Mission to Mars!

IS EARTH THE ONLY PLANET TO EXPERIENCE PLATE TECTONICS?

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GeoBus

UK SPACE AGENCY

PLATE TECTONICS

Earth's <u>crust</u> is split up into several <u>tectonic plates</u> which are constantly moving around

(about the same speed human fingernails grow)

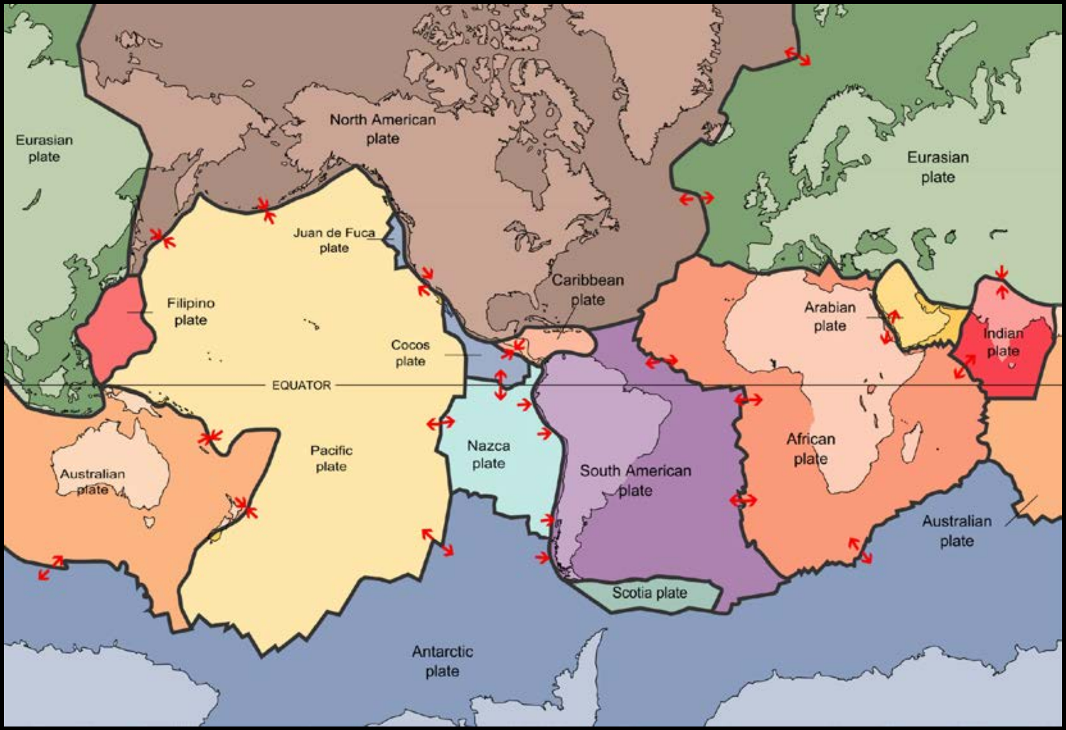

PLATE TECTONICS

Plate movement is caused by mantle convection: because Earth's core is hot, the mantle warms up and becomes less dense, rising towards the crust

It then cools and sinks back down

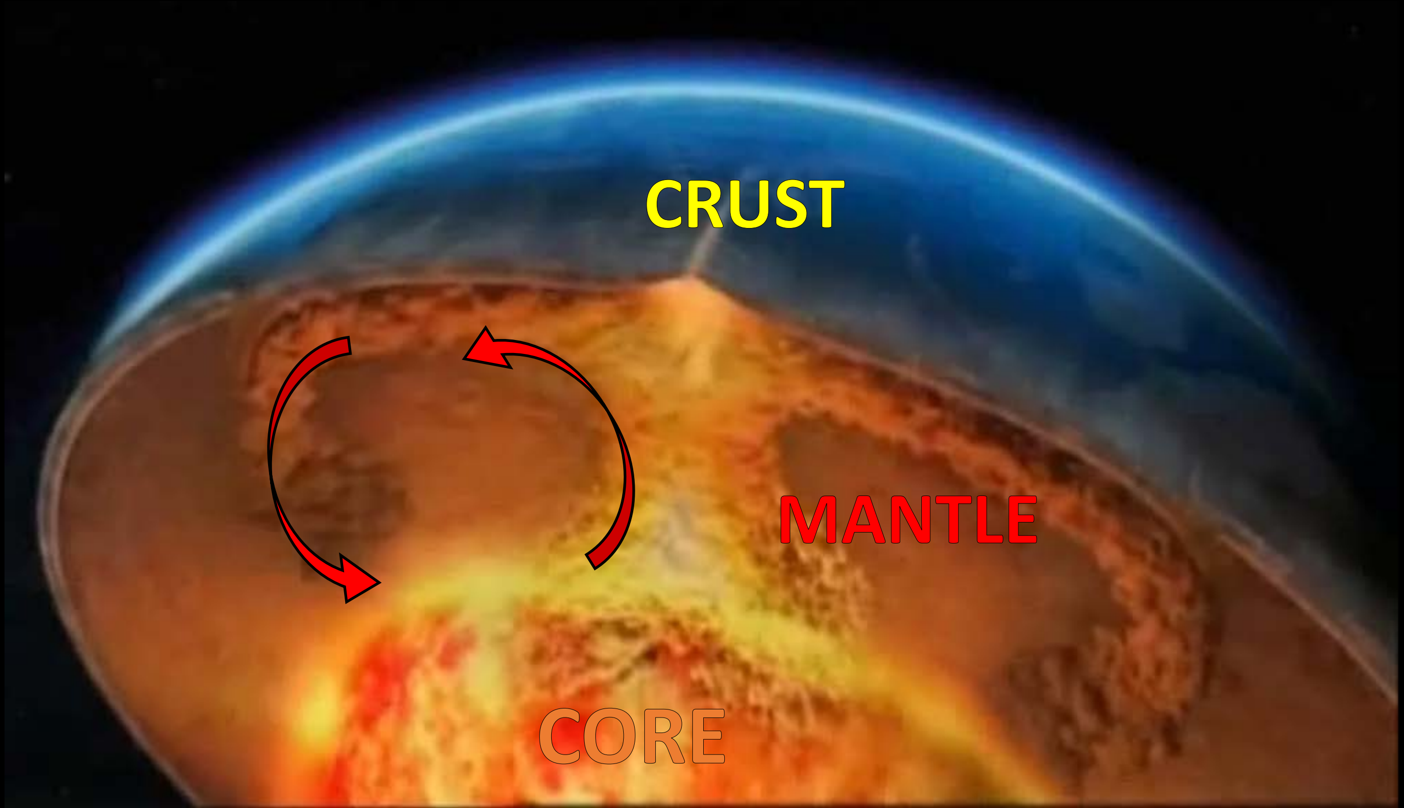

PLATE TECTONICS

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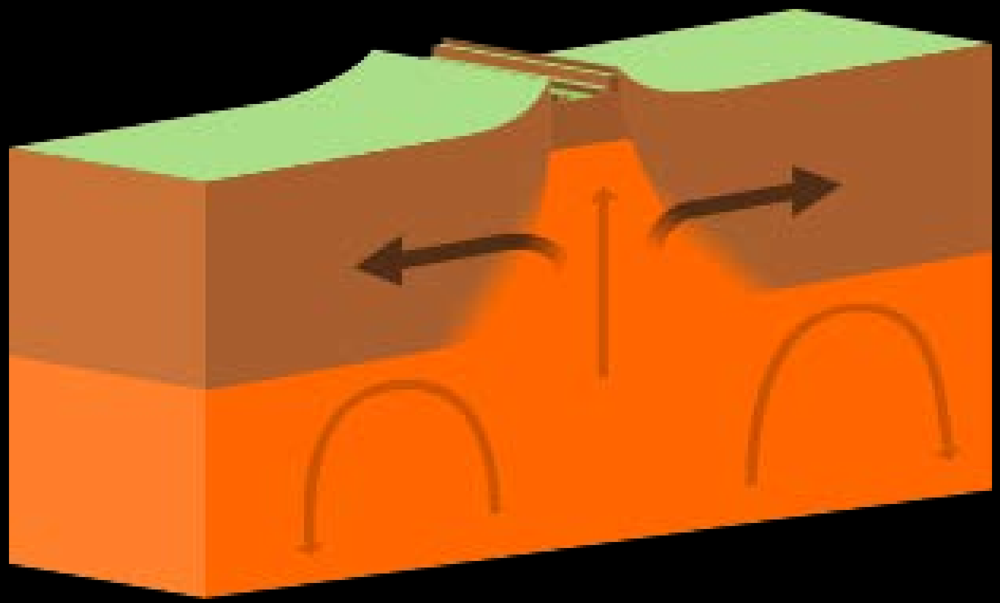
The movement of the plates causes them to interact with each other, forming different geological features which can be identified

GEOLOGICAL FEATURES

…FORMED AT 4 TYPES OF PLATE BOUNDARY

DIVERGENT BOUNDARIES

Two plates moving apart – magma (melted rock from the mantle) rises up to fill the gap between



DIVERGENT BOUNDARIES

DIVERGENCE
CONTINENTAL CRUST:

magma
rising

DIVERGENCE
OCEANIC CRUST:

magma
rising

DIVERGENT BOUNDARIES

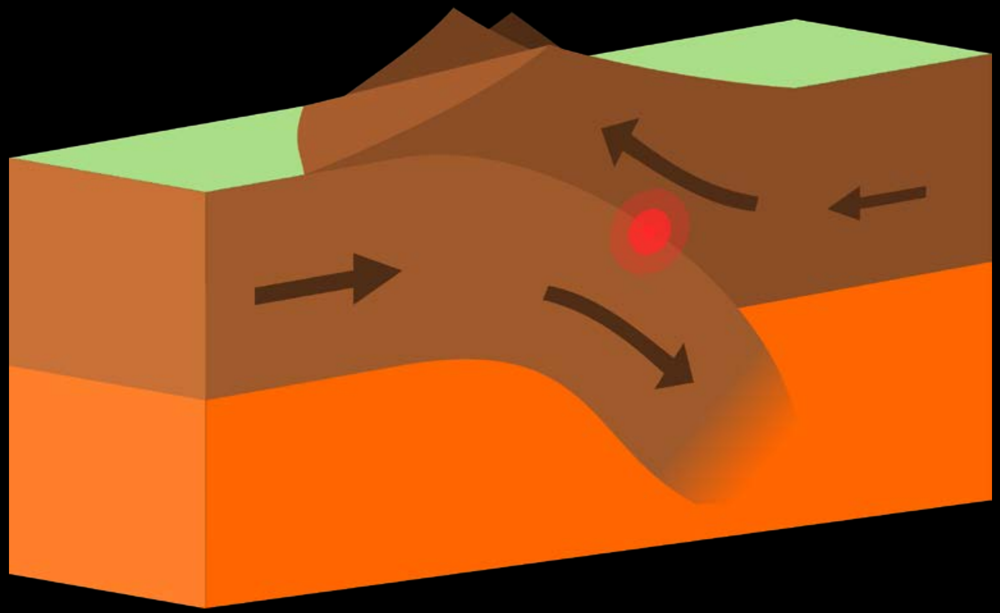
EXTENTION
FEATURES

Rifting

Volcanism

CONVERGENT BOUNDARIES

Two plates moving towards each other
CASE 1 – both continental crust



CONVERGENT BOUNDARIES

Collision of two plates made of continental crust results in
MOUNTAIN BUILDING
for example the Himalayas or the Rocky Mountains

CONVERGENT BOUNDARIES

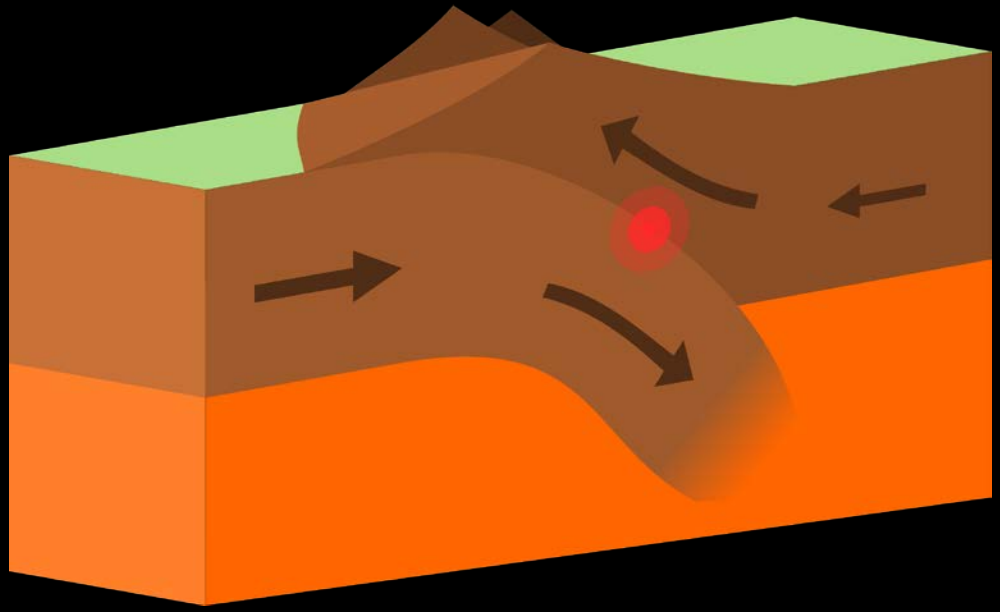
COMPRESSION
FEATURES

Mountain
building

Folding

CONVERGENT BOUNDARIES

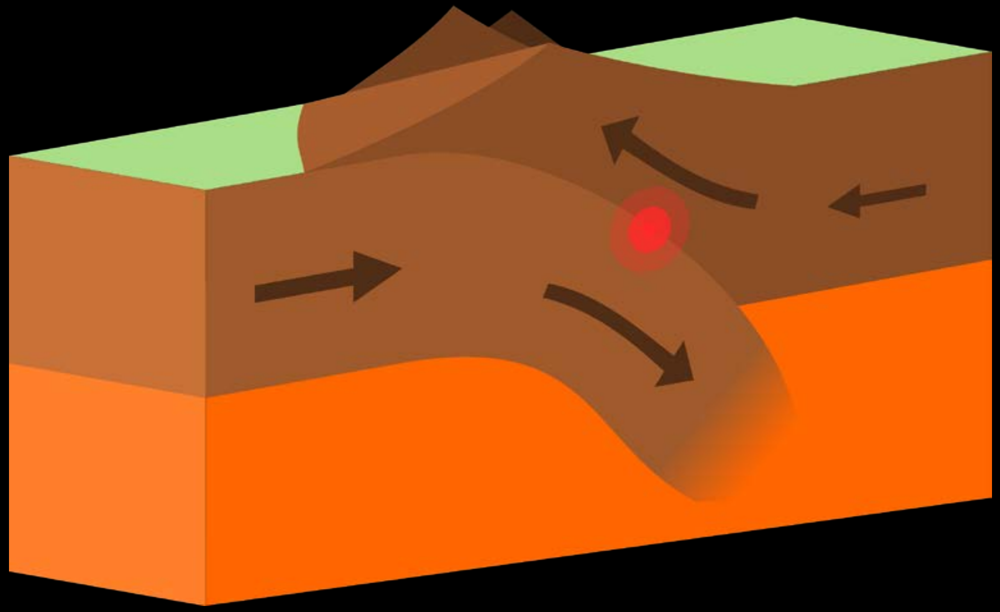
Two plates moving towards each other
CASE 2 – continental + oceanic crust



CONVERGENT BOUNDARIES

Oceanic curst is pushed down underneath continental crust, resulting in a

SUBDUCTION ZONE



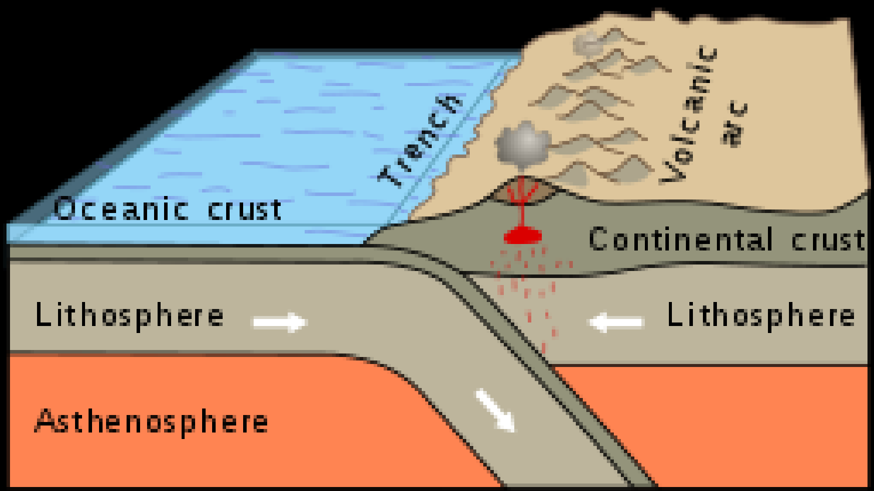
SUBDUCTION ZONE

SUBDUCTION ZONE
FEATURES

Oceanic crust is more dense so sinks in to the mantle, creating slab pull

A trench is formed between the two plates as the oceanic plate sinks, as well as a volcanic arc where the mantle melts and rises up

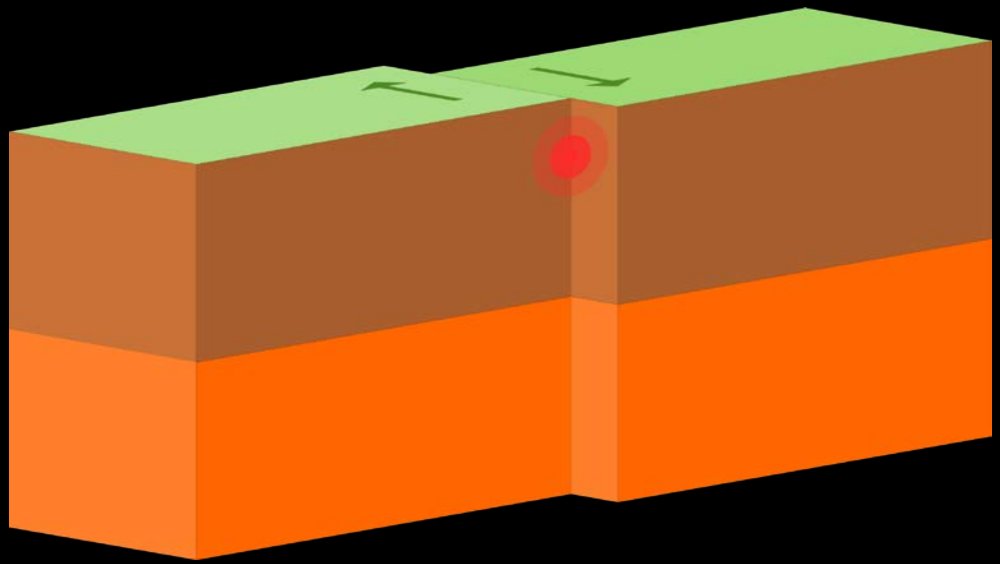
Earthquakes are also common as friction occurs between the two plates



TRANSFORM BOUNDARIES

(ALSO KNOWN AS CONSERVATIVE BOUNDARIES)

Two plates 'slide' past each other, but no crust is created or destroyed

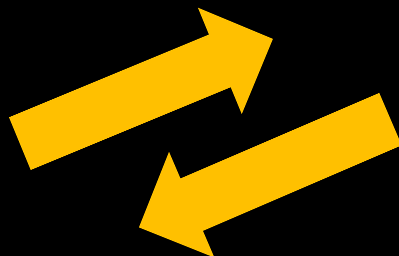


TRANSFORM BOUNDARIES

Earthquakes are common at transform boundaries as friction between the moving plates builds up, then the energy is released

The San Andreas fault, which runs along western coast of USA, is a result of the transform boundary between the Pacific and North American plates

TRANSFORM BOUNDARIES



TRANSFORM FEATURES

Fault systems

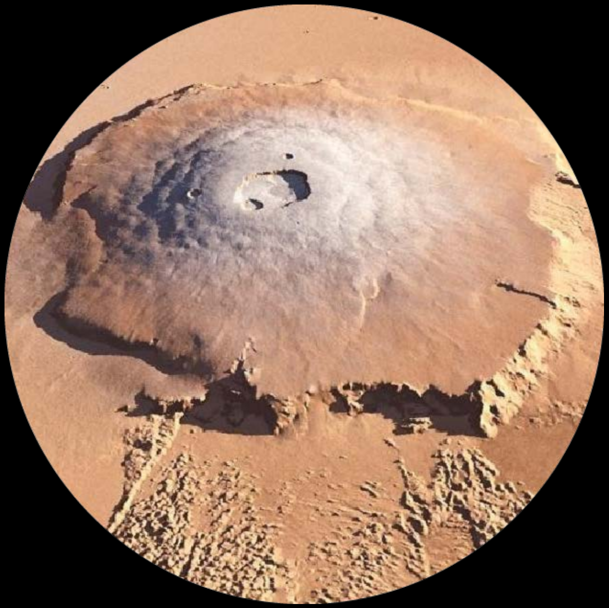
Earthquakes

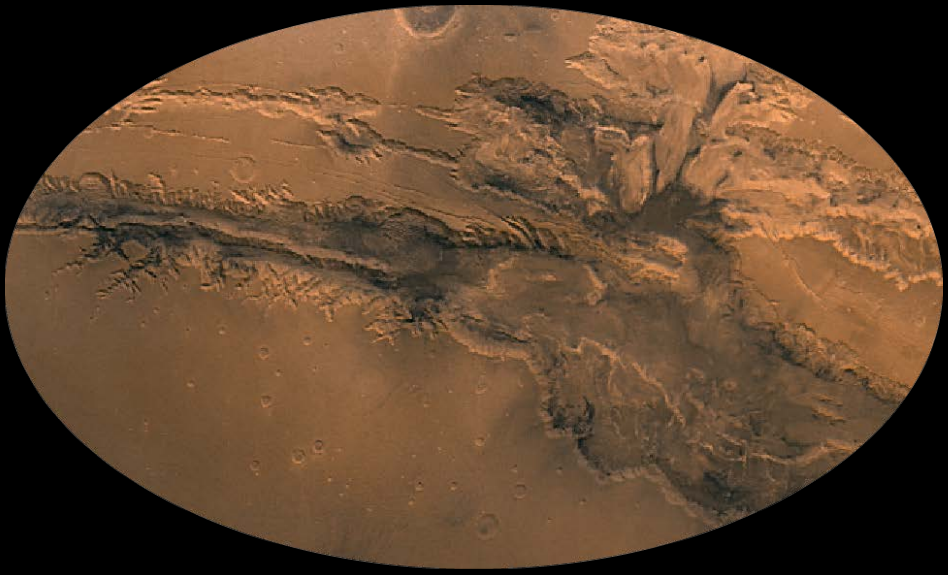
TECTONICS ON MARS?

Mars **no longer** appears to be geologically active (i.e. no erupting volcanoes or earthquakes)

HOWEVER

There is evidence of surface features similar to those on Earth



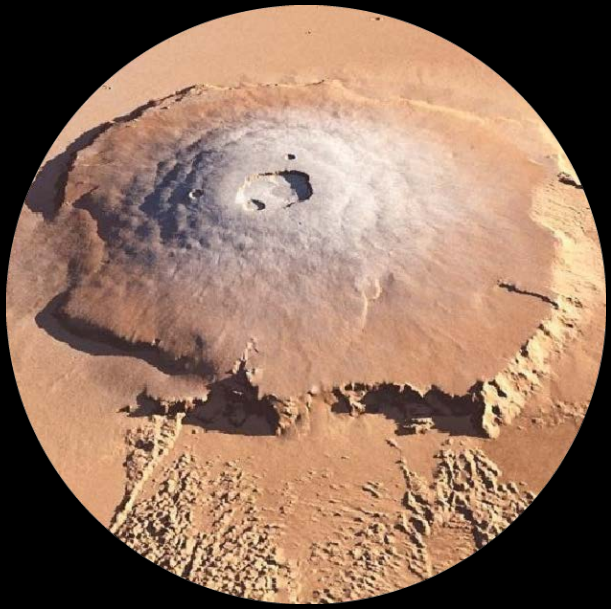


TECTONICS ON MARS?

OLYMPUS MONS

Largest volcano in the solar system

Evidence of geological activity: magma rising from interior



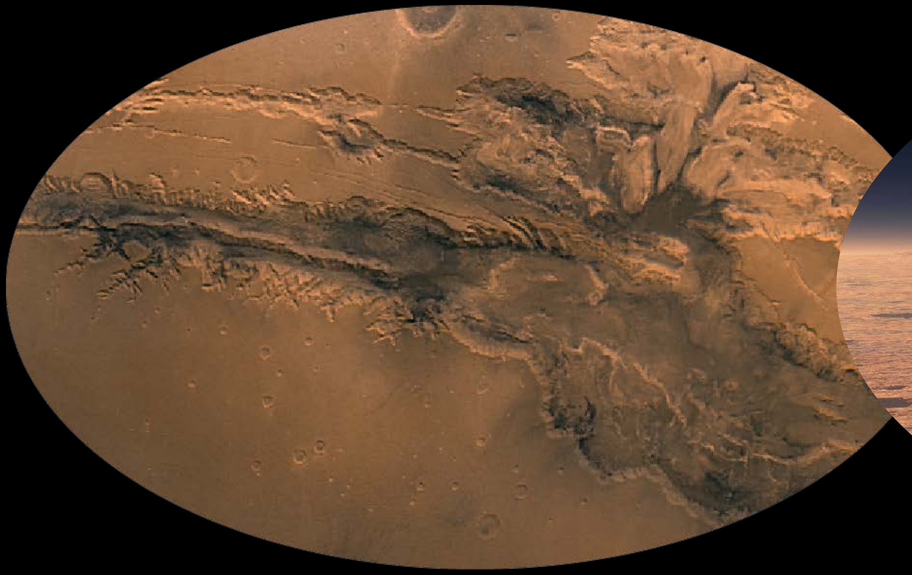
TECTONICS ON MARS?

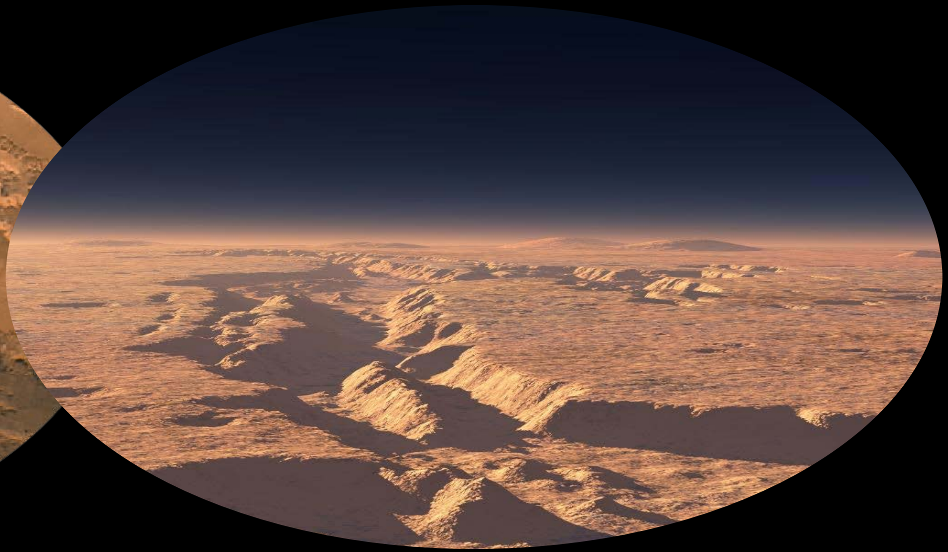
VALLES MARINERIS

Rift valley

Evidence of activity: plate movements causing rifting

(indicates PLATE TECTONICS)



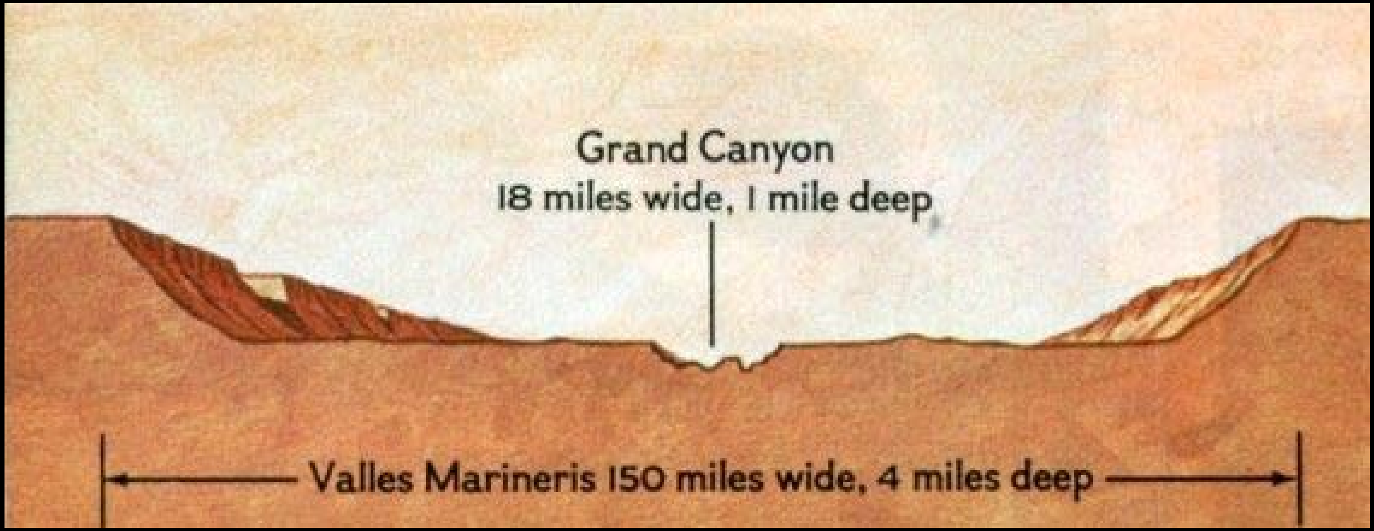


TECTONICS ON MARS

- VALLES MARINERIS

The ‘matching sides’ of the rift are separated by a distance of 150 km (93 miles)!

It has been suggested that the surface of Mars was/is effectively two large tectonic plates



TECTONICS ON MARS
- WHAT HAPPENED?

On Earth, heat from the core drives convection in the mantle, which in turn drives the movement of the tectonic plates

However, Mars has cooled down much more rapidly and therefore may lack heat in the interior – preventing the active process of plate tectonics occurring

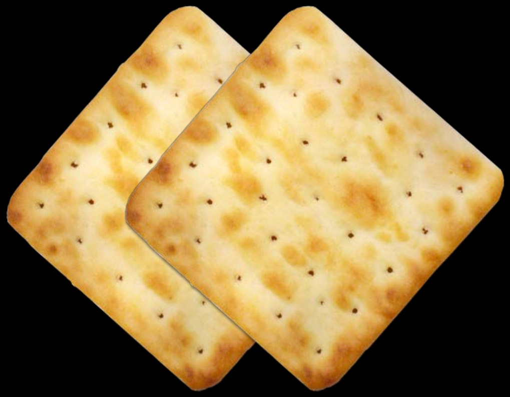
MODELLING PLATE TECTONICS

The aim is to demonstrate the differences between plate tectonics on Earth and Mars, as well as investigating the different types of plate boundary

CRACKERS = TECTONIC PLATES

YOU WILL NEED:

3 crackers
½ cup of water (large enough to dunk cracker)
2 plates
Yogurt
Slice of bread



MODELLING PLATE TECTONICS

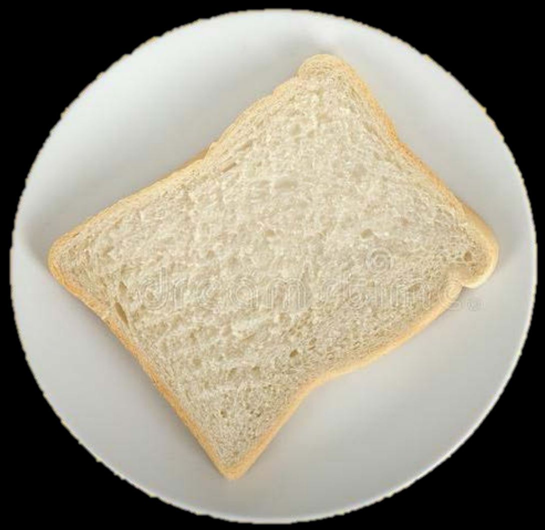
On one plate, spread enough yogurt to form a uniform layer approximately 3-5cm thick

This plate will be used to model Earth, and represents the fact that Earth's mantle is able to flow (even though it is made of solid rock)

MODELLING PLATE TECTONICS

On the second plate, place a slide of bread

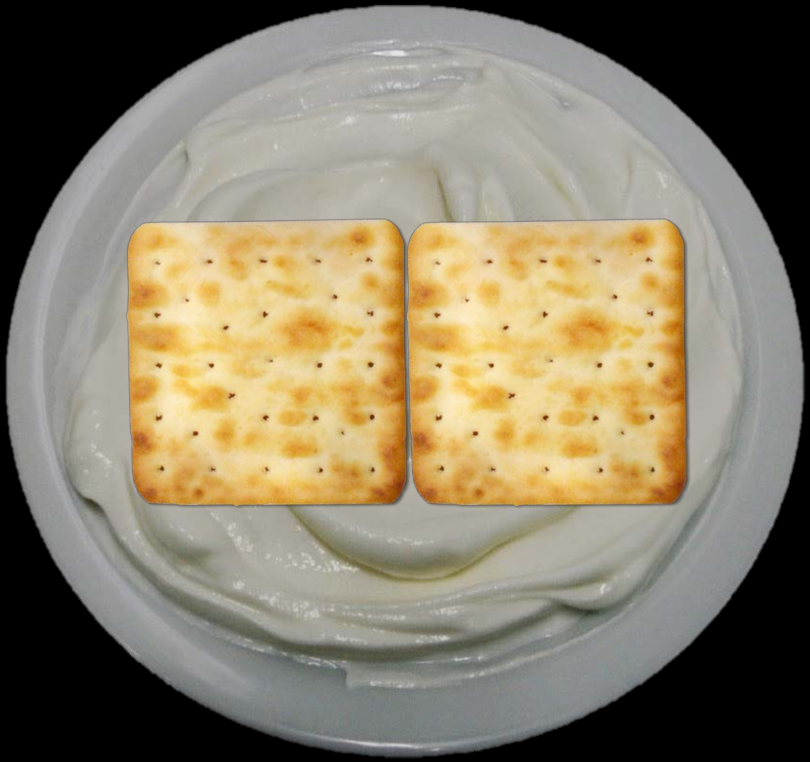
This plate will be used to model Mars, and represents the fact that (as far as we know) the interior of Mars has cooled down and does not flow

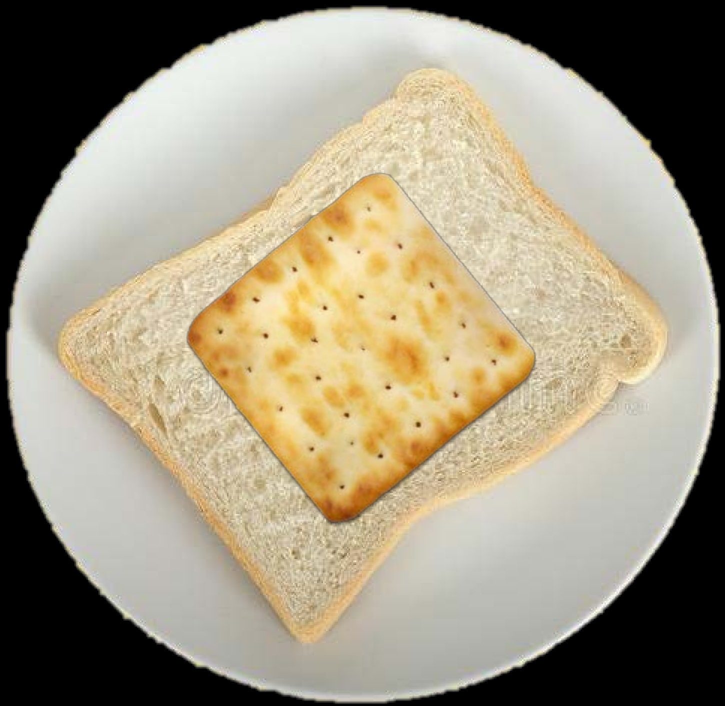


MODELLING PLATE TECTONICS

Place 2 of the crackers on the yogurt so that 1 side of each cracker is just touching the other

Place the remaining cracker on the slice of bread

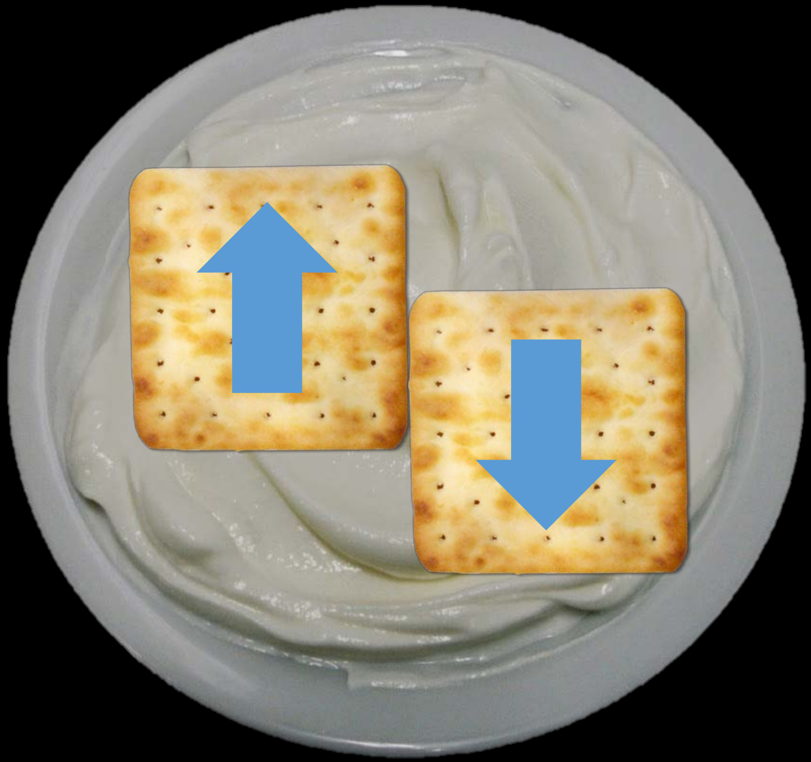




MODELLING PLATE TECTONICS

- EARTH TECTONICS: TRANSFORM BOUNDARY

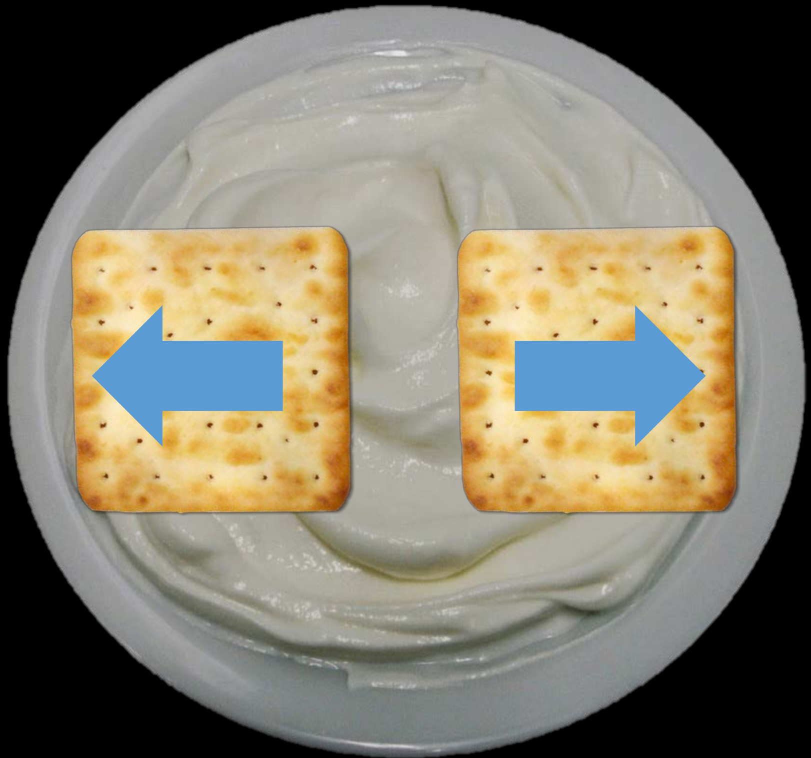
Slide the 2 crackers past each other



MODELLING PLATE TECTONICS

- EARTH TECTONICS: DIVERGENT BOUNDARY

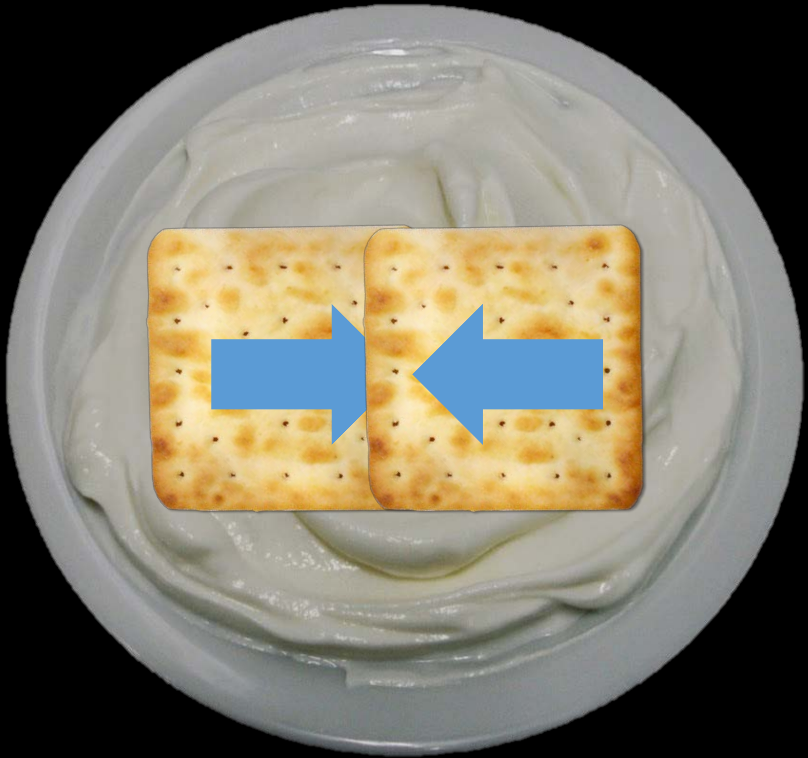
Push one cracker to the left, and the other to the right



MODELLING PLATE TECTONICS

- EARTH TECTONICS: SUBDUCTION ZONE

Push the crackers towards each other, letting one slide underneath

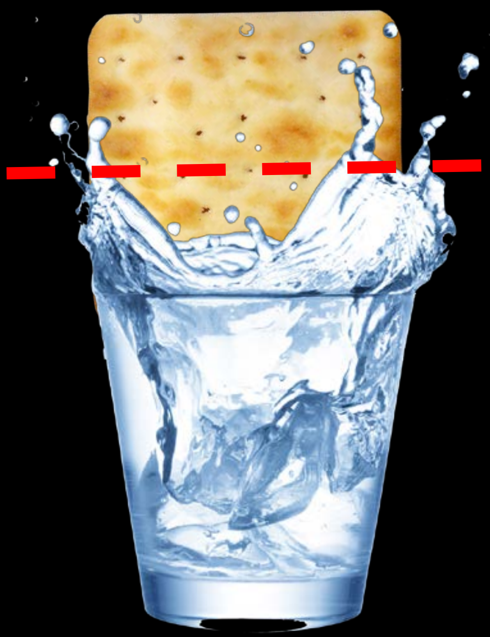


MODELLING PLATE TECTONICS

- EARTH TECTONICS: CONVERGENT BOUNDARY

Wet half of your 2 Earth crackers in the cup of water provided until they are slightly soggy

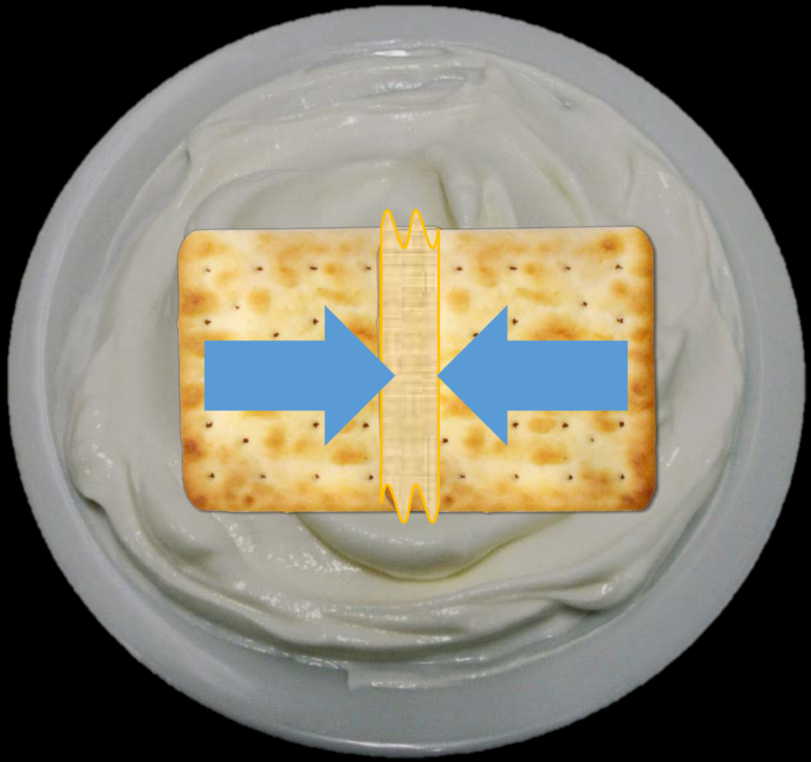
DUNK ONLY HALF WAY



MODELLING PLATE TECTONICS

- EARTH TECTONICS: CONVERGENT BOUNDARY

Put the crackers back on the yogurt (wet halves touching) and push them together, forming a mountain belt



MODELLING PLATE TECTONICS

Now see if you can repeat each of these steps for the Mars plate, with only one large tectonic plate

Even if you break the cracker in half to represent two plates, how easy is it to get them to move?