

Filling the gap – picturing the unconformity ‘abyss of time’? Working out what happened during unconformity time gaps

Ask your pupils to picture what happened in the time between the upper and lower beds of an unconformity.

Help them to see the tiny gap you are talking about, by framing the line of the unconformity between their finger and thumb, as shown here.



Framing an unconformity. (David Bailey).

Here the finger and thumb are framing the unconformity at Siccar Point between lower near-vertical Silurian rocks and upper tilted Devonian rocks, where the time gap of the unconformity is about 55 million years.



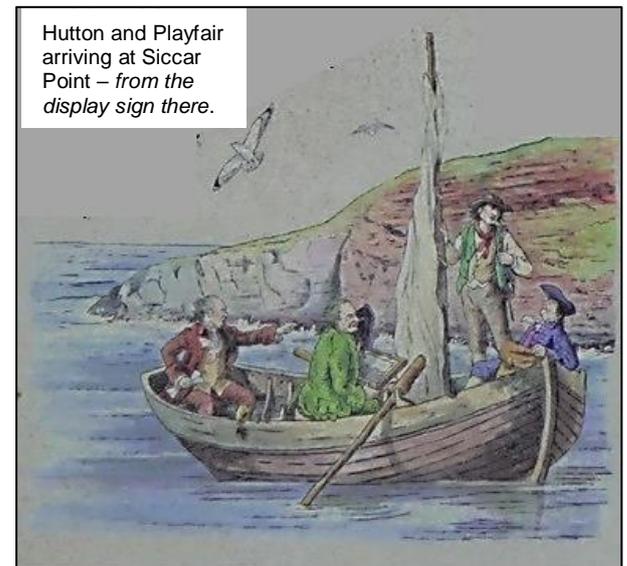
The unconformity at Siccar Point, Scotland with the unconformity highlighted. (David Bailey).

The ‘story’ of this unconformity between Silurian and Devonian rocks is:

- after the lower Silurian beds were laid down flat on the sea floor, they were buried and tilted during a mountain-building episode; the overlying rocks were eroded away forming an erosion surface; then beds of Devonian sediment were laid down on top;
- the time gap is about 55 million years; since plates move at around 4cm per year, the continent may have moved more than 2000 km in the space between your finger and thumb;
- in the time between the lower and upper layers:
 - the first primitive plants appeared on land;
 - the first ray-finned fish evolved;

- land scorpions and insects appeared;
- the first coiled nautiloid shellfish swam in the sea;
- the first tracks on land were made.

Siccar Point is the famous place where the Scottish geologist James Hutton brought his friends in 1788. There he showed them all the events that must have happened to form the unconformity. Hutton's friend Playfair later wrote ‘*The mind seemed to grow giddy by looking so far back into the abyss of time ...*’



Hutton and Playfair arriving at Siccar Point – from the display sign there.

So this is the place where the enormous length of geological time was first demonstrated – through the events of an unconformity.

Try telling the story for other unconformities, like the unconformity discovered by another famous geologist, Henry De La Beche, in Somerset, UK.



The Henry De La Beche unconformity, Vallis Vale, Somerset, UK. Carboniferous limestone below; Jurassic limestone above. (Alan Holiday).

The time-gap story for this unconformity between the Carboniferous and Jurassic rocks is:

- the Carboniferous limestone was laid down on the sea floor and became buried and tilted in an episode of mountain building; the area was uplifted and the rocks above eroded to leave an

erosion surface; this sank beneath the sea and the Jurassic limestone sediments were laid down on the top;

- since the time gap is about 150 million years, with plates moving at around 4cm per year, the continent may have moved 6000km in the finger to thumb space;

- between the lower and upper layers:
 - the first large sharks swam;
 - reptiles appeared;
 - nearly all life on Earth died in the 'Great dying' extinction;
 - the first dinosaurs and the first mammals appeared;
 - forests began to dominate the land.

The back up

Title: Filling the gap – picturing the unconformity 'abyss of time'?

Subtitle: Working out what happened during unconformity time gaps

Topic: A method of helping pupils to visualise the enormous time-spans between the upper and lower layers of unconformities.

Age range of pupils: 10 years upwards

Time needed to complete activity: 10 minutes

Pupil learning outcomes: Pupils can:

- describe how an unconformity must have formed;
- explain the great time span between the lower and upper layers of an unconformity.

Context:

Another example using this method is based on an unconformity between Precambrian and Triassic rocks, below:



A valley eroded into Precambrian rocks filled, above the unconformity, with Triassic layered sediments, Newhurst Quarry, Charnwood Forest in the English Midlands. (Peter Kennett).

The story of this gap between two different groups of rocks is:

- the lower sedimentary and volcanic rocks were formed in Precambrian times. They were folded, and intruded by a mass of molten rock, which solidified to form a coarse-grained granite-like, crystalline rock, seen in the lower part of the photo. Much later, uplift and erosion occurred, producing a range of hills and valleys. The area that later became Britain was moved through desert latitudes during the Triassic period, and the valleys, known as wadis, became filled with red sand, washed in from the desert at times of flash flooding;

- the interval between the late Precambrian and the Triassic is about 320 million years;
- plates move at c4cm per year so the continent may have moved more than 12,000km between your finger and thumb;
- between the layers at the unconformity surface:
 - animals with hard parts evolved;
 - the first fish appeared;
 - plants and animals colonised the land;
 - amphibians and reptiles appeared;
 - c90% of life died in the 'Great dying' extinction event;
 - the earliest dinosaurs walked the Earth.

This exercise can be carried out for any unconformity in the field or on a photograph. You could superimpose this hand onto an unconformity photo of your own.



Hand. (David Bailey).

Following up the activity:

Try the same approach for other unconformities, in the field or in photographs.

Underlying principles:

- An unconformity is a time-gap between the geological events below an unconformity and those above.
- Unconformity time-gaps are always many millions of years, because that amount of time is necessary between the deformation of beds, their uplift and the erosion of a several kilometre thickness of overlying material, before the layers above an unconformity can be deposited.

Thinking skill development:

Picturing the events between the rocks above and below an unconformity needs creative thinking.

Resource list:

- just imagination

Useful links:

Type 'unconformity animation' into a search engine like Google to find several animations of unconformity-formation.

A history of life on Earth with geological ages is given at:
https://en.wikipedia.org/wiki/Timeline_of_the_evolutionary_history_of_life

Other Earthlearningidea activities cover James Hutton (James Hutton or 'Mr. Rock Cycle') and unconformities (Earthlearningidea's geological mapwork series; the 'Rocks from the big screen' ELI)

Source: Devised by Chris King of the Earthlearningidea Team.

© **Earthlearningidea team.** The Earthlearningidea team seeks to produce a teaching idea regularly, at minimal cost, with minimal resources, for teacher educators and teachers of Earth science through school-level geography or science, with an online discussion around every idea in order to develop a global support network. 'Earthlearningidea' has little funding and is produced largely by voluntary effort. Copyright is waived for original material contained in this activity if it is required for use within the laboratory or classroom. Copyright material contained herein from other publishers rests with them. Any organisation wishing to use this material should contact the Earthlearningidea team. Every effort has been made to locate and contact copyright holders of materials included in this activity in order to obtain their permission. Please contact us if, however, you believe your copyright is being infringed: we welcome any information that will help us to update our records. If you have any difficulty with the readability of these documents, please contact the Earthlearningidea team for further help. Contact the Earthlearningidea team at: info@earthlearningidea.com

