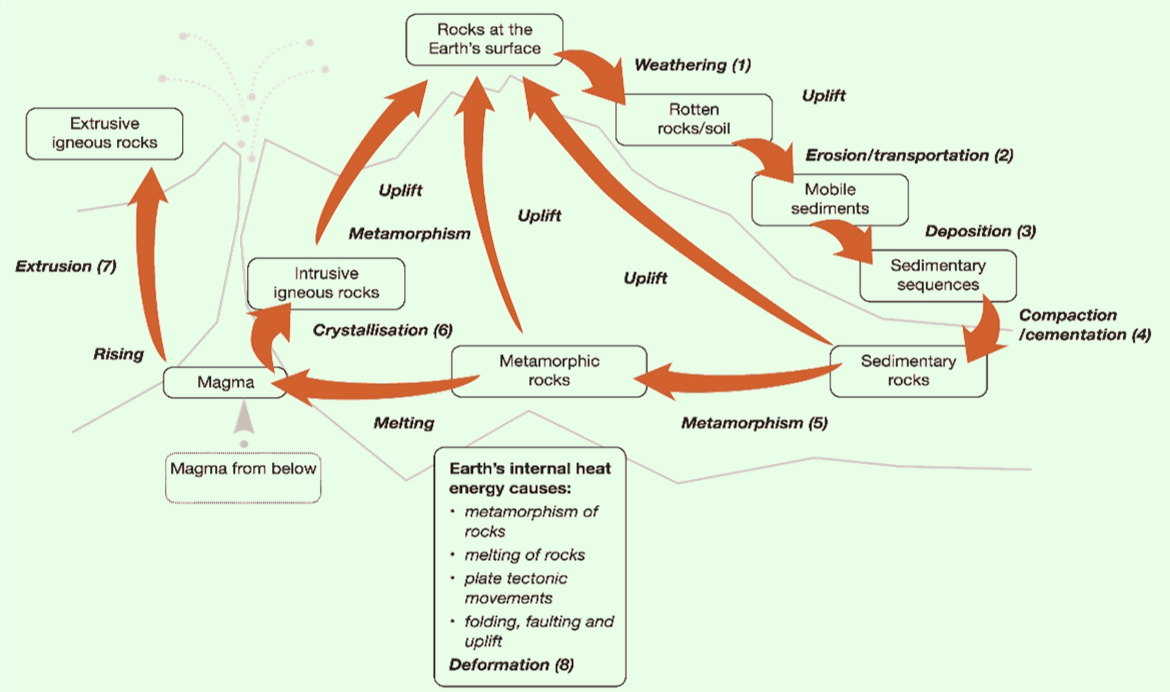
The dynamic rock cycle – online

Earth Science for science and geography – video workshop



Developed from the Earth Science Education Unit 'The dynamic rock cycle' workshop, with permission

Earthlearningidea online video workshops

Purpose – ESEU background

- Most Earthlearningidea online video workshops are based, with permission, on workshops originally developed by the Earth Science Education Unit (ESEU)
- These were designed as interactive workshops for teachers and trainees, involving interaction, discussion and presentations by participants to others
- Global research into professional development workshops shows that these aspects are critical to success
- ESEU research shows that this workshop approach is highly successful in changing teaching in schools; evaluation feedback has also been very strong

Earthlearningidea online video workshops

Purpose – Earthlearningidea development

- The Earthlearningidea Team has developed the ESEU workshops into online video workshops for those unable to take part in face to face interactive workshops
- Each workshop is led by a PowerPoint presentation and has an accompanying booklet that contains all the activity background details, resource lists, risk assessments, etc.
- The individual workshop activities have been published for open access online at the website: https://www.earthlearningidea.com/
- Each workshop activity has a question script and a video keyed into CASE principles, that can be accessed through the PowerPoint hyperlinks
- The aim is to facilitate online Earth science learning

The dynamic rock cycle – using CASE

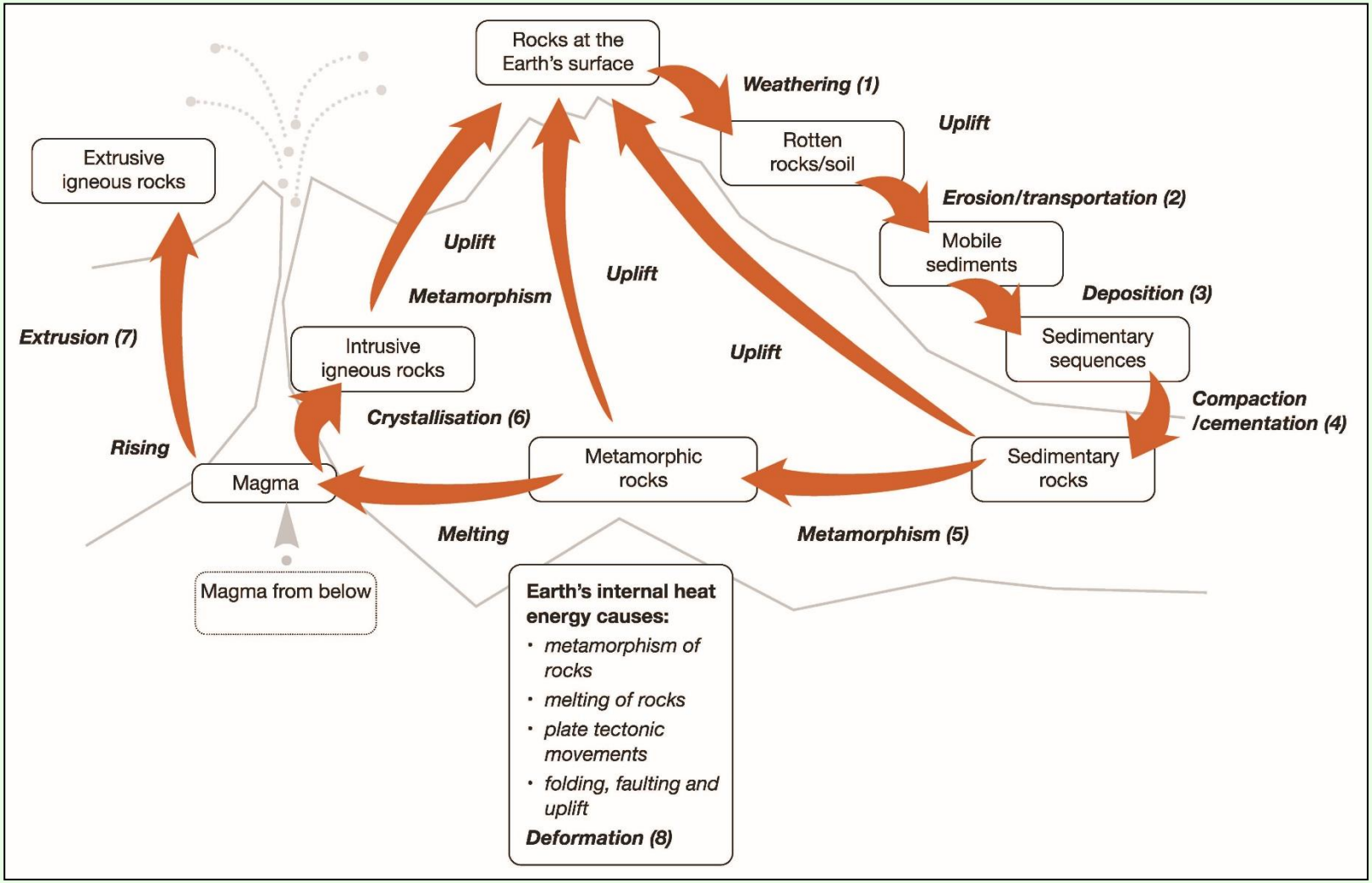
Teaching Earth science using the Cognitive Acceleration through Science (CASE) approach

- The activities in this workshop are keyed into the CASE approach – to develop thinking skills while teaching key Earth science material
- If you are unfamiliar with the case approach, you can access a video introduction at: https://www.earthlearningidea.com/Video/CASE.html
- An exemplar Earth science teaching activity with a question script using the CASE approach is at: https://www.earthlearningidea.com/Video/Atmosphere_ocean.html

The dynamic rock cycle

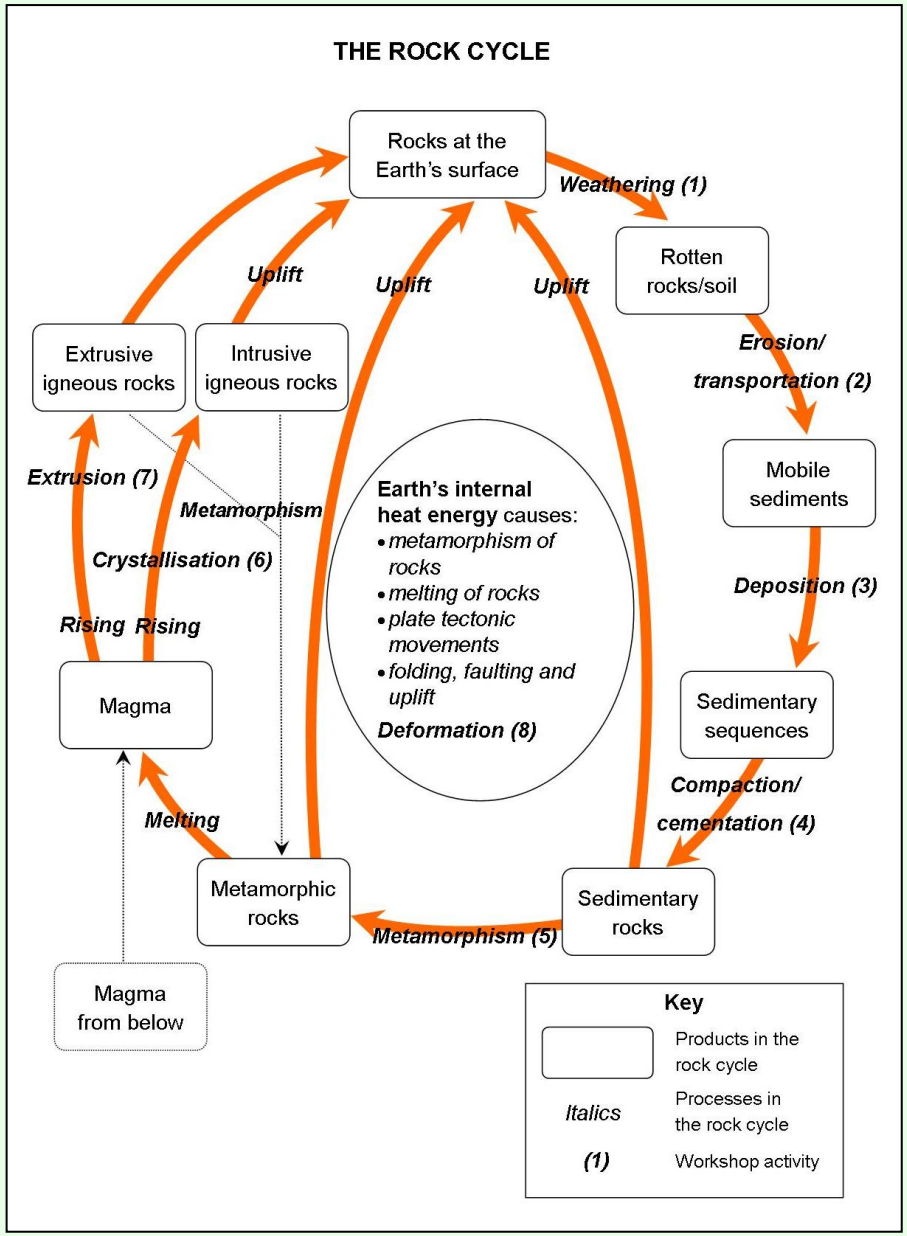
Workshop video run times		m	s	m	s
CASE – Cognitive Acceleration through Science Education				**21**	**51**
Using CASE		6	24		
Atmosphere and ocean		15	27		
The dynamic rock cycle				**90**	**18**
Laying out the rock cycle	introduction	5	27	13	43
	mobile sediments	0	29		
	rock names	3	04		
	processes	4	43		
Weathering	heating and cooling	5	29	13	04
	freeze-thaw	2	40		
	weathering limestone	4	55		
Erosion				6	28
Transportation and deposition	transportation and deposition 1	4	44	10	06
	transportation and deposition 2	5	22		
Compaction and cementation				7	05
Metamorphism	squeezed out of shape	3	50	5	57
	change of shape	2	07		
Crystallisation				9	27
Extrusion				9	26
Deformation and uplift	deformation	4	23	5	33
	extension	1	10		
Rock cycle review	wax volcano	4	17	9	29
	rock cycle in wax	2	41		
	rock cycle at your fingertips	2	31		

The dynamic rock cycle



'Diagrammatic version of the rock cycle'

The dynamic rock cycle



The dynamic rock cycle

Pre- warning

If you would like to take part in the **‘Starter Activity: Rock cycle products and processes’** instead of just watching it on video – you will need to:

- Print off an A4 version of the rock cycle diagram, from the following slide or page 9 of the booklet
- Print off an A4 version of the ‘Rock reference sheet’ from the following slide or from p11 of the booklet and cut it up into small cards, one for each rock – with or without the rock name and description (your choice)
- Print off photographs of ‘Rocks at the Earth’s surface’ and ‘Sedimentary sequence’ (next slide or p8) and photos of the small bags of a) soil, b) sand (next slide)

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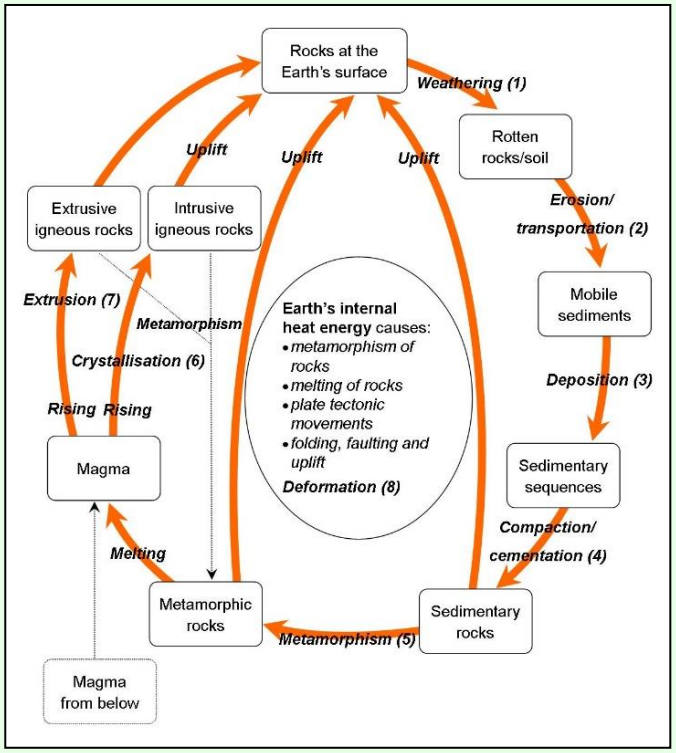
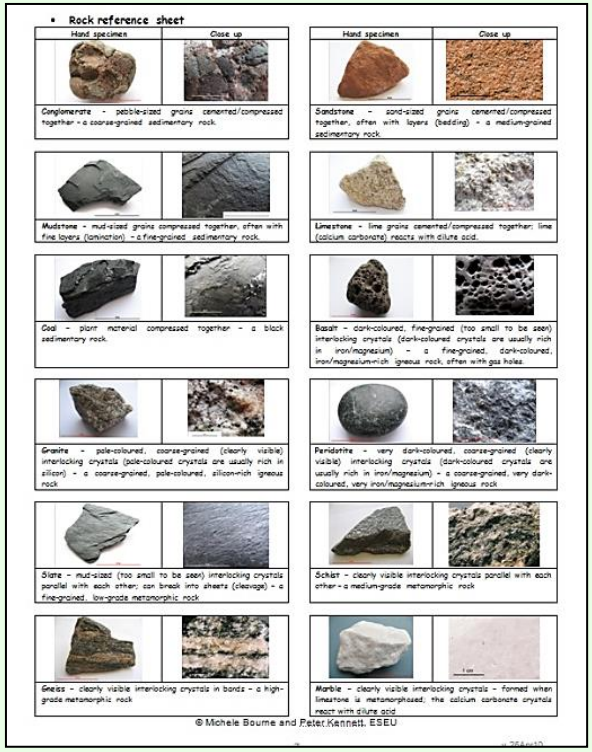
Pre- warning – to take part in the starter activity print these off, first two at A4 size:





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Summary

Try a series of ‘hands-on’ activities experimenting on and simulating the processes involved in the rock cycle.

Use the integrating model of the rock cycle as a means of encountering common rocks and Earth-processes in a practical, investigative way.

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Workshop outcomes

The workshop and its activities provide the following outcomes:

- identification and terminology of rock cycle products, including soils, sediments and rocks;
- knowledge and understanding about rock cycle processes and timescales, including weathering, erosion/transportation, deposition, compaction/ cementation, metamorphism, melting, crystallisation, extrusion and deformation;
- methods of teaching the abstract concept of the rock cycle, using a range of teaching approaches;

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Workshop outcomes – continued

- introduction to a range of Earth science laboratory activities, from simple modelling to more complex investigations;
- approaches to activities designed to develop the thinking and investigational skills of pupils;
- links between laboratory models and planetary processes, some of which are locally active and therefore relevant to pupils;
- an integrated overview of the geological Earth science commonly taught to 11 – 14 year olds

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The workshop integrates all these ‘rock cycle’ activities:

- Laying out the rock cycle, starter activity
- Weathering – breaking up, or breaking down material at the Earth’s surface
- Erosion – investigating the resistance of rock samples to “erosion”
- Transportation and deposition – investigating the movement of sand in water
- Compaction and cementation of sediments
- Metamorphism - detecting the distortion
- Crystallisation – with salol
- Extrusive igneous rocks – simulating magma flow
- Deformation and uplift – make your own folds and faults
- Rock cycle review, plenary activities

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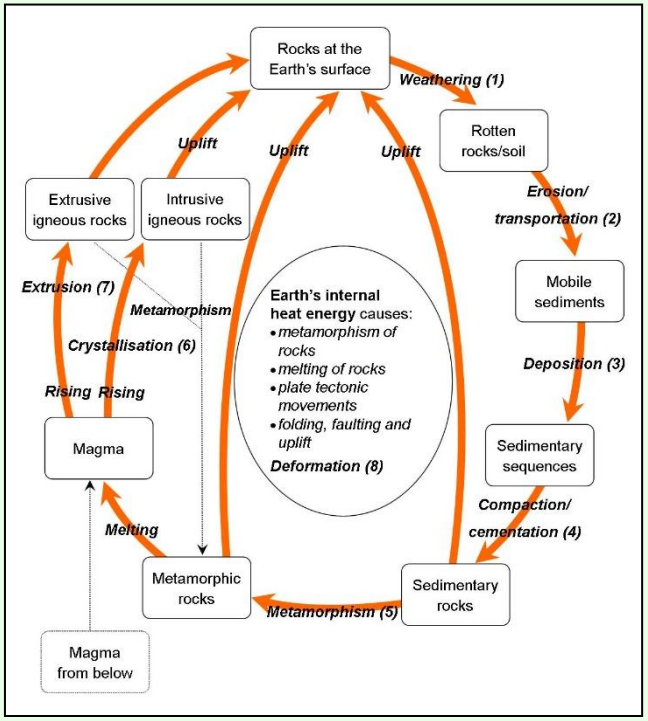
Starter Activity: Rock cycle products and processes

Place a series of rock cycle products in the correct places on a diagram of the rock cycle, then consider how all these are linked by rock cycle processes.

See how this is done through the question script and videos at: https://www.earthlearningidea.com/Video/Rock_cycle1.html

See details of all the rocks used, in the 'Virtual Rock Kit' at: https://www.earthlearningidea.com/virtual_rock_kit/START.htm



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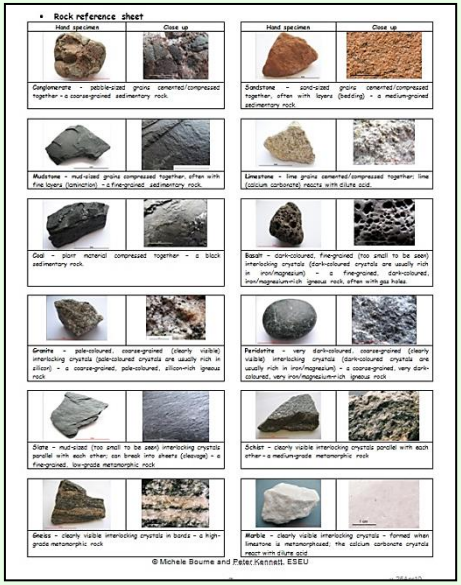
Starter Activity: Rock cycle products and processes

See details of all the rocks used:

- in the ‘Virtual Rock Kit’ at: https://www.earthlearningidea.com/virtual_rock_kit/START.htm
- on the rock reference sheet on page 11 and the lists on pages 41/42 of the booklet



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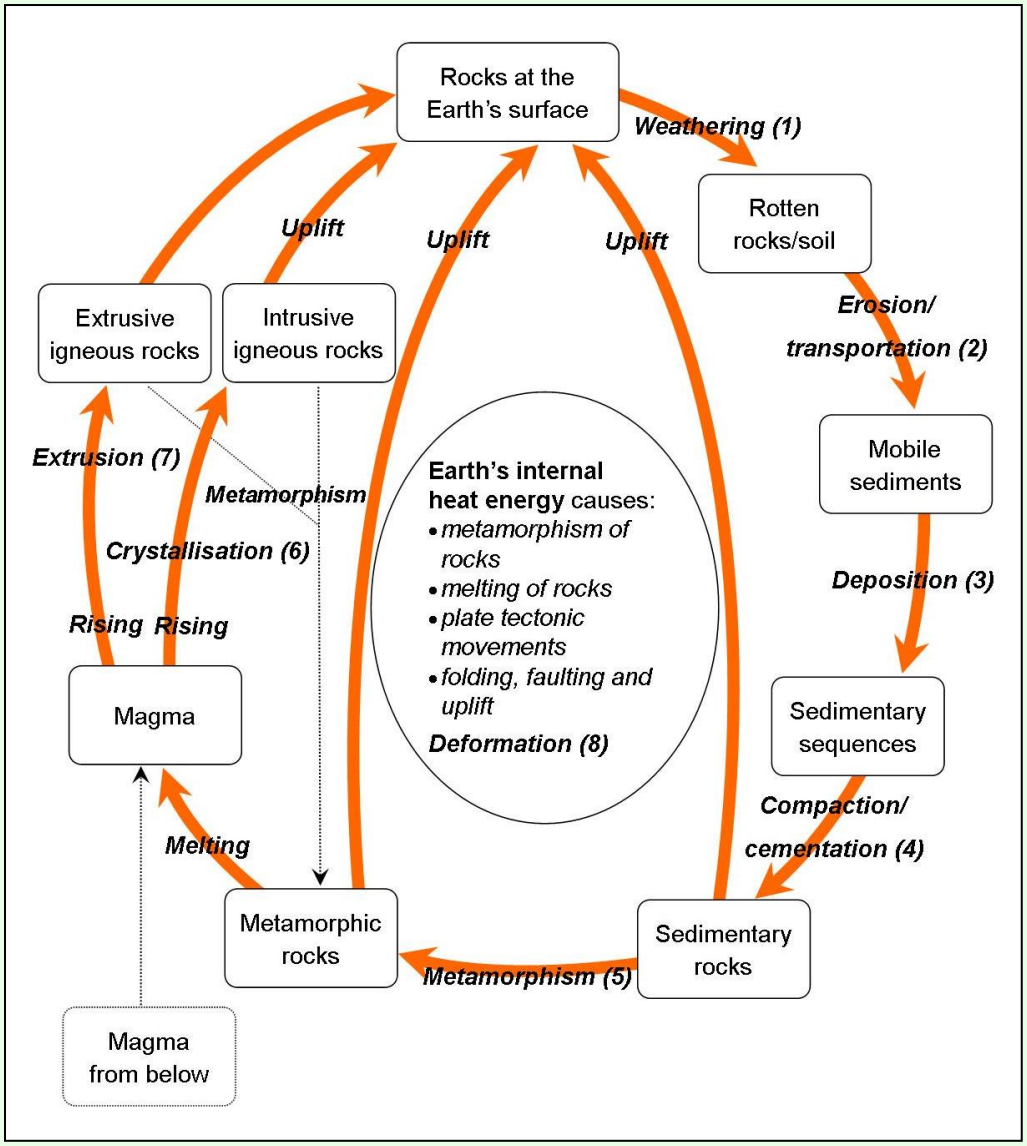
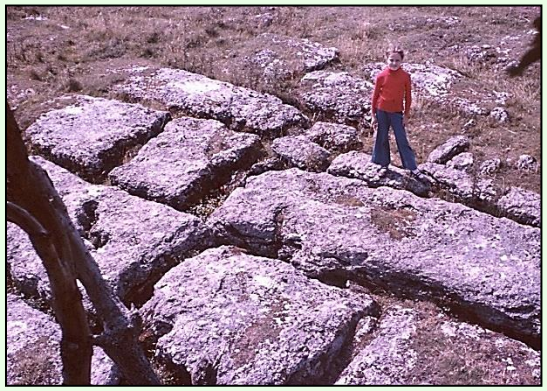


'The Rock Cycle'

The dynamic rock cycle

Activity 1: Weathering
- breaking up or breaking down material at the Earth's surface
(tens to hundreds of years)

Investigate three different types of weathering through:
https://www.earthlearningidea.com/Video/Weathering1.html



The weathering of a limestone platform, Yorkshire, UK

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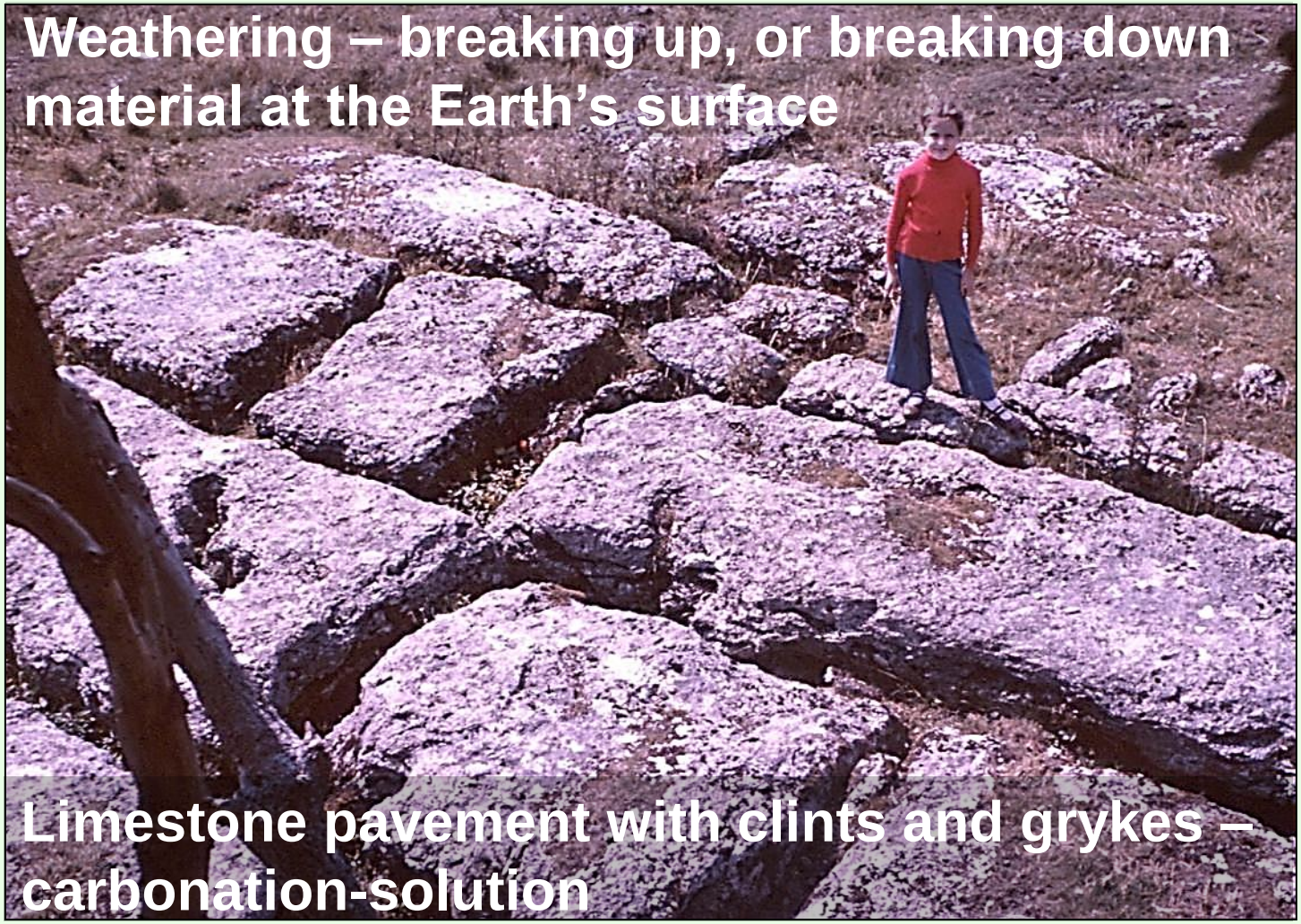
The dynamic rock cycle



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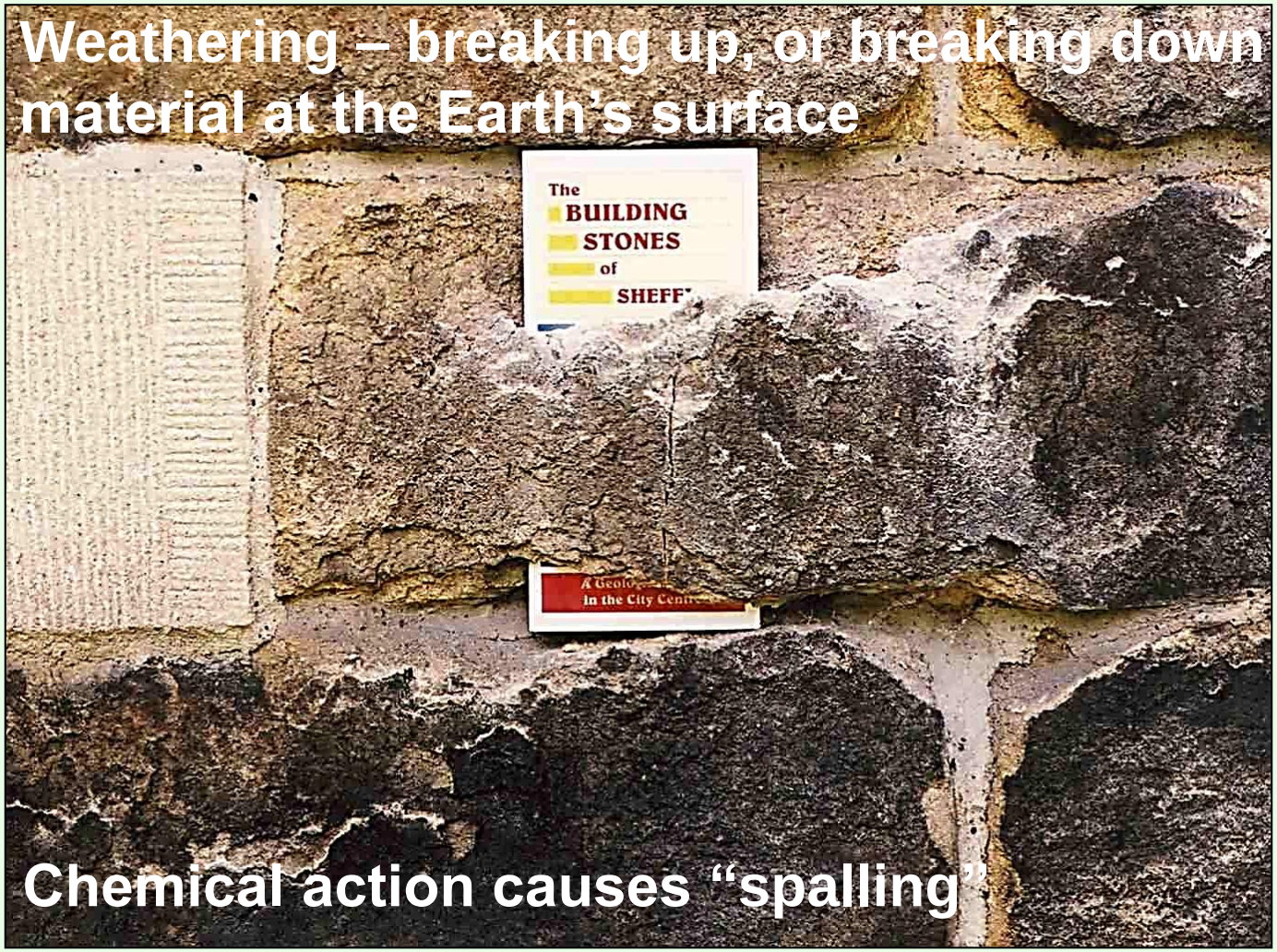

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Weathering and erosion

Weathering definition: Weathering is the natural break up (physical break up) and break down (chemical breakdown) of rock and other materials *in situ* (in place) at the Earth's surface, without the removal of solid material

Erosion definition: Erosion is the removal of solid material, which has usually been loosened by weathering - by gravity, flowing water, wind or ice; erosion is usually the beginning of transportation

So, in summary:
Weathering loosens solid material and removes dissolved material.
If solid material is removed – this is erosion

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Activity 2: Erosion and transportation - rock resistance

(seconds to tens of years)

Investigate rock resistance to find out how rocks erode at different rates and use this to explain the formation of uplands and coastal headlands by the more resistant rock types. You can find the video at: https://www.earthlearningidea.com/Video/Erosion.html

Investigating erosion

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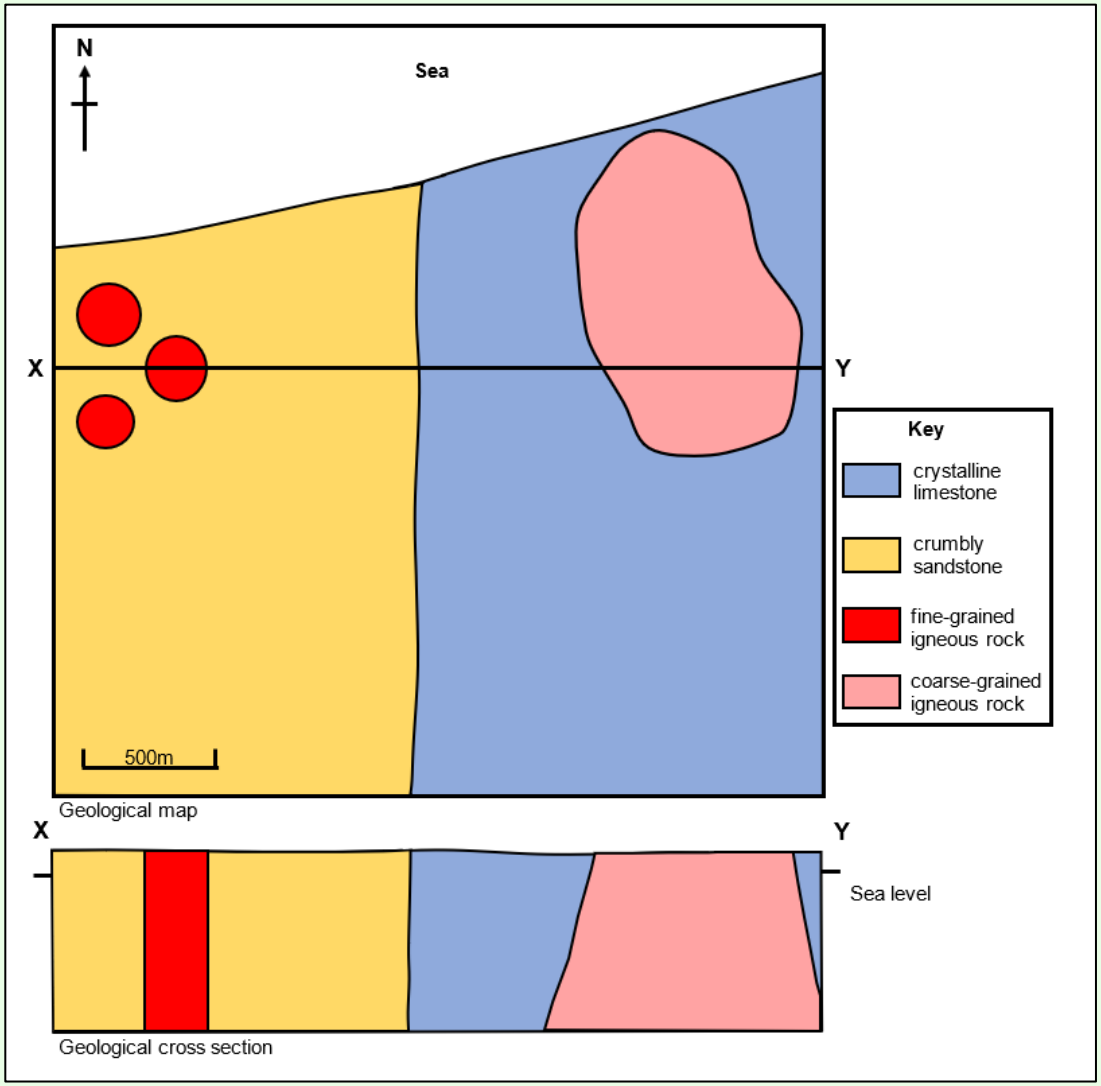

Erosion – investigating the resistance of rock samples

This area formed of four different rock types has a straight coastline and a flat surface.

What will it look like in 10,000 years ?

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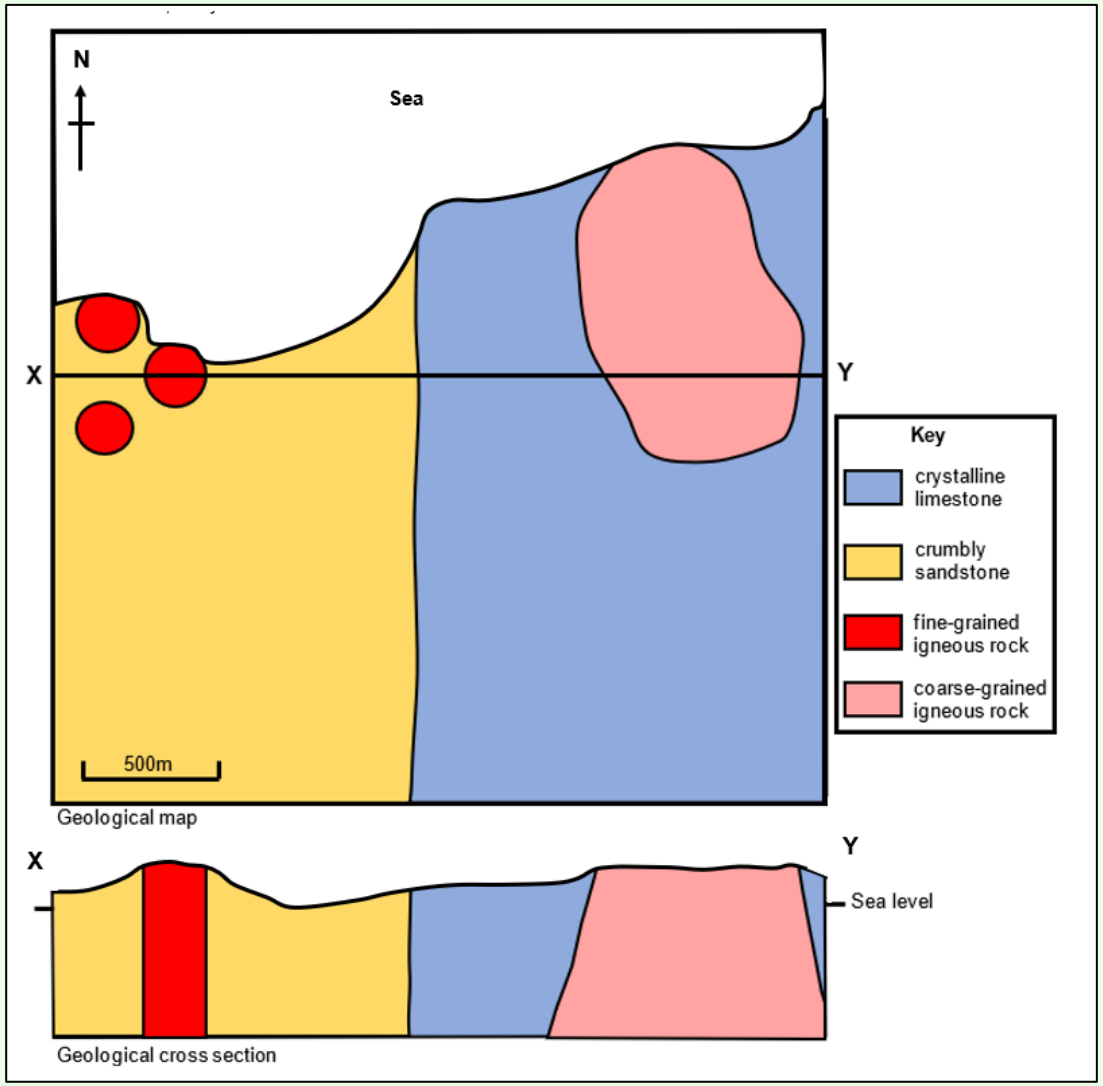

Erosion – investigating the resistance of rock samples

- Which rocks form headlands, hills? Which form bays, valleys?
- What does it mean when you walk uphill?

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Activity 3: Transportation and deposition - the movement of sand in flowing water

(seconds to thousands of years)

Investigate the processes by which sediment grains are eroded, transported and deposited by flowing water, in the lab – through the videos at: https://www.earthlearningidea.com/Video/Small_scale_processes1.html

'Rainstorm erosion' (runoff from a heavy rain carries topsoil from unprotected, highly erodible soils in northwest Iowa)

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Cross-bedded sandstones in the Orkneys, Scotland

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Activity 4: Compaction and cementation - sediments into rocks

(hundreds to millions of years)

All sediment was once loose. To become rock, the grains need to be squeezed together (compacted) and/or glued together (cemented). Investigate this through: https://www.earthlearningidea.com/Video/Compact_cement1.html

'Syringe on the palm of your hand and press the plunger to squeeze water out'

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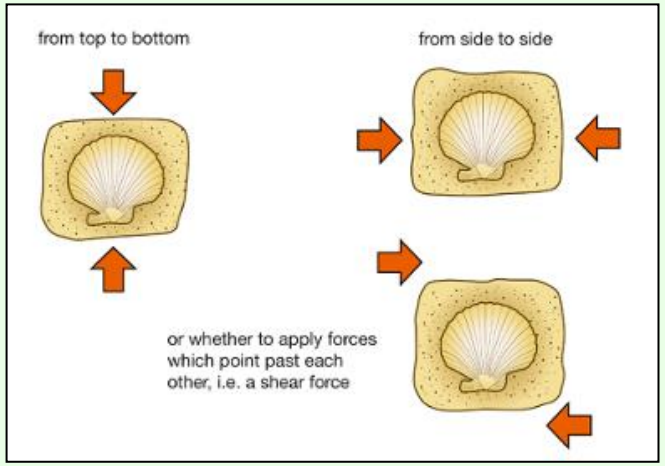
Activity 5: Metamorphism
- detecting the distortion
(millions of years – during mountain building)

These activities simulate the effects of pressure in forming metamorphic rocks. Video at: https://www.earthlearningidea.com/Video/Metamorphism1.html



'Distortion'

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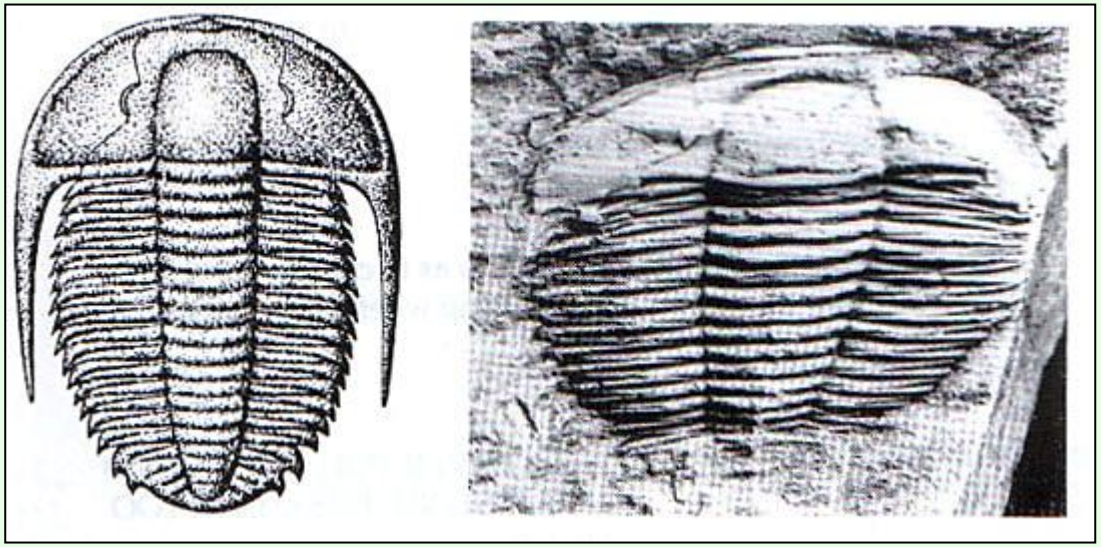
Metamorphism - detecting the distortion



A trilobite - as it lived (and died)

A trilobite as found in the metamorphic slates of North Wales

- By how much has the trilobite been distorted? - $^1/_2$, $^1/_3$, $^1/_4$, $^1/_5$?
- By how much have the surrounding rocks been distorted?
- By how much has North Wales been distorted?
- What might be big enough to cause this scale of distortion?

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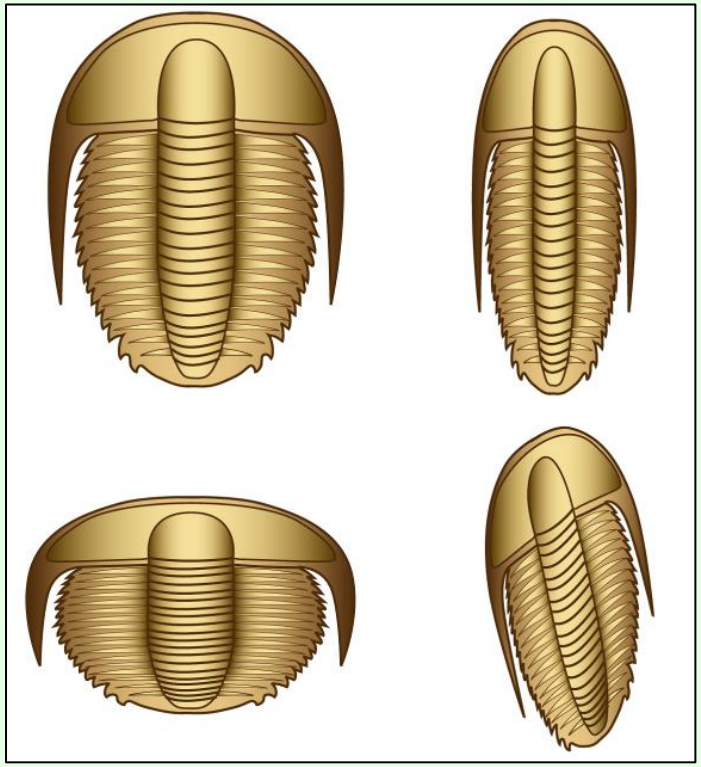
Metamorphism - detecting the distortion

Study each of the drawings below. They show several trilobites found in slates. The top left is an undistorted trilobite; the trilobites in the other pictures have been distorted by forces in the Earth.



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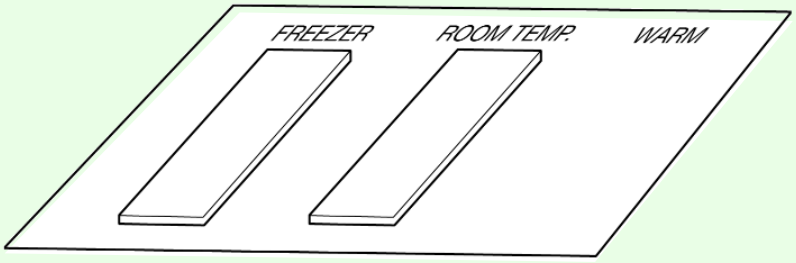
Activity 6: Crystallisation
- fast or slow cooling, large or small crystals

(Extrusive – seconds to weeks; Intrusive - thousands to millions of years)

We can find out why the crystals in igneous rocks have different sizes through simulating the growth of crystals from magma by growing crystals from a melt in the laboratory. See: https://www.earthlearningidea.com/Video/Crystallisation.html



microscope slides on the 'freezer' and 'room temperature' parts of the paper

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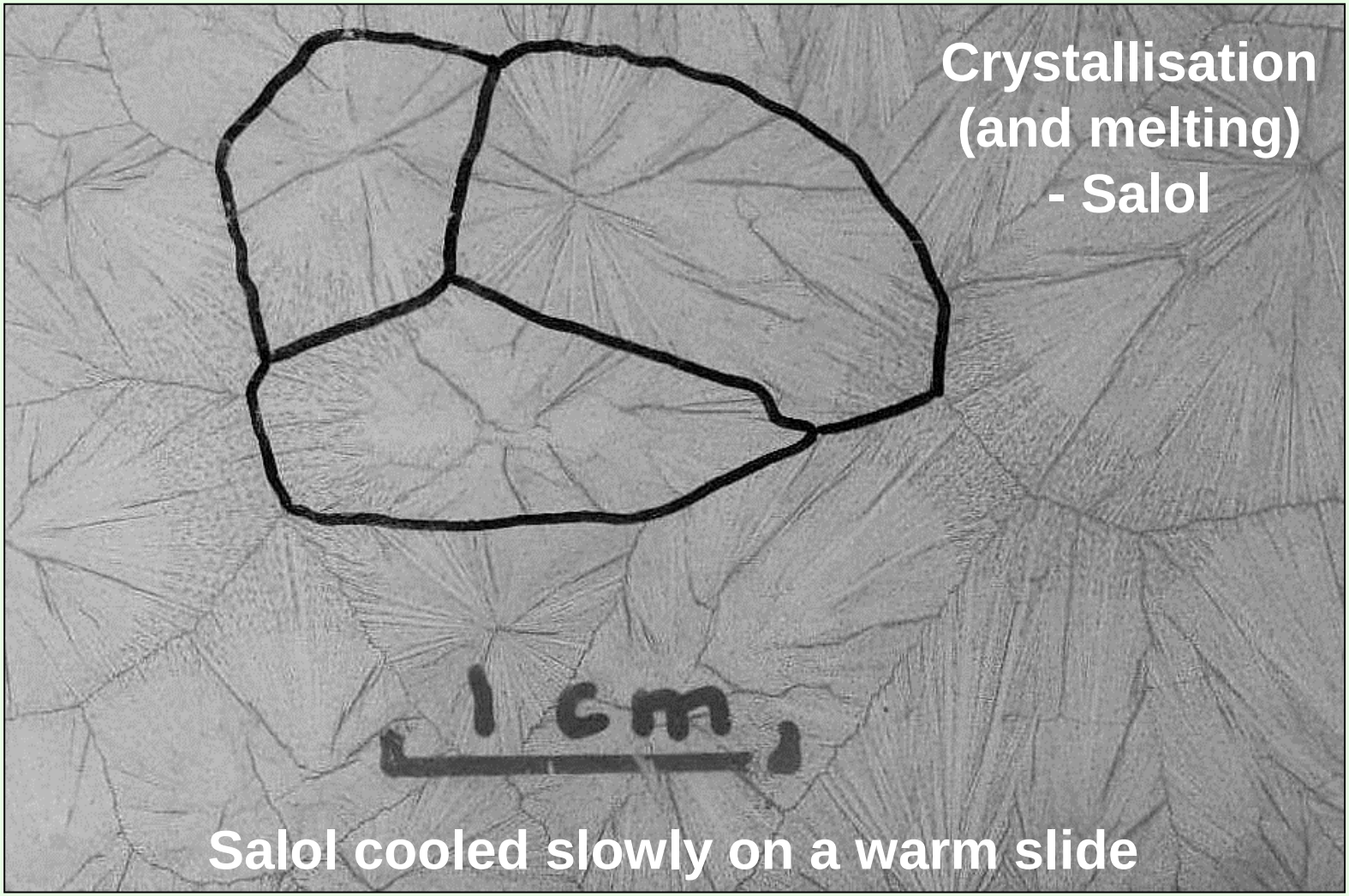

See videos at: https://www.earthlearningidea.com/Video/Salol.html

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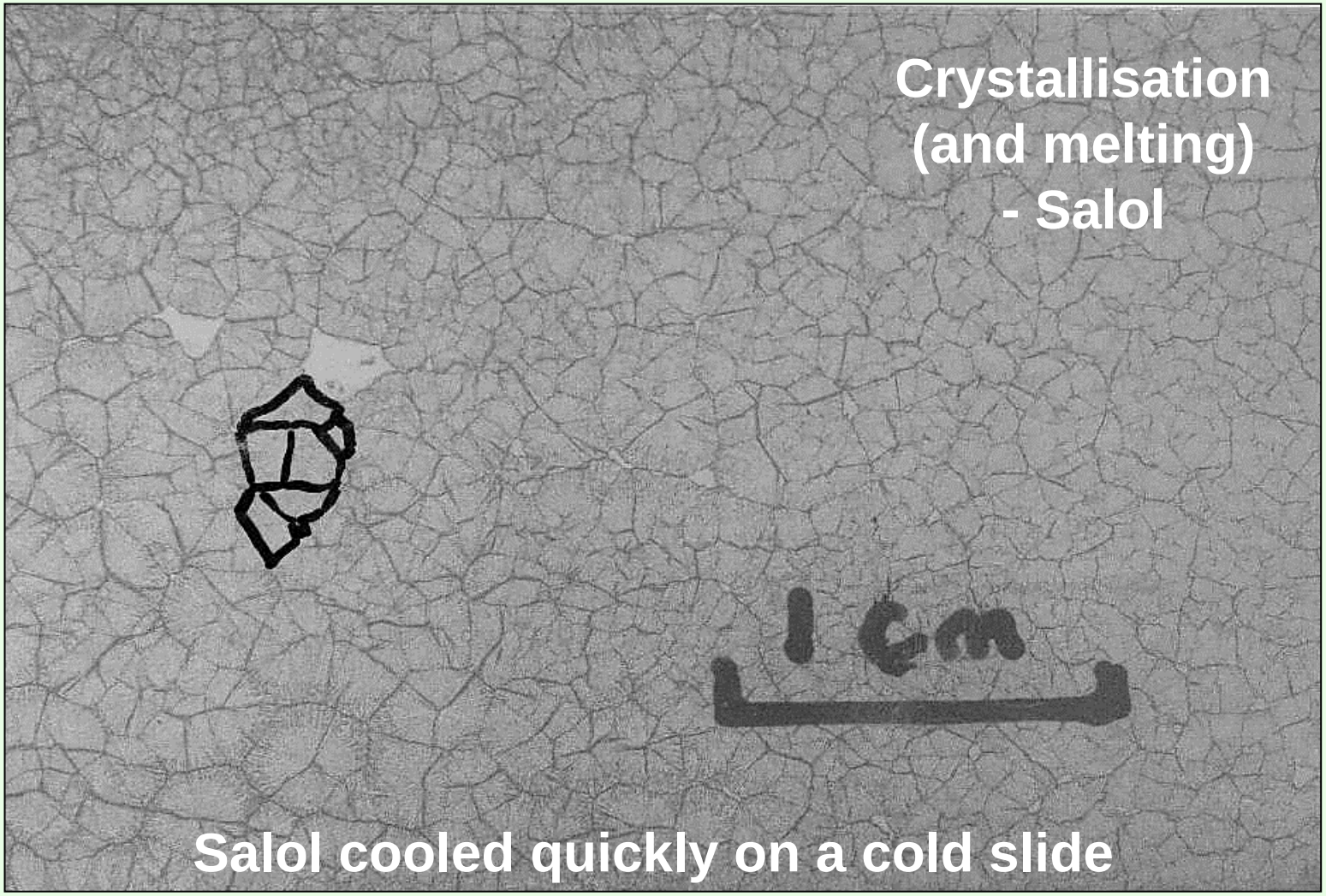

See videos at: https://www.earthlearningidea.com/Video/Salol.html

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Activity 7: Extrusion
- Igneous rocks ‘in the laboratory’
(seconds to weeks)

This activity helps to investigate what controls the viscosity of lava and how this influences the shape of volcanic landforms – at:
https://www.earthlearningidea.com/Video/Extrusion.html

Mount Etna eruption

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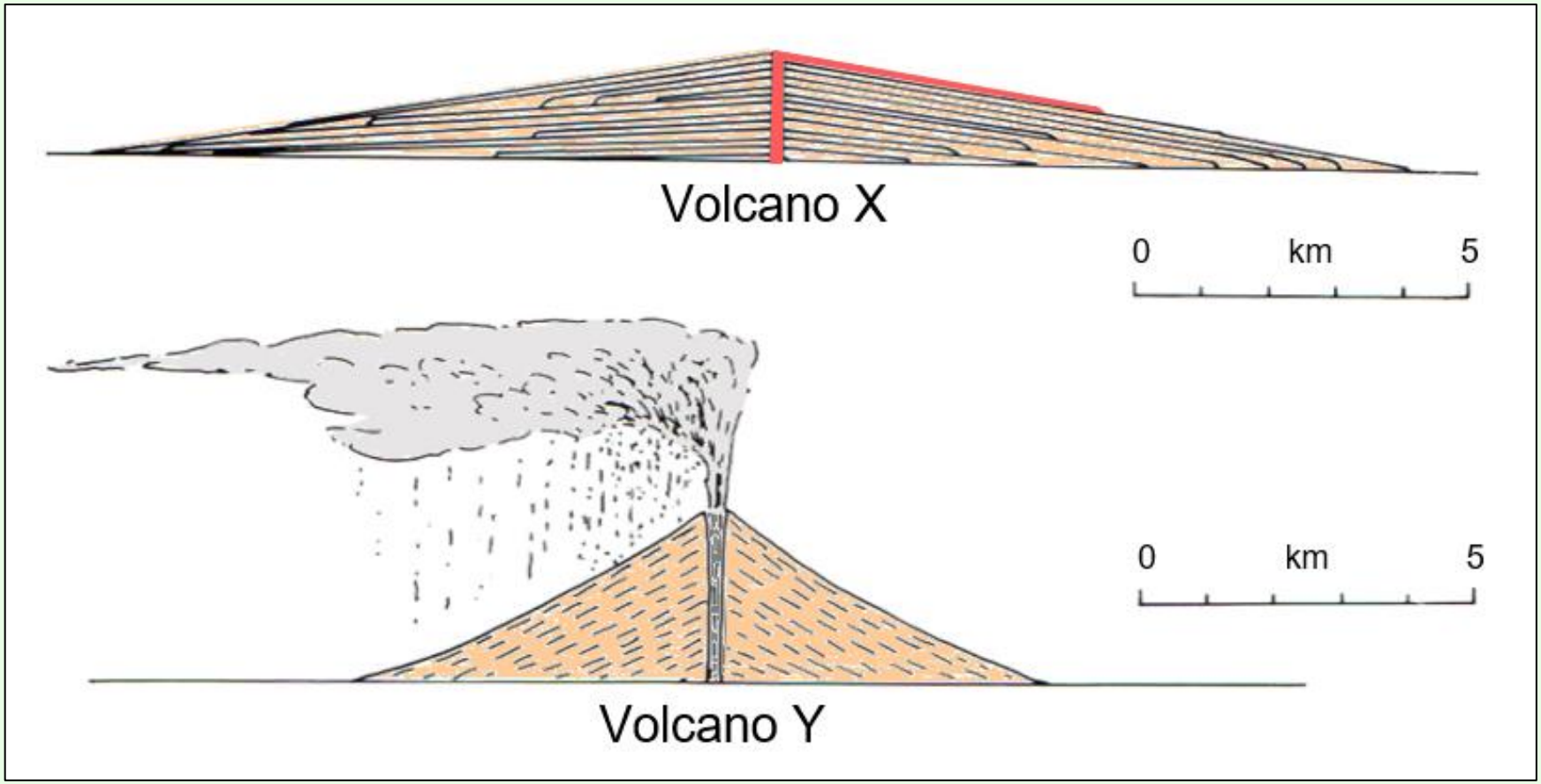
‘Lava’ in the laboratory: the treacle investigation



- Which volcano was formed by runny lava?
- Which volcano was formed by slow-flowing lava?
- Which sort of eruption would you like to watch?

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‘Lava’ in the laboratory: the treacle investigation

Scientific accuracy

- Whilst the treacle model of magma correctly shows that the temperature of the magma, the amount of crystals it contains and its water/gas content (as well as its composition), all play key roles in how explosive eruptions are …
- … water content has the opposite effect of that shown by the treacle model
- For complex reasons, the more water a volcanic magma contains, the more explosive it usually becomes.

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Activity 8: Deformation and uplift
- make your own folds and faults
(seconds [faulting] to millions of years [folding, faulting, metamorphism during mountain building])

This activity shows how folded and faulted rocks can provide evidence of the size and direction of the forces which produced the deformation. See the video at: https://www.earthlearningidea.com/Video/Deformation.html

'Folded strata'

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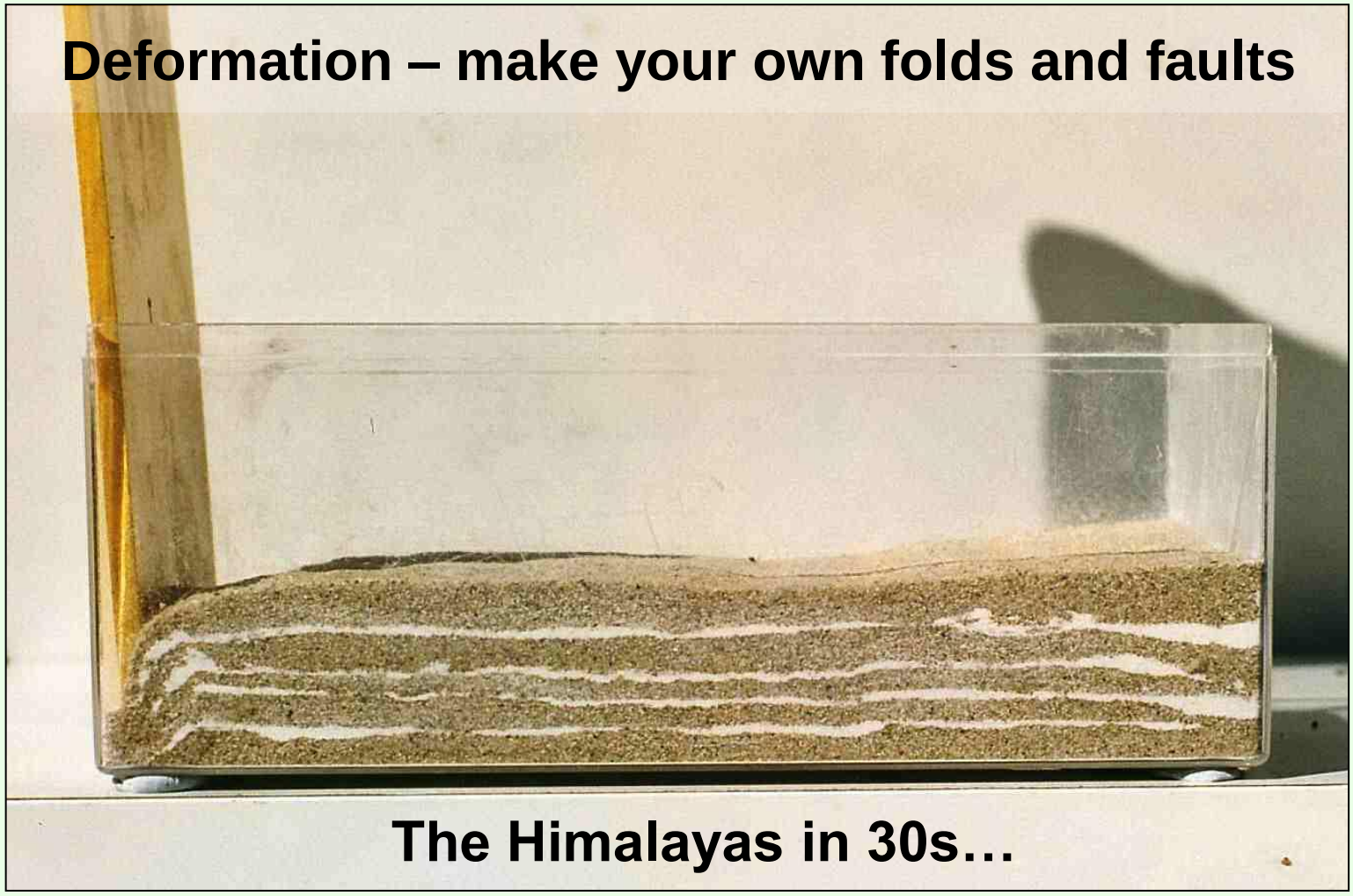

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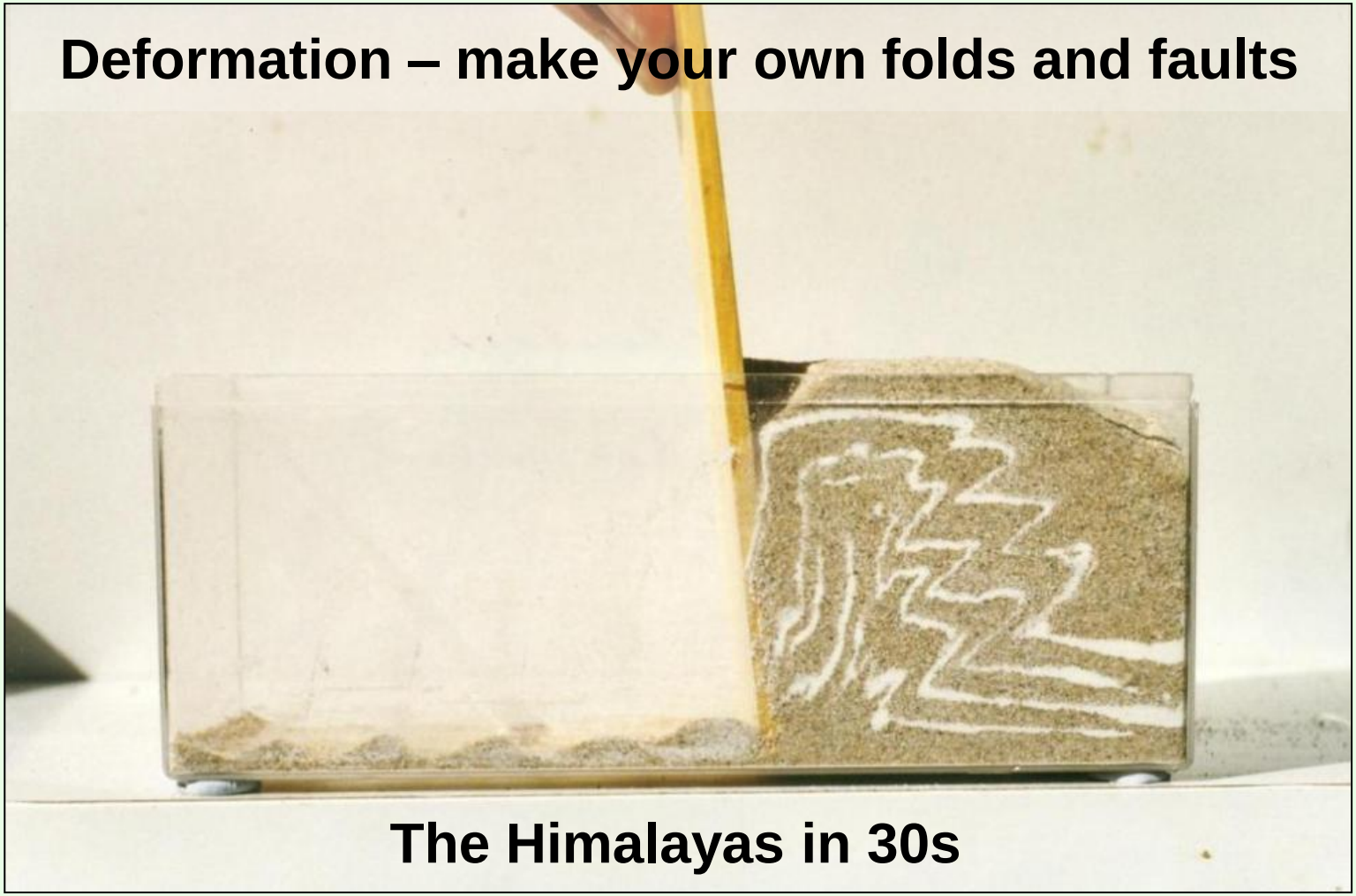
Deformation – make your own folds and faults



The Himalayas in 30s

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Deformation – make your own folds and faults

The Himalayas in 30s

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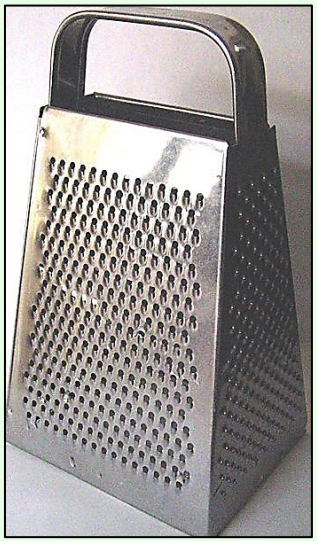
The dynamic rock cycle

The dynamic rock cycle

Rock cycle review: The rock cycle in wax

When you have taught the rock cycle, revisit and revise it with your pupils. Videos at: https://www.earthlearningidea.com/Video/RC_review1.html



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Rock cycle review: A wax volcano in the lab

Volcanoes are exciting – hence all the volcano footage on TV. They can be used to fire pupils' imaginations, and safe analogues of the behaviour of molten rocks can be demonstrated in the school laboratory. This Activity consists of a teacher-led demonstration for the whole class. It also demonstrates how "rocks" may form below "ground", as well as on the surface. See: https://www.earthlearningidea.com/Video/RC_review2.html

'wax volcano'

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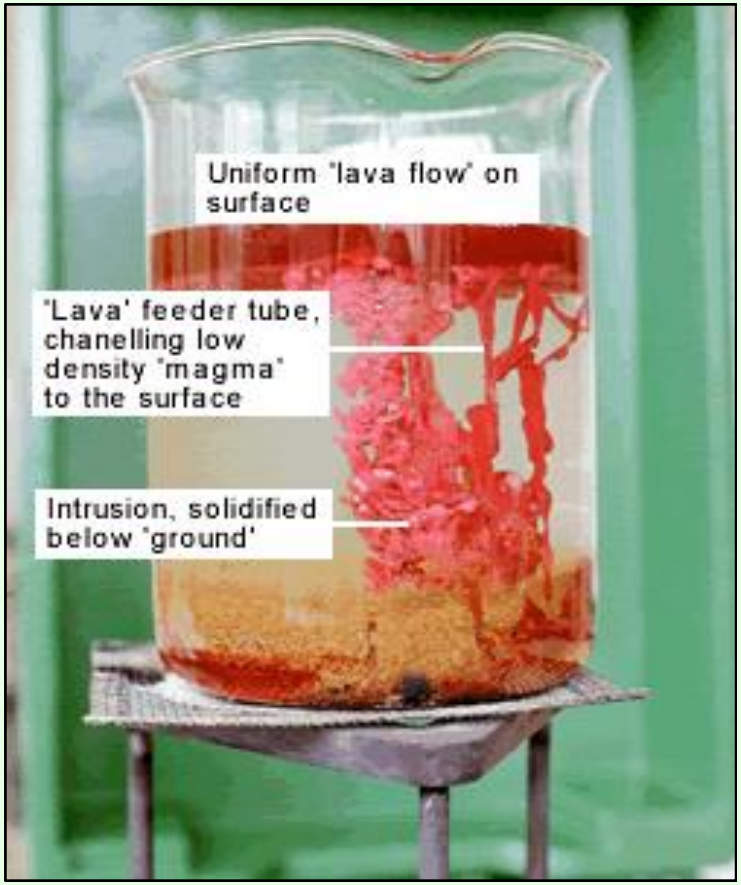
Rock cycle review: A volcano in the lab



(Click to set the volcano off)

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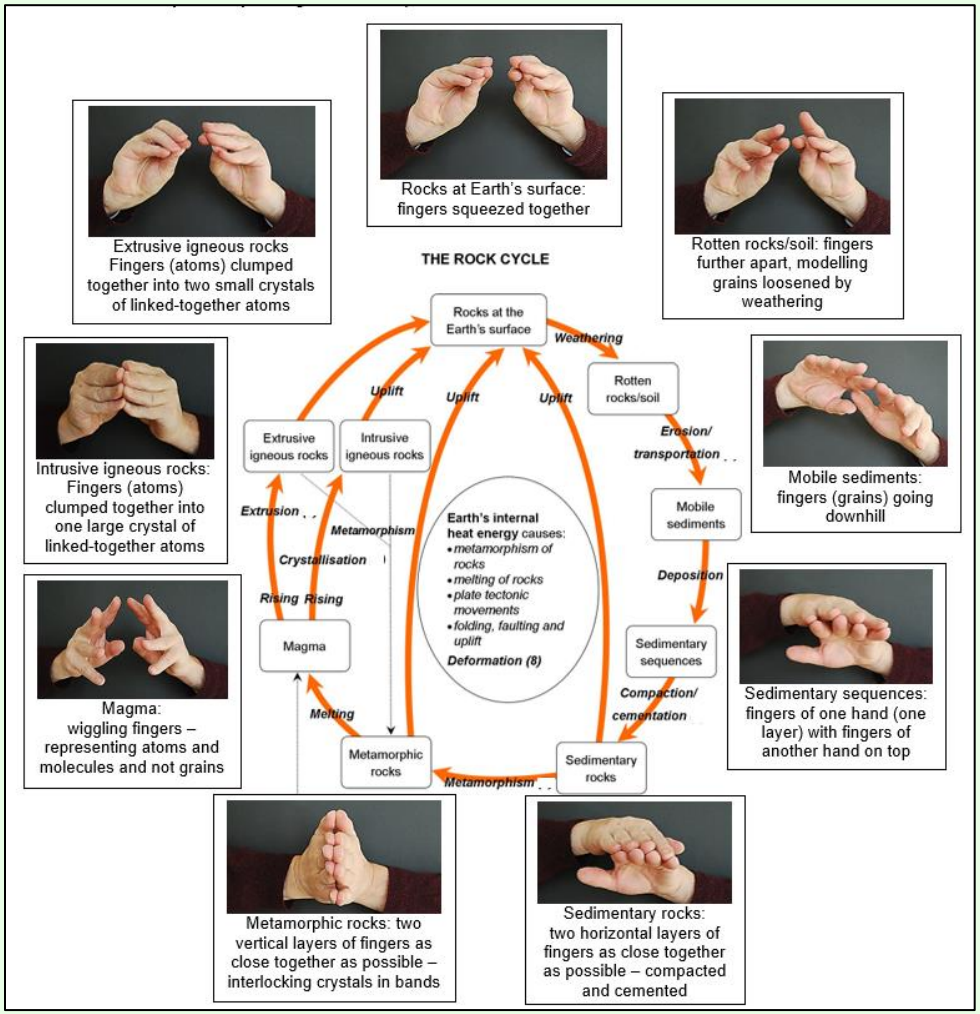
Rock cycle review: The rock cycle at your fingertips



See: https://www.earthlearningidea.com/Video/RC_review3.html

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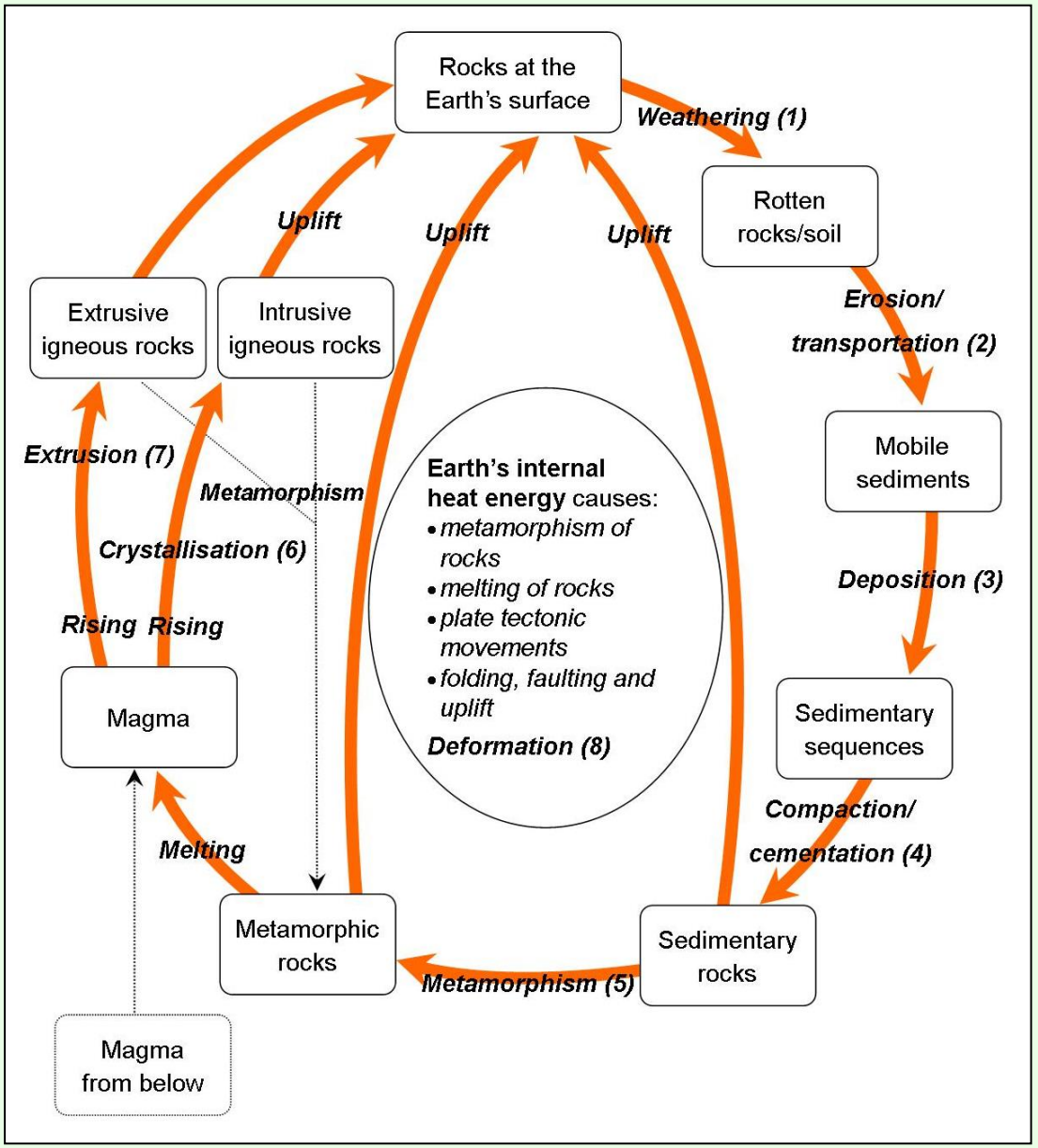
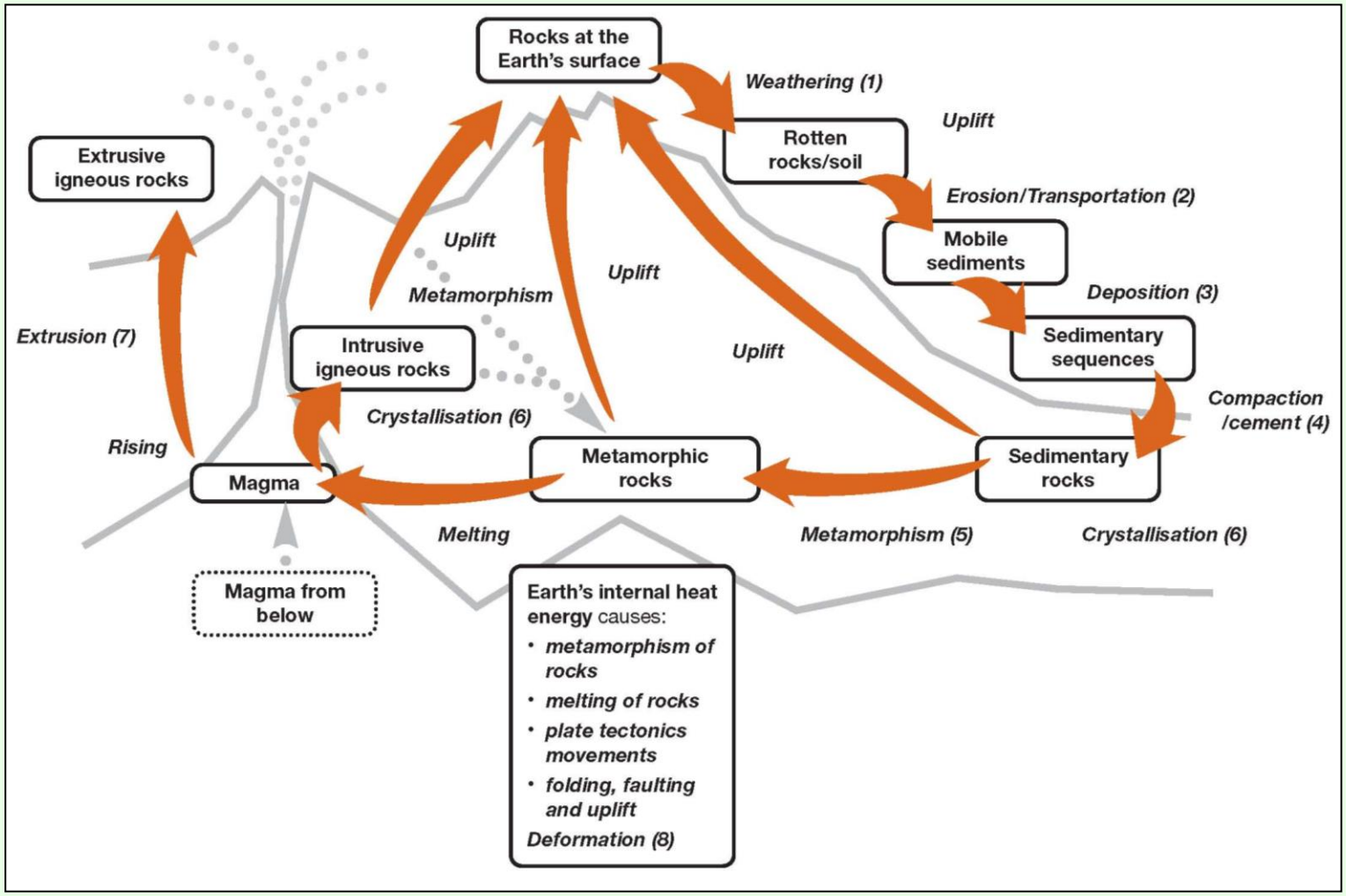


The dynamic rock cycle



'Diagrammatic version of the rock cycle'

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Copyright

The dynamic rock cycle

Copyright continued…

Workshop outcomes

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- identification and terminology of rock cycle products, including soils, sediments and rocks;
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Workshop outcomes

- introduction to a range of Earth science laboratory activities, from simple modelling to more complex investigations;
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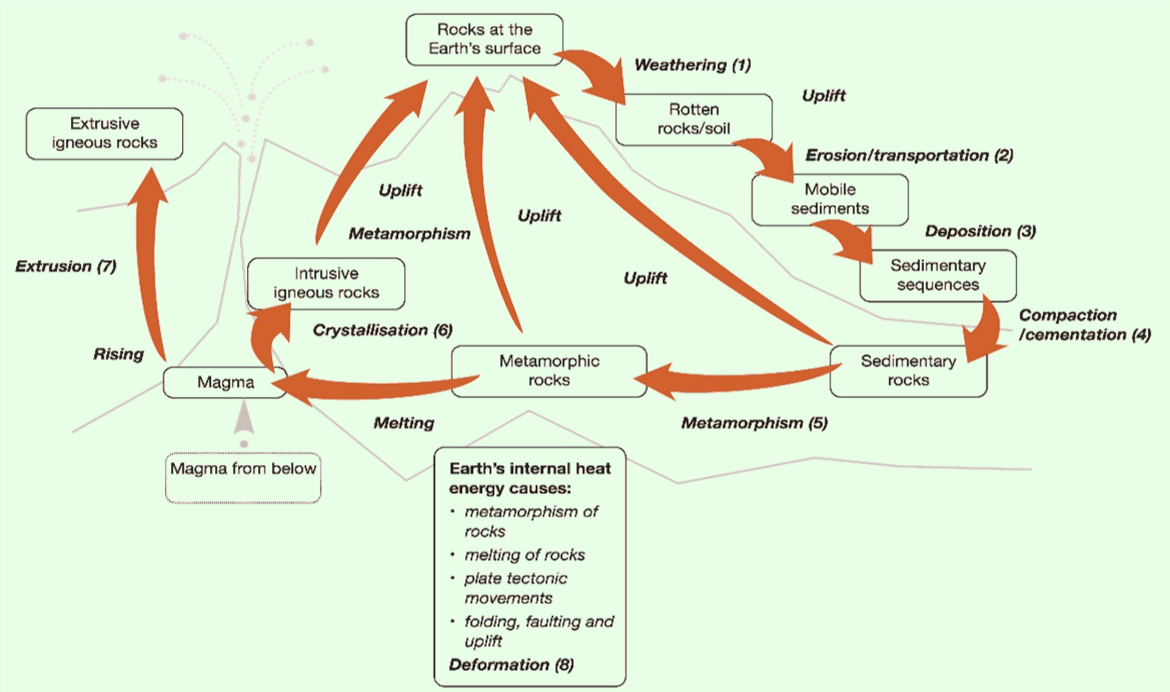
Earth Science for science and geography – video workshop



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