AUSTRALIAN EARTH SCIENCE EDUCATION

Plate Tectonics

Mars Bar Earth

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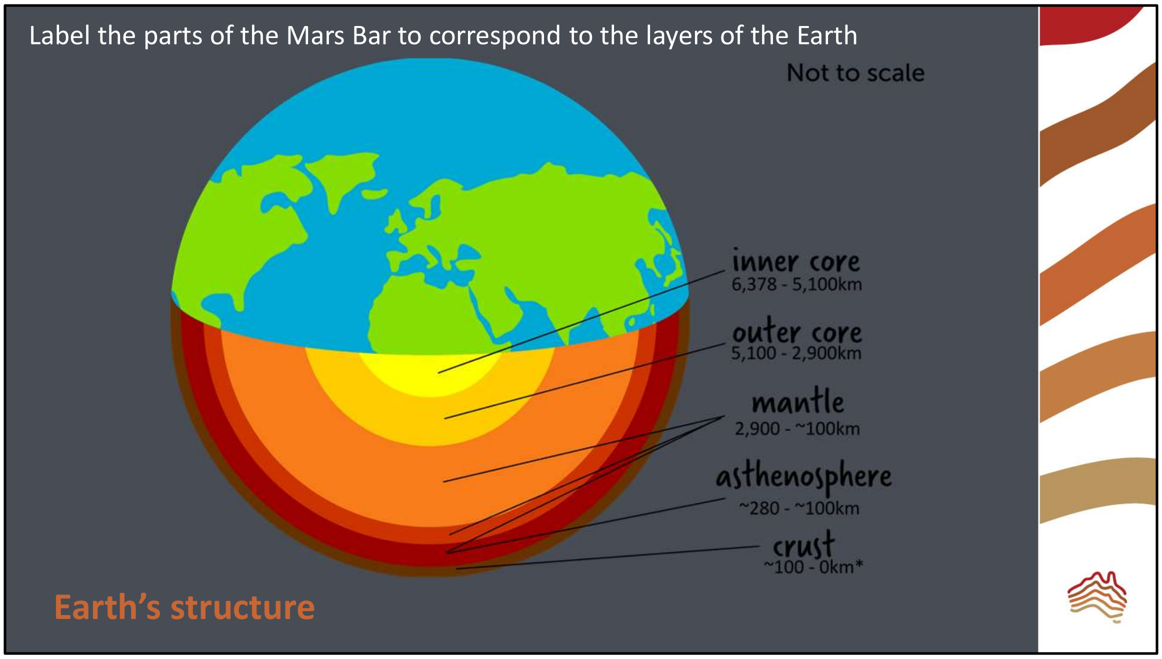
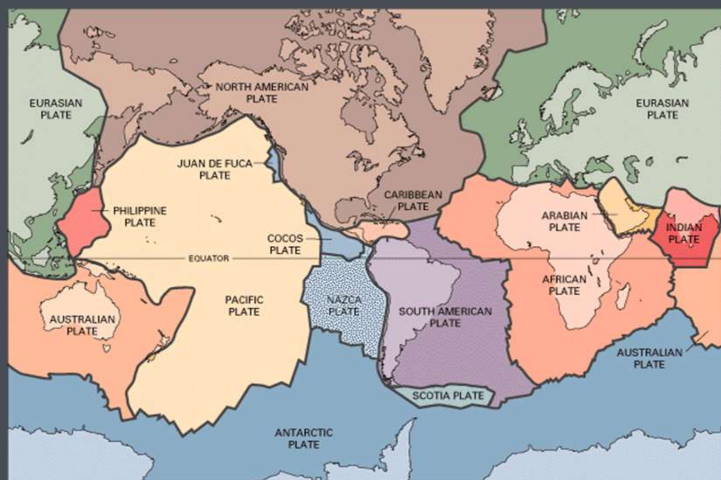


The Mars Bar is a reasonable analogy for the Earth, although not the same shape or scale!

- The chocolate represents the brittle crust. Although if the Mars Bar was a scaled down representation of the Earth the chocolate would need to be nanoparticles thick.
- The caramel represents the mantle. A solid that can behave plastically due to the temperatures and pressures it experiences. It is, however, too thin to represent a scaled back Earth. The very upper part of the caramel (mantle) (and lower part of the crust) represents the mobile asthenosphere.
- The fluffy nougat in the centre of the Mars Bar does let us down, however, if it was representative of the Earth it would be very dense and hard (just like the iron and nickel rich core), it would also be significantly hotter and liquid (outer) and solid (inner). Perhaps students could brainstorm alternate materials for the inside of the Mars Bar (a gobstopper surrounded by chocolate ganache has been my favourite so far).

I like to spend some time here discussing how this structure has been worked out (especially considering we haven't even drilled into the mantle!)

Use your fingernail to make small cracks in the surface of your “Earth” (Mars Bar)



(USGS, 2011)

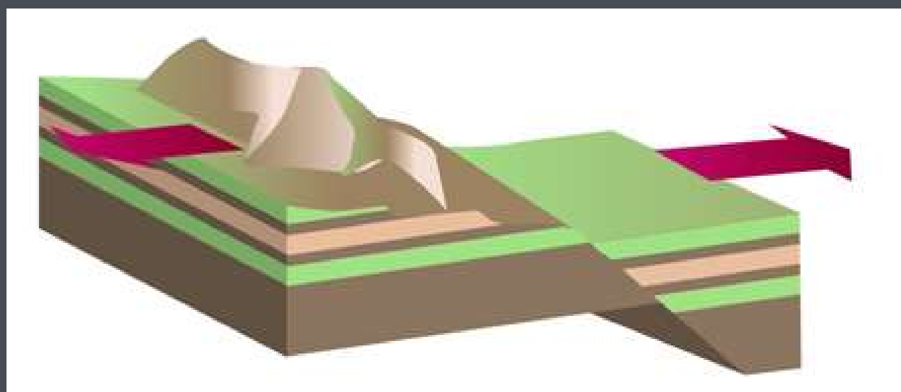
Tectonic plates

If you make a lot of random cracks across the top of your Mars Bar your crust will break up into tectonic plates. Students will find they are irregular in shape and size and not straight edged, just like the tectonic plates of Earth.

These plates are mobile thanks to convection currents and the processes of slab-pull and ridge push.

Pull the ends of the Mars Bar away from each other (don't let it tear completely)

What happens? List two things you observed.



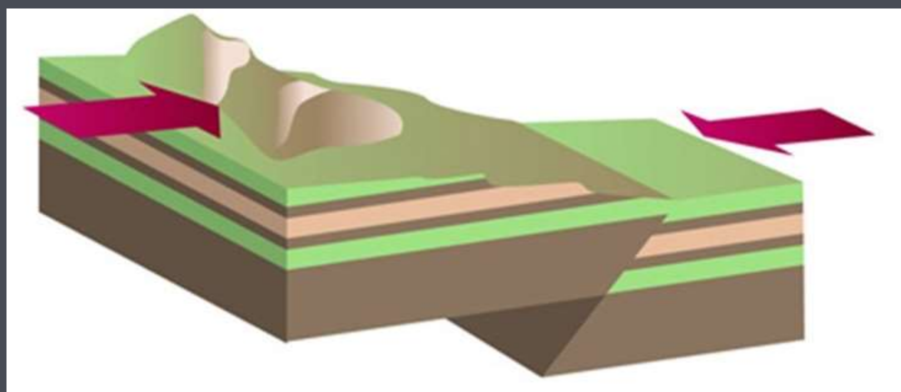
(Sparknotes LLC, 2011)

Stretching crust: normal faults

This is when I like to 'zoom in', instead of thinking about plate boundaries as a whole, I talk about anywhere the crust is under stress. This can include within a plate, an example I like to use is 100s of kilometres of crust (so we can talk about landforms). If students imagine the Mars Bar now represents 100s of kilometres of crust, with the different materials within representing different rock layers of the crust, they can observe what happens when the crust is stretched. They will find that the Mars Bar does not crack straight up and down, but in fact on an angle, and they can replicate the diagram of a normal fault. The resulting landforms are mountains and a plains.
It is always good to provide examples from your local area.
For those in and around Perth, the Perth hills were formed in this way, by movement of the Darling Fault.
Normal faults are also a prominent feature around divergent plate boundaries.

Push the ends of the Mars Bar towards each other

What happens? List two things you observed.



(Sparknotes LLC, 2011)

Compressing crust: reverse faults

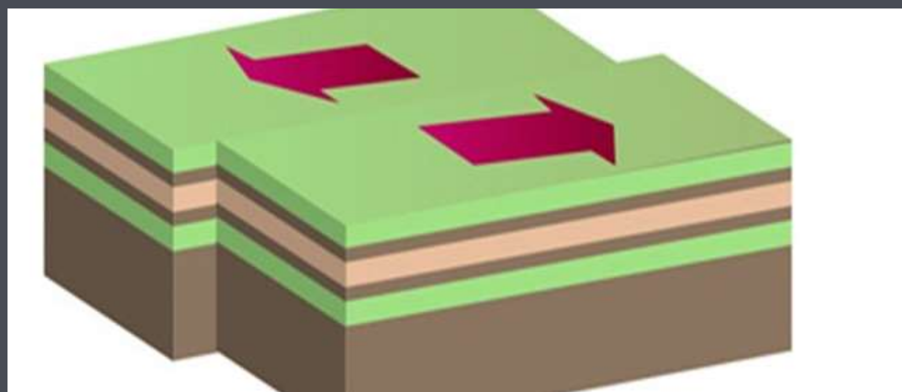
If you carry this thinking across, you can now squeeze the ends of the Mars Bar towards each other. Initially it will fold but eventually one side will be pushed up onto another – a reverse fault.

Again, an example is great – the Meckering fault is a reverse fault (you can still see the fault scarp).

Reverse faults are common at convergent plate boundaries.

Push the ends of the Mars Bar parallel to each other, in opposite directions

What happens? Why is this not a great example of strike-slip movement on Earth?



(Sparknotes LLC, 2011)

Sliding crust: strike-slip faults

Finally, if you slide the ends of the Mars Bar past each other you are replicating strike-slip faulting – not well unfortunately. The crust does not rip apart (like the Mars Bar) and more crust will follow behind in this movement.
Strike-slip faults are common at transform plate boundaries.

References

Based on an activity from: The Science Spot, 2011, Havana, viewed August 2011, http://sciencespot.net/index.html

Earth's structure diagram: original picture licensed to ESWA through Canva, labels by ESWA using information from geology.com

Tectonic plates map: USGS, last modified 27/8/11, USA government, viewed August, 2011, http://www.usgs.gov/default.asp

Fault diagrams: Sparknotes LLC, 2011, viewed August, 2011, http://sparkcharts.sparknotes.com

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