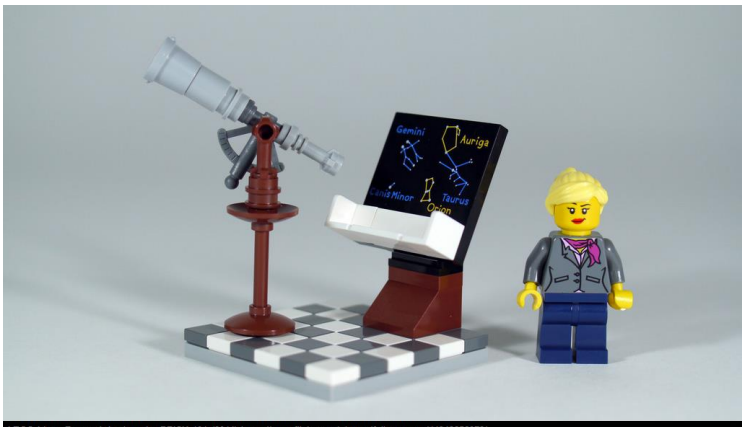
FOREST LEARNING

Students

Year 11 Earth and Environmental Science

Depth Study – Module 2

Making and using Scientific Models



Content Outcomes of Module Two

Inquiry question:

What occurs at plate boundaries?

Students:

Use geological maps of the Earth to locate boundary types and model the processes that have contributed to their formation, including: (ACSES006, ACSES035, ACSES099)

- divergent boundaries
- convergent boundaries
- transform boundaries

Inquiry Question:

What are the geological and topographic features that have resulted from plate tectonics at each plate boundary type?

Students:

Model types of plate boundaries showing the dominant topographic and geological features, including: (ACSES006)

- divergent boundaries: rift valley, mid-ocean ridge, normal and transform faults
- convergent boundaries: mountain range, trench, reverse faults and folds

Contents

NB: Schools will need to complete their own risk assessment for the activities contained in this lesson

Types of Plate Boundaries

Scientific observations and research have provided evidence to support a model of a solid and rigid lithosphere divided into approximately 12 pieces, or tectonic plates, which move slowly across the Earth's surface. The plates can be made of two different types of lithosphere - continental or oceanic.

The place where these plates meet are called plate boundaries. Tectonic plates either collide (converge), separate (diverge) or move past one another (transform movement).

Activity Overview

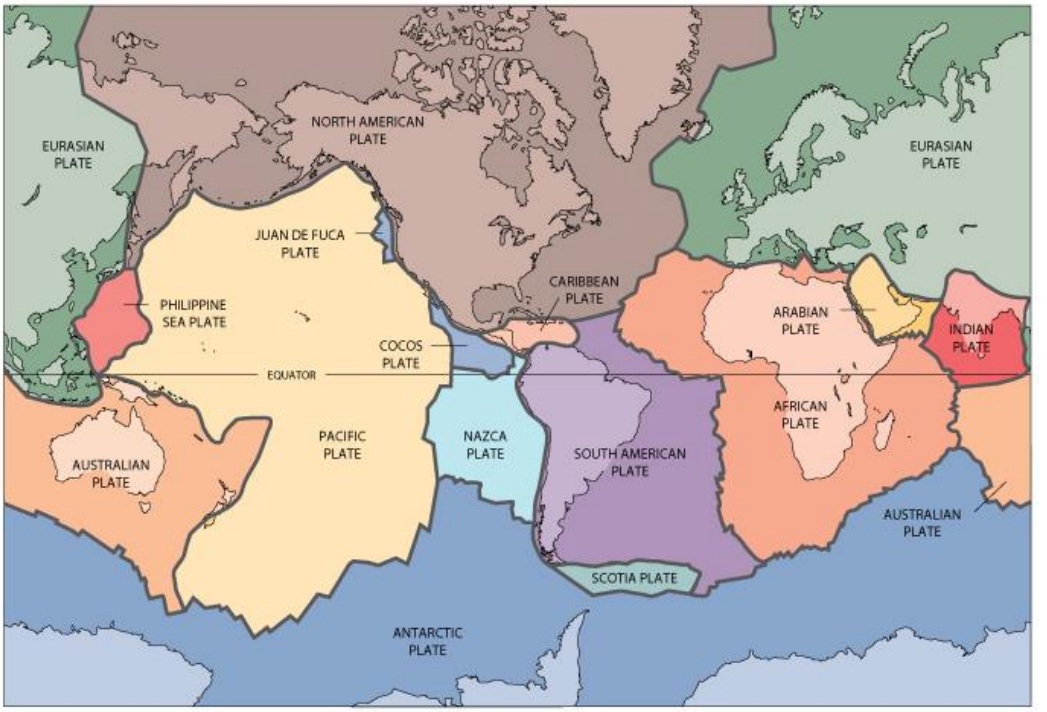
- Activity 1 - Locating Plate Boundaries on a Geological Map (ACSES006, ACSES035, ACSES099)
- Activity 2: Geological features at Plate Boundaries – Modelling Normal, Reverse and Transform Faults (ACSES006)
- Activity 3: Plate Boundary Models in groups (ACSES006)

Activity 1: Locating Plate Boundaries on a Geological Map

In this activity you will use a map of the world and locate the following plate boundary types:

- Divergent
- Convergent
- Transform

Place colours in the key below the map that can be used to distinguish between the 3 plate boundary types listed above.



https://pubs.usgs.gov/publications/text/slabs.html - *Source: USGS. Historical Perspective Tectonic Plates.*

MAP KEY

Divergent Boundary = ☐

Convergent Boundary = ☐

Transform Boundary = ☐

While watching the following video using the URL below,

a. use the 3 colours in the key above to highlight where the boundaries are located around the world,
b. annotate the map with any relevant notes,
c. at the completion of the video fill in the summary table below:

URL: https://www.youtube.com/watch?v=Kg_UBLFUpYQ

Source: YouTube. Tectonics of Planet Earth.

Plate Boundaries and their location

Boundary Type	Direction of Movement	Location Examples
Divergent Oceanic-oceanic		
Continental-continental		
Convergent Oceanic-oceanic		
Oceanic-continental		
Continental-continental		
Transform		

Using the map found at the following URL site, check your answers and add any boundaries not labelled.

URL: https://opentextbc.ca/geology/chapter/10-4-plates-plate-motions-and-plate-boundary-processes/

Source: Physical Geology BC Open Textbook

Activity 2: Geological features at Plate Boundaries – Modelling Normal, Reverse and Transform Faults.

https://pixabay.com/en/play-doh-plasticine-toys-841826/

Your teacher will show you a ball of play dough. The dough represents rock.

a. In the space below, make a prediction for what you think will happen to the ball of dough when it is squeezed between your hands?

This stress is called COMPRESSION. The dough has become squeezed into less space and changes the dough by shortening it.

b. What type of plate motion do you think results in compression of rocks?

c. Make a prediction about what you think will happen to the dough when it is stretched.

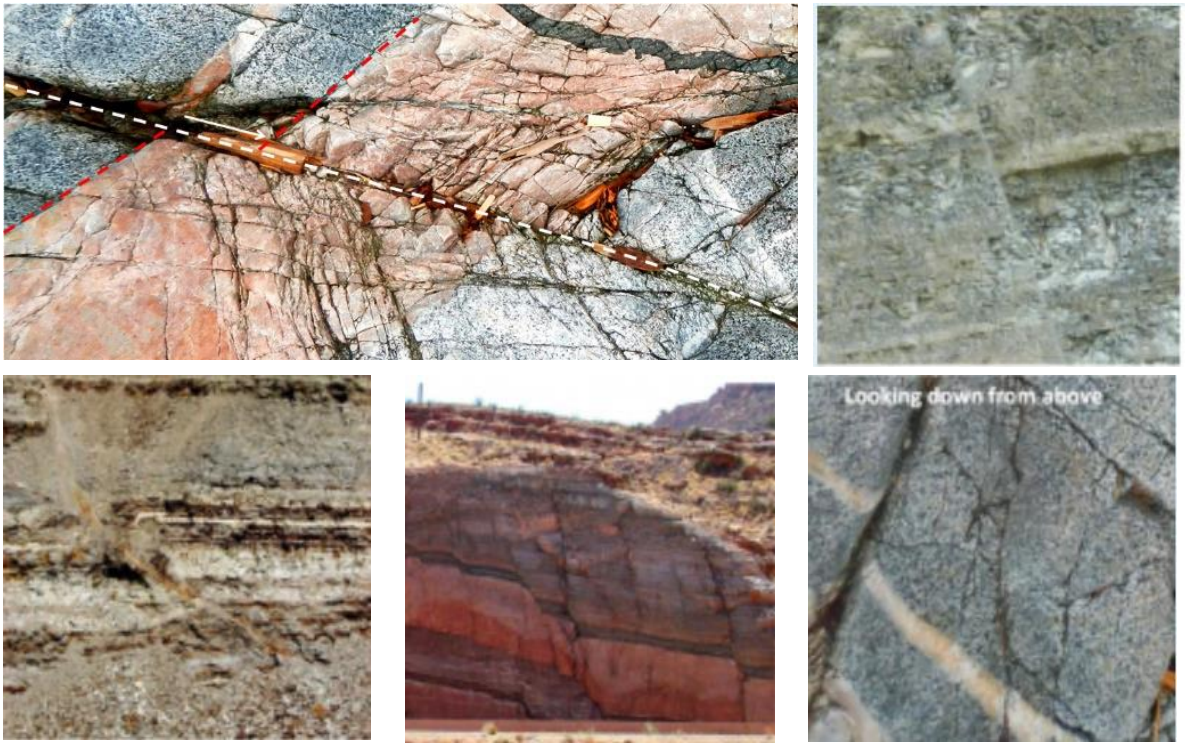
This stress is called TENSION and it changes the dough by lengthening it.

d. What type of plate motion do you think results in a tension force acting on rocks?

e. Form pairs with another student. Stand next to each other and hold a ball of dough between you using your fingertips. One will face the board and the other will face the back of the classroom. What do you think will happen if they walk away from each other?

This is called SHEAR stress. Transform plate motion shears rocks.

The outer part of the Earth is cold compared to the other layers of the Earth. When it is stressed it tends to break. The breaks are called faults. Below, you can see some examples of different types of faults in rocks:



Images source: https://opentextbc.ca/geology/chapter/12-3-fracturing-and-faulting/

In this lesson, your teacher will show you models of faults, and how different forces act on rocks to move them in different directions and how this in turn produces different types of faults - normal, reverse and strike-slip faults.

1. Rock with Fault line

Draw and label a cross section of rock stratum showing the fault line, hanging wall and footwall

2. Normal Faults

Draw or take a photo of a rock with normal faults and paste it in the space below. Label the model and the movement of the fault in the space below.

Type of Force:

Movement of hanging wall:

Plate Boundary Fault is located:

3. Reverse Fault

Draw, or take a photo of a real reverse fault example, and paste it in the space below. Label the model and movement of the fault in the space below.

Type of Force:
Movement of hanging wall:
Plate Boundary Fault is located:

4. Transform Fault – Strike-slip fault.

Draw, or take a photo of a real transform fault – strike-slip fault example, and paste it in the space below. Label the model and movement of the fault in the space below.

Type of Force:
Movement of hanging wall:
Plate Boundary Fault is located:

Activity 3: Plate Boundary Models in groups.

Groups will be allocated a plate boundary to model. It must show topographic and geological features as listed below. Once the groups have completed their models, they will be displayed around the classroom and students will complete an evaluation of the models.

Equipment:

1. All available craft equipment and any requested by students
2. Scissors
3. Glue
4. Marking pens
5. Sticky white labels
6. Playdoh
7. Pins
8. Access to the internet

Method:

1. Working in groups, on a scrap piece of paper, draw a sketch of the plate boundary design you have been allocated, making sure you include all the features below for your boundary and any others that you think are relevant
    - divergent boundaries: rift valley, mid-ocean ridge, normal and transform faults
    - convergent boundaries: mountain range, trench, reverse faults and folds
2. Gather the craft material you require to complete your model, and working as a team, construct a labelled model of your boundary.
3. Display it in an area of the classroom with the other group's models.
4. Complete the evaluation of the models below.

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Students

Evaluation of Your Groups Plate Boundary Model

1. List the features of plate boundaries that should be included in a model

2. What plate boundary did your group construct?

3. Place a picture in the space below of your group's model

4. List the features of plate boundaries your model shows.

7. What features of plate boundaries are not shown on your model?

8. If you made your model again, what improvements would you make?

Evaluation of Groups Models

Plate Boundary Model (photo of model)	Strengths	Limitations
Divergent oceanic-oceanic		
Divergent continental-continental		
Convergent oceanic-oceanic		

Convergent oceanic - continental		
Convergent continental- continental		
Transform		

Exam Style Question

Evaluate which model was the most effective at representing a plate boundary.

Evaluation

Reasons

1.
2.
3.

References

1. Historical Perspective Tectonic Plates. USGS. https://pubs.usgs.gov/publications/text/slabs.html. September 2011. Accessed 3rd October 2017.
2. Tectonics of Planet Earth. YouTube. https://www.youtube.com/watch?v=Kg_UBLFUpYQ. October 2013. Accessed 3rd October 2017.
3. Image Play Dough https://pixabay.com/en/play-doh-plasticine-toys-841826/ July 2015. Accessed 7th October 2017.
4. Physical Geology BC Open Textbook. Steven Earle https://opentextbc.ca/geology/chapter/12-3-fracturing-and-faulting/ Accessed 3rd October 2017.