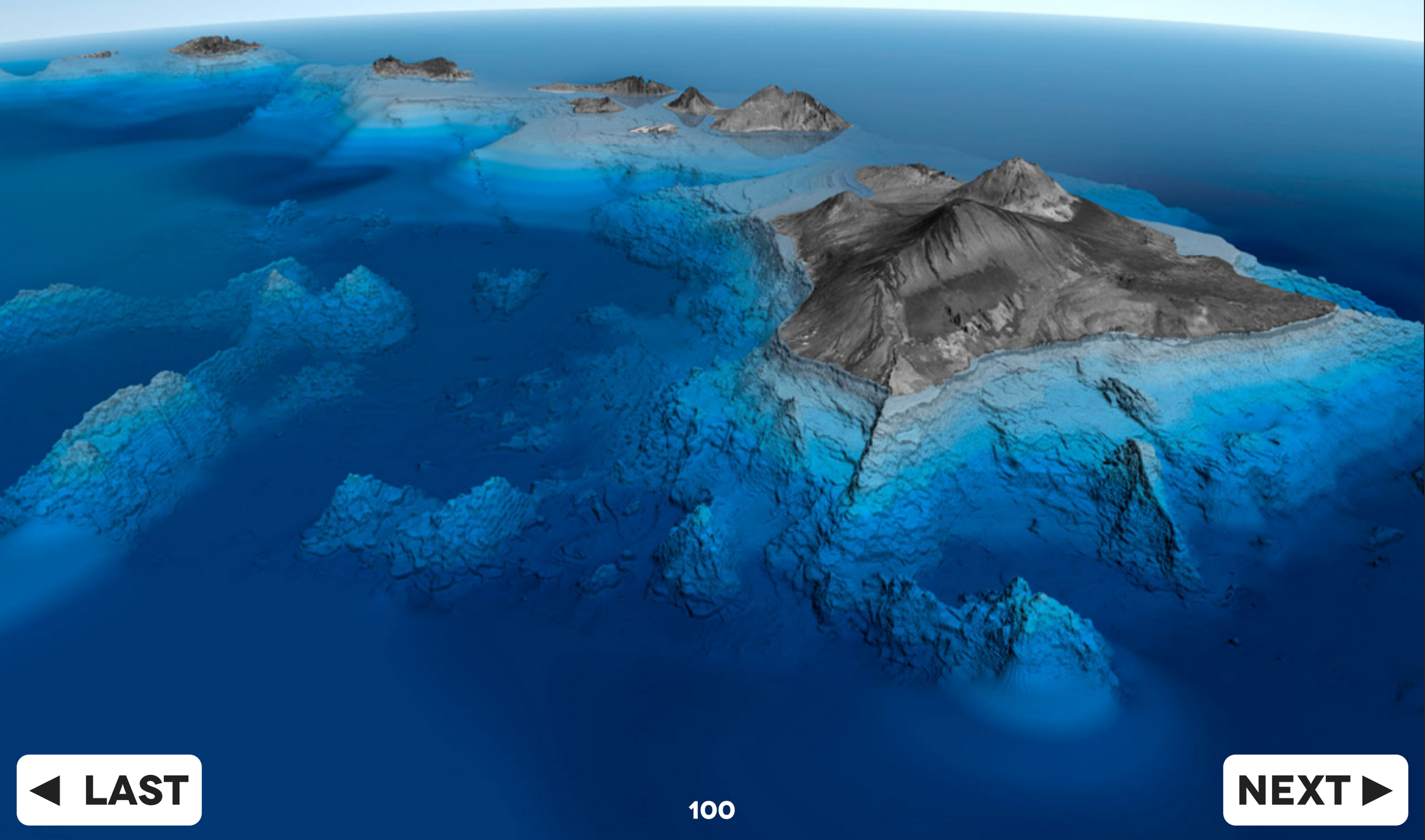


DIVERGENT

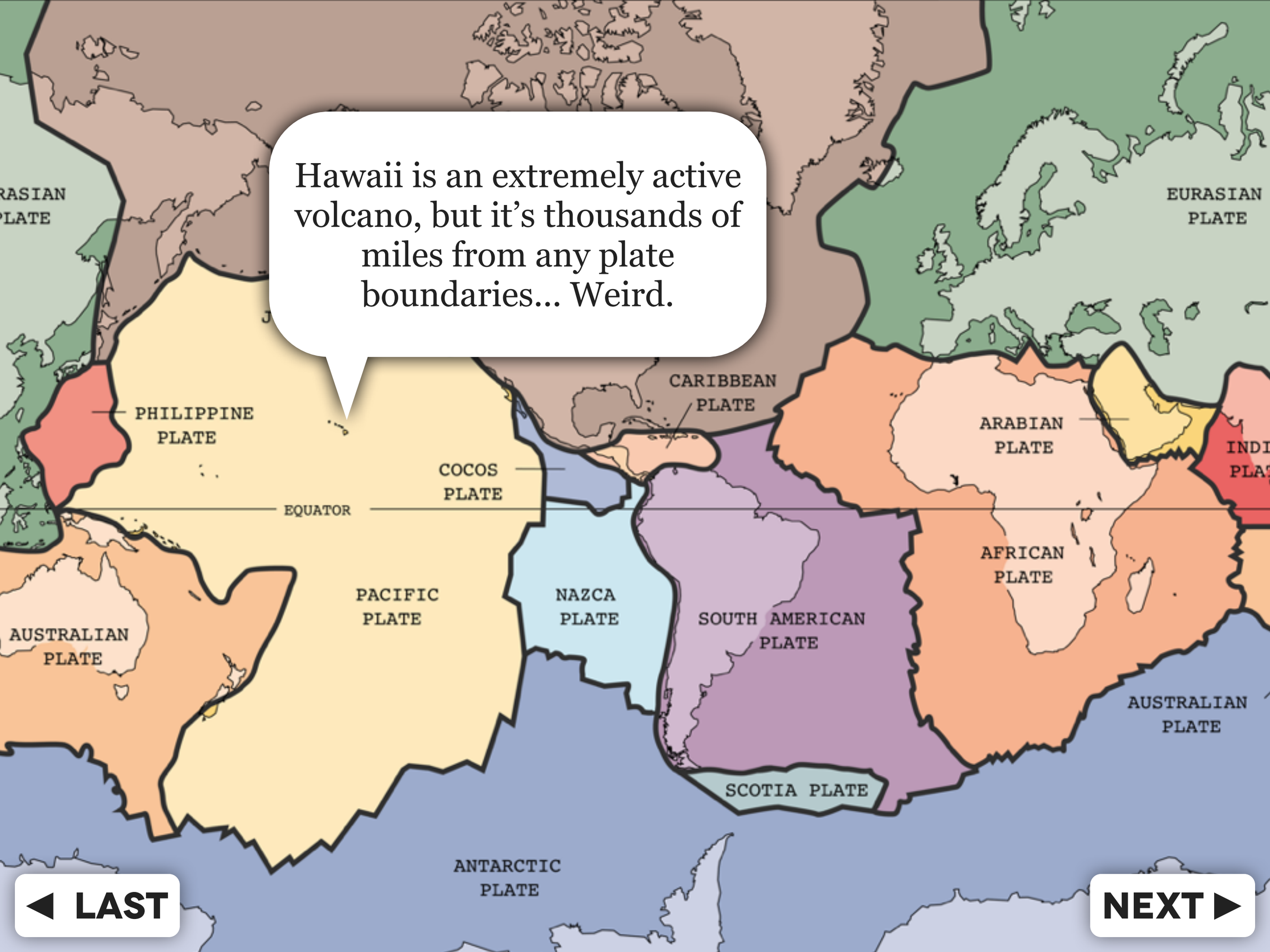
Plates move away from each other

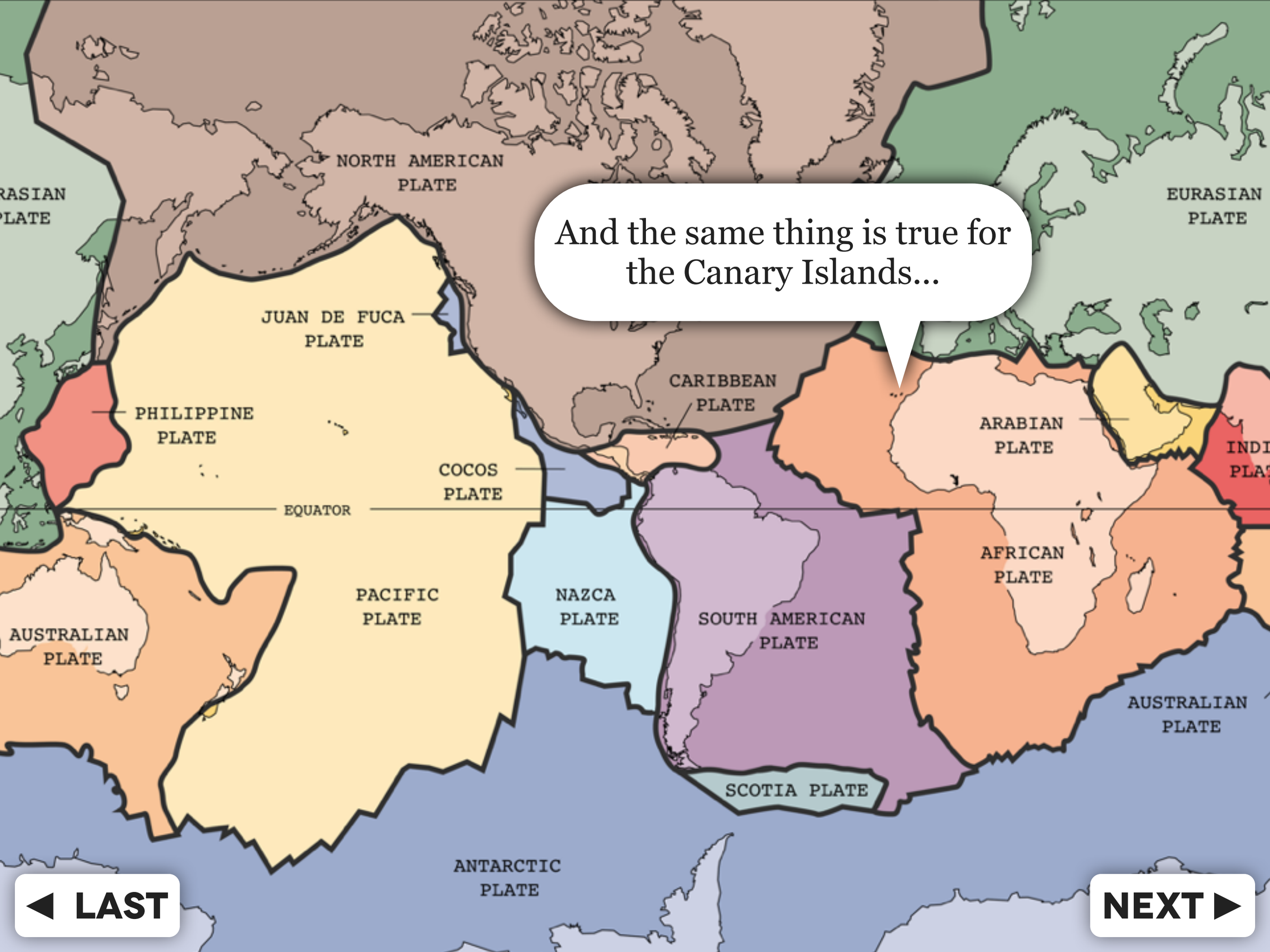
BUT WAIT...
THERE'S ONE PROBLEM!

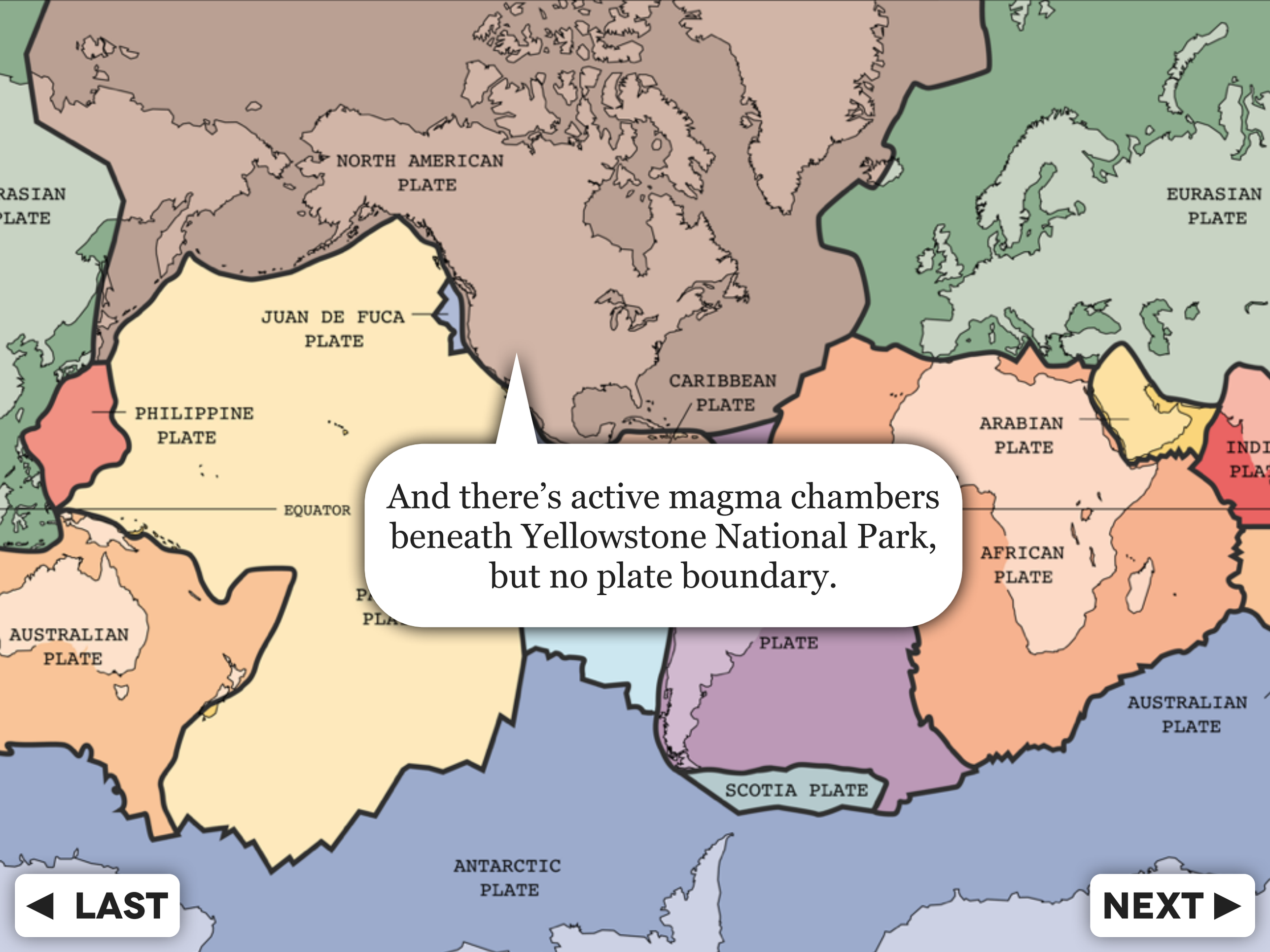
BUT WAIT...
THERE'S ONE PROBLEM!



BUT WAIT...
THERE'S ONE PROBLEM!

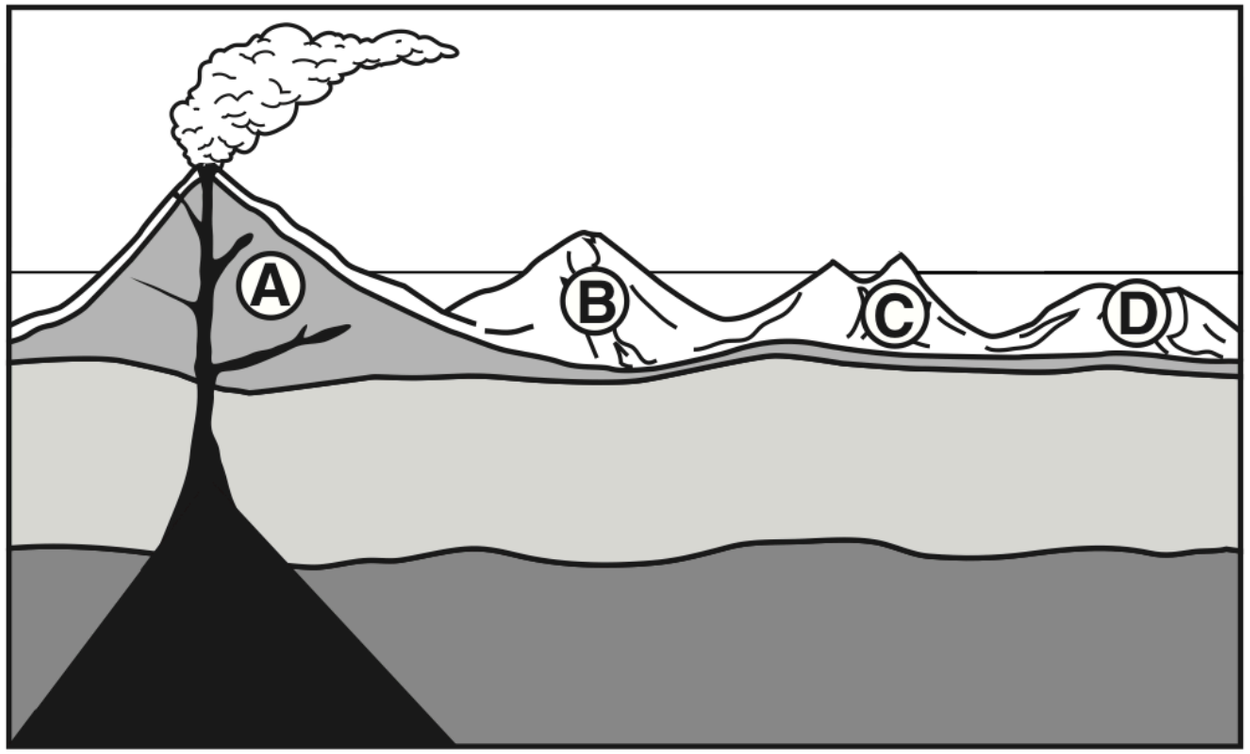

Hawaii is an extremely active volcano, but it's thousands of miles from any plate boundaries... Weird.
EURASIAN PLATE
PHILIPPINE PLATE
CARIBBEAN PLATE
ARABIAN PLATE
COCOS PLATE
EQUATOR
AFRICAN PLATE
PACIFIC PLATE
NAZCA PLATE
SOUTH AMERICAN PLATE
AUSTRALIAN PLATE
AUSTRALIAN PLATE
SCOTIA PLATE
ANTARCTIC PLATE
LAST
NEXT


And the same thing is true for the Canary Islands...
NORTH AMERICAN PLATE
EURASIAN PLATE
JUAN DE FUCA PLATE
CARIBBEAN PLATE
PHILIPPINE PLATE
ARABIAN PLATE
COCOS PLATE
EQUATOR
AFRICAN PLATE
PACIFIC PLATE
NAZCA PLATE
SOUTH AMERICAN PLATE
AUSTRALIAN PLATE
AUSTRALIAN PLATE
SCOTIA PLATE
ANTARCTIC PLATE
LAST
NEXT

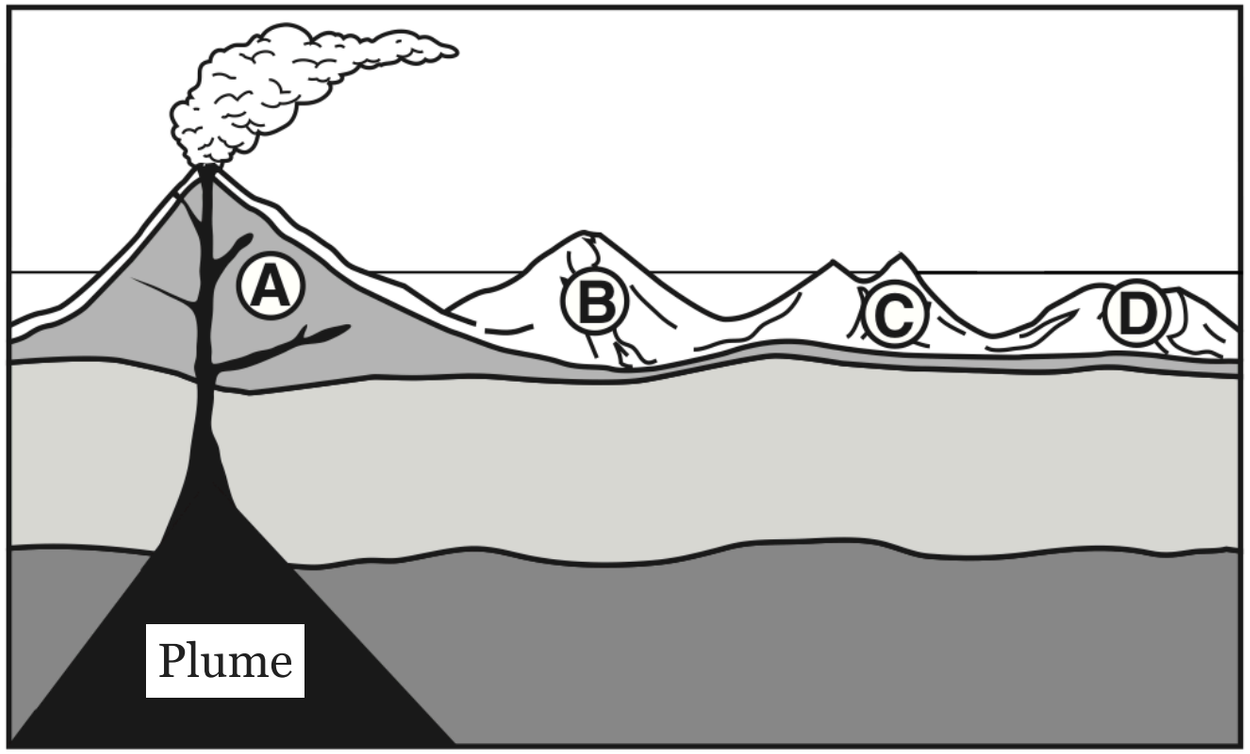

NORTH AMERICAN PLATE
EURASIAN PLATE
JUAN DE FUCA PLATE
CARIBBEAN PLATE
PHILIPPINE PLATE
ARABIAN PLATE
EQUATOR
AFRICAN PLATE
AUSTRALIAN PLATE
PLATE
AUSTRALIAN PLATE
SCOTIA PLATE
ANTARCTIC PLATE
And there's active magma chambers beneath Yellowstone National Park, but no plate boundary.
◀ LAST
NEXT ▶

GEOLOGIST CALL THESE *Hot Spots*

HOT SPOTS

DESCRIPTION	DIAGRAM
	

HOT SPOTS

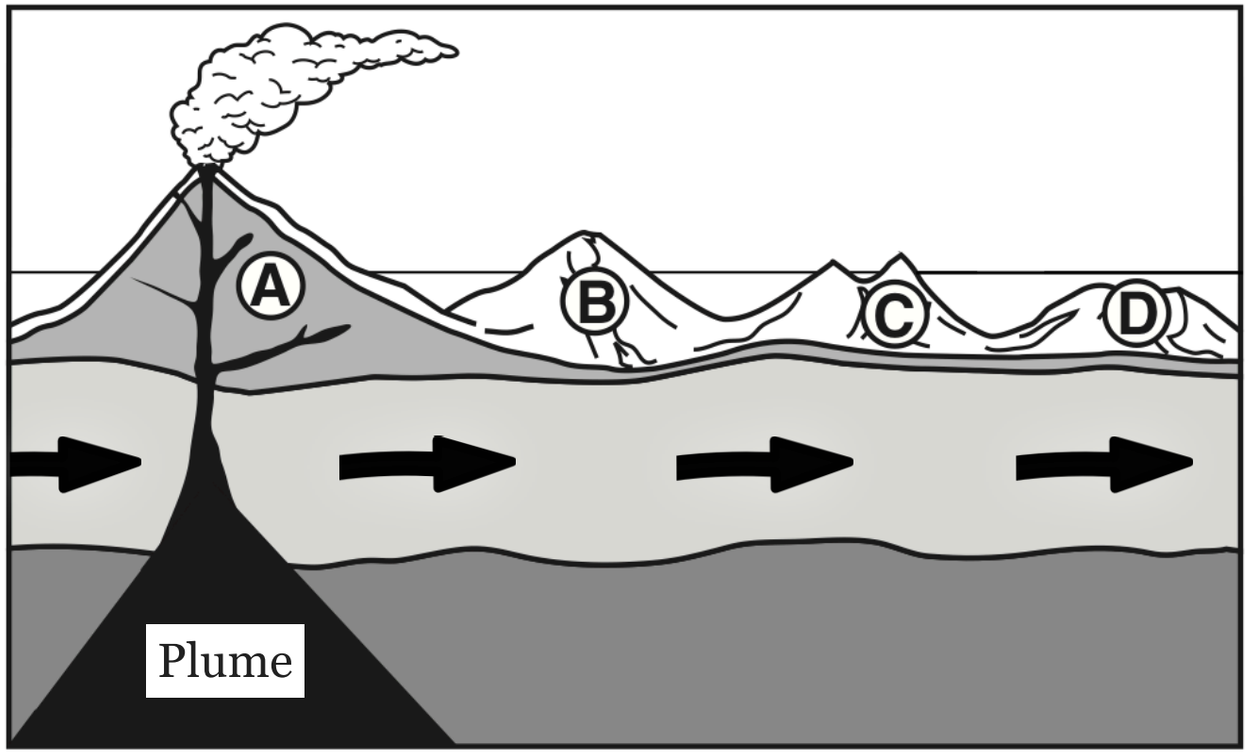
DESCRIPTION	DIAGRAM
1. A plume of magma rises through the plate above creating an active volcano	

HOT SPOTS

DESCRIPTION

1. A plume of magma rises through the plate above creating an active volcano
2. The plate continues to move across the earth's surface away from the plume

DIAGRAM

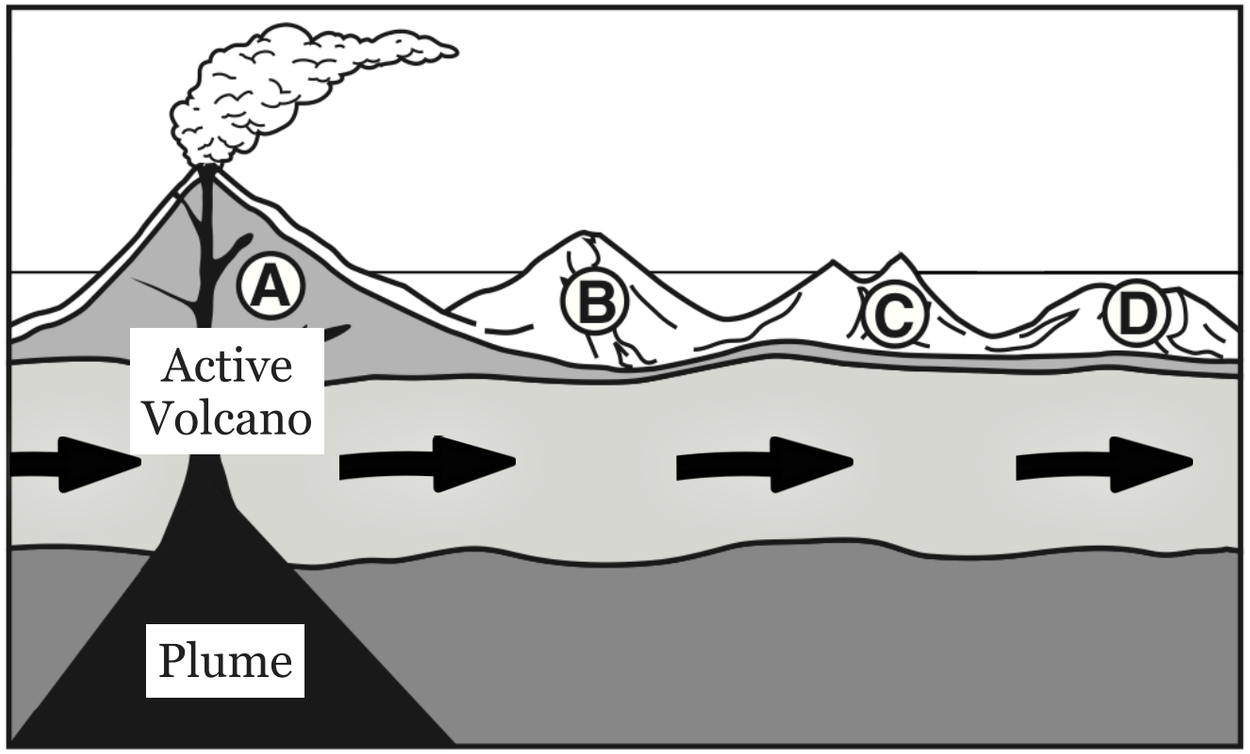


HOT SPOTS

DESCRIPTION

1. A plume of magma rises through the plate above creating an active volcano
2. The plate continues to move across the earth's surface away from the plume
3. The result is one active volcano over the hot spot (A)...

DIAGRAM

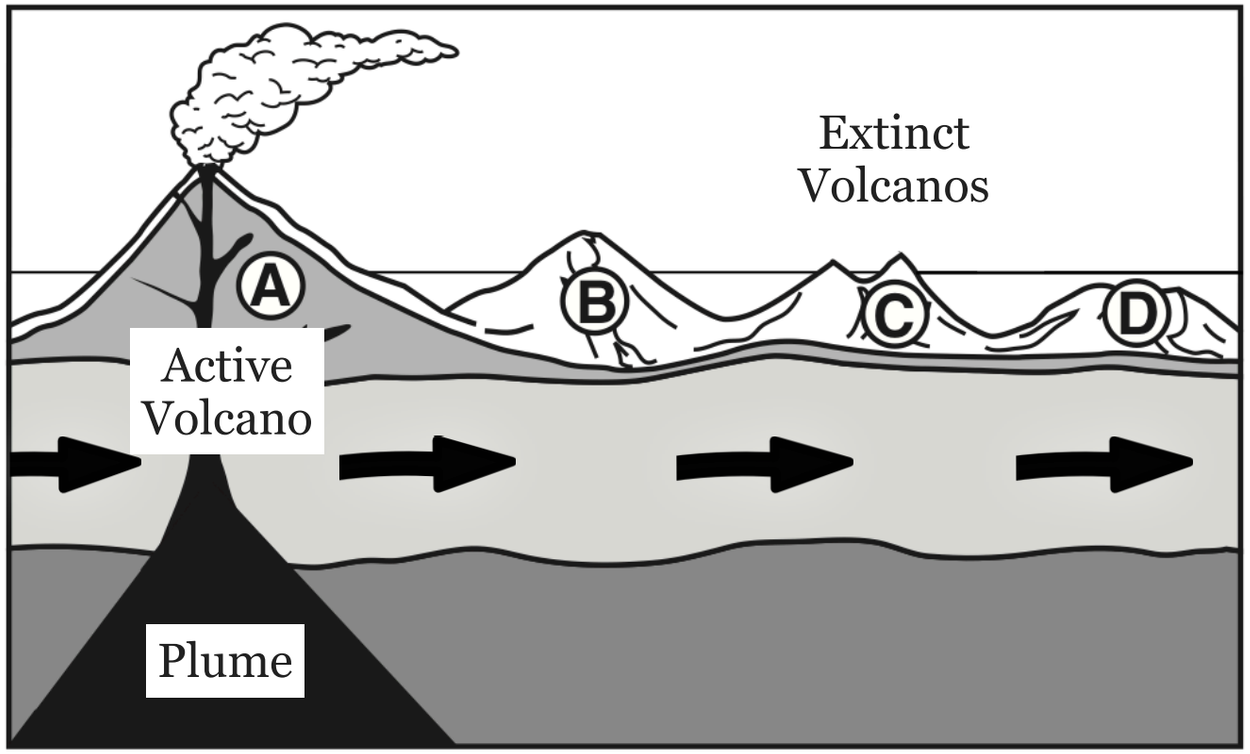


HOT SPOTS

DESCRIPTION

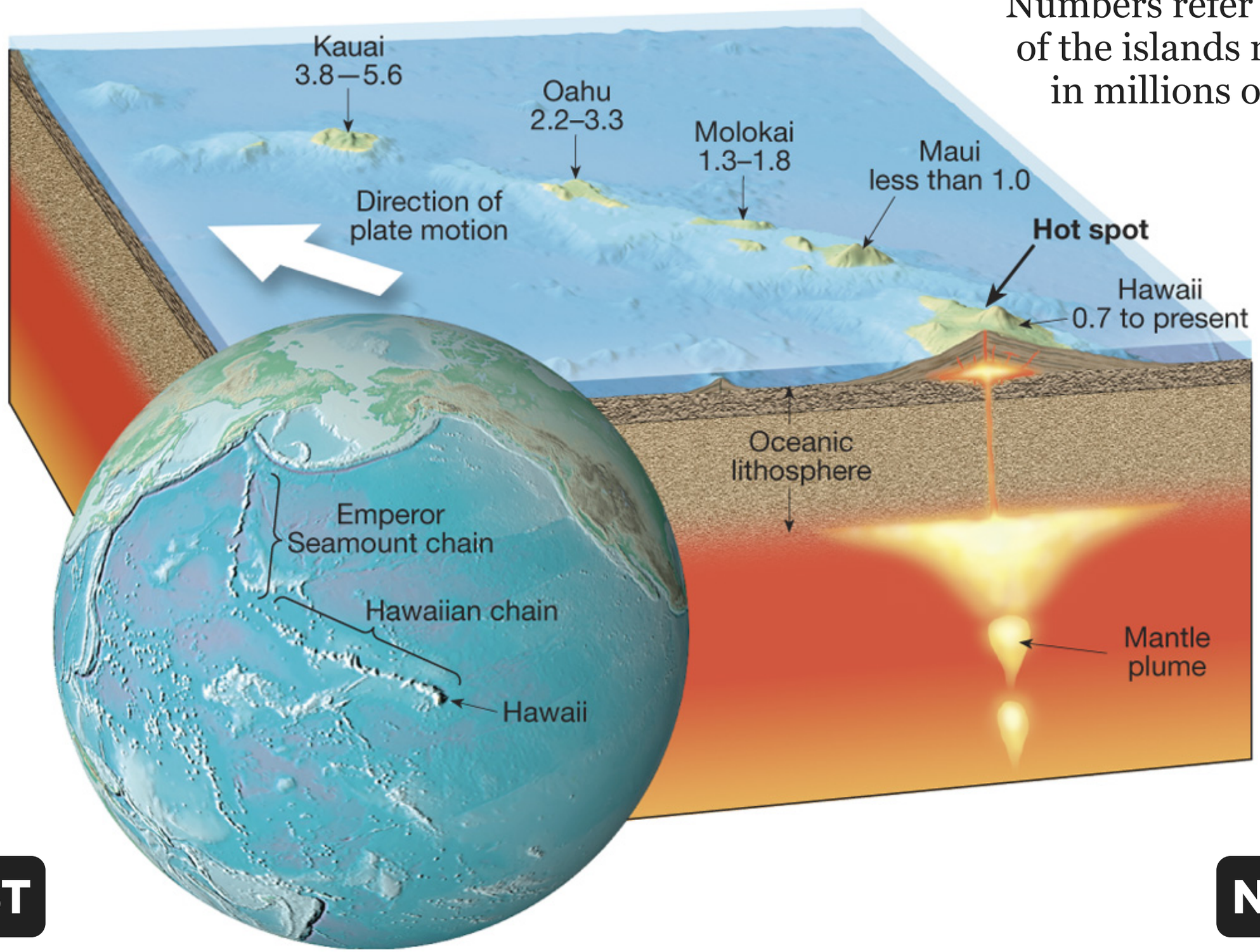
1. A plume of magma rises through the plate above creating an active volcano
2. The plate continues to move across the earth's surface away from the plume
3. The result is one active volcano over the hot spot (A)...
4. ...and a chain of extinct volcanoes in the direction of the plate motion (B, C, D).

DIAGRAM



HOT SPOTS

Numbers refer to the age of the islands measured in millions of years.



◀ LAST

NEXT ▶

VIDEO #8: HOT SPOTS 1

1. *Go to the "built-in apps" folder*
2. *Open the "Videos" app*
3. *View the video Entitled "Hot Spots 1"*
4. *Answer the questions on your sheet*

VIDEO #9: HOT SPOTS 2

1. *Go to the "built-in apps" folder*
2. *Open the "Videos" app*
3. *View the video Entitled "Hot Spots 2"*
4. *Answer the questions on your sheet*

YOU ARE

YOU ARE *done!*