# Lesson 11: Towards a theory of formation of the Earth's Crust

## Teachers' notes

***Introduction***

This lesson is meant as an evidence selection exercise. There have been many theories of formation for the Earth's crust which attempt to explain the features we see. Those considered here are :

- Creationism
- Contracting Earth Theory
- Isostatic uplift
- Expanding Earth Theory
- Plate tectonics

***Running the lesson***

The lesson is a group-based activity where students select from a bank of 40 statements evidence to support a theory allocated to them. They are encouraged to choose statements which support their theory and statements which contradict others.

***Resources***

- Teachers notes and lesson plan (this document)
- PowerPoint presentation – "Towards a theory of formation of the Earth's crust"
- Handout / interactive worksheet (pdf) – "Labelling Earth's structure diagram"
- Evidence cards, printed and laminated if required. There are 10 pages of evidence cards. I suggest printing 2 pages on 1 A4 sheet giving 5 sheets per set. Print each set on a different colour and laminate them. You will have them forever and are less likely to lose any.

***You will need to provide***

- Either sugar paper and pens or
- OHT sheets and pens for the presentation.

***Starter***

Two starter activities are available which involve labelling a structure of the Earth, either using an interactive whiteboard or manually on OHT. The writing will stay on the presentation until it is closed so can be revisited if required. It is therefore necessary that students have studied Earth's structure prior to this lesson. All answers are given on the 'notes' section of the accompanying PowerPoint presentation.

The answers to the diagram labelling the Earth's structure (in case you are not a geologist ...) are:

1. Continental crust – a layer of thick, light rocks
2. Crust – 3 to 30 miles thick. A thin rocky crust
3. Mantle – Layer containing molten or semi-molten rock
4. Core – Central layer of the Earth
5. Oceanic crust – A thin layer of heavier rocks
6. Upper mantle – Cooler and more liquid than deep mantle

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7. Deep mantle – very hot liquid. Moves very slowly (6cm/year)
8. Outer core – Very, Very hot liquid. Causes mantle above to move and creates Earths magnetic field
9. Inner core – solid layer of iron and nickel
10. Lithosphere – Crust and upper part of mantle
11. Aesthenosphere – hot slushy layer – moves very slowly

There is an accompanying homework sheet in PDF format which students can either print out and complete, complete and print out or complete and email. The choice is yours / theirs!

There is also a slide which allows you to *mind map* the students ideas about the features of the Earth's surface which they have seen or heard about and any other ideas you are aware of. The writing will stay on the presentation until it is closed so you can revisit this slide at any time.

***Main Activity***

Run through the 5 slides showing details of the 5 theories with the students. There are suggestions in the 'notes' section with ideas for some demonstrations during this part if desired. Split the class into 10 groups and assign each theory to 2 groups. You may wish to print the relevant slides from the PowerPoint presentation to give to the groups for a little more guidance.

Issue a pack of evidence cards. Allow the students 10-15 minutes to read through the cards and select the evidence which supports their theory. They will also need to use this time to prepare some feedback for the rest of the group. It is interesting to see the different approach the groups with the same theory take!

Suggested answers for Evidence cards (This may not be an exhaustive list!)

**Theory A Creationism**
For: 2, 3, 5, 6, 8, 9, 10, 11, 13, 14, 23, 28
Against: 4, 22

**Theory B Contracting Earth**
For: 3, 7, 12, 15, 16, 18, 19, 26
Against: 6

**Theory C Isostatic uplift**
For: 3, 21, 24, 29, 30, 31
Against: 6

**Theory D Expanding Earth**
For: 3, 15, 25, 32, 33, 34, 35
Against: 1, 3, 6

**Theory E Plate tectonics**
For: 3, 4, 15, 17 , 20, 21, 25, 27, 34, 37, 38, 39
Against: 6, 9, 13, 14, 36, 40

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***Plenary***

You may wish to use the final slide of the presentation to recap plate tectonics or you may wish to allow the students to attack each others theories and evidence in a mini-debate. In this case, choose one advocate of each theory and conduct a 'question time' style event.

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