

## ‘Photo dating’

### Using photos to simulate the relative dating of the rock record.

The geological record can be dated relative to several key geological events and fossils that define a range of different periods of geological time over different scales.

Recognising that fossils can indicate different periods of geological time was first used by canal surveyor William Smith in the late Eighteenth Century. During his survey work, Smith realised that rocks of the same age could be identified across the country based on the fossils they contain rather than rock type. This led to the very important geological ‘Principle of Faunal Succession’ - rock strata of the same age can be correlated (linked together in time) from one place to another based on the fossils they contain.

Some fossils (called zone fossils) are better than others at defining a specific time period when they

- show easily identifiable characteristics,
- are associated with rapid evolution,
- lived over a short time range.

Where fossils don’t change over long periods of time, it is difficult to use them to establish a close age of the rock unit in which they are found.

Sometimes fossils can be misleading in dating rocks. ‘Derived’ fossils, which are fossils that have been eroded from an older formation and redeposited in a younger sediment, will suggest the rocks in which they are found are older than they really are.

This ELI activity is an attempt to simulate the relative dating technique by substituting a range of photographs within the experience of the student audience rather than fossils. Students are asked to order them in their correct time sequence and evaluate their importance in precise dating of the event shown.

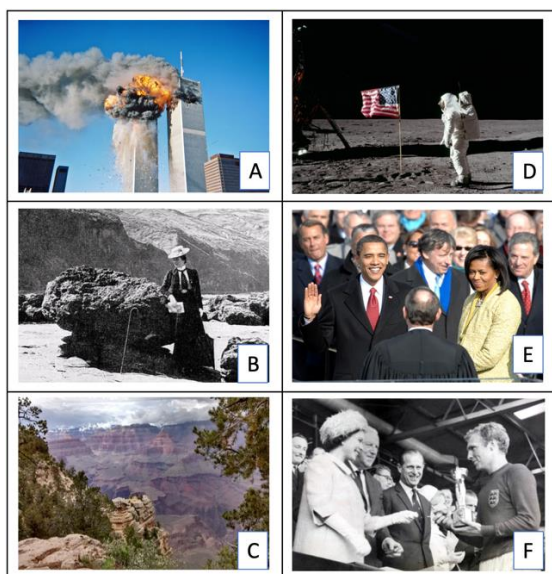


Fig. 1 – Six historic photo ‘fossils’. (See Appendix 1)

#### Method

Provide the class with six photos (Fig. 1). These photos are used only as examples and the choice of photograph should be adapted to the age and experience of the class).

Ask them to put the photos in the order of when the photograph was taken (their relative ages); oldest to youngest.

- Ask students what evidence they used to place photos in this order. Ask them to discuss with their neighbour/group what characteristics in the photo led them to this conclusion (*photo colour, what people are wearing, specific well known historical events etc.*).
- Suggest that they have used the photos just as geoscientists use zone fossils and specific geological events illustrated in the rock record (e.g. a volcanic ash layer, an unconformity or extinction event) to divide up geological time into smaller periods.
- Ask how sure they are that their order is correct after discussing with other groups or the class (*See answers to specific photos*).
- Ask which of the photographs might best be described as a ‘zone fossil’ and are better than others at establishing the date the photo was taken. Why? Which are not so useful? (*Some may represent a precise period of time or date, rather than a longer, non-specific time interval*).
- Ask students to research examples of fossils from the fossil record that might best be used as zone fossils and explain why.
- Ask them to research other reasons that might make fossils useful as zone fossils. (*abundant/plentiful with a wide geographic distribution, occurring in a variety of rock types*).
- Introduce the concept of an anomalous ‘derived fossil’ – e.g., an Ordovician trilobite that has been eroded from the original rock where it was preserved and included as a pebble in a later, younger sediment of Jurassic age. This would incorrectly suggest the later Jurassic rock was of earlier Ordovician age.
- Explain that *some* of the photos might ‘appear’ to indicate a particular date/time when in fact they were taken more recently and can be thought of as being ‘derived’ from a previous time. Ask the class to discuss which photo they think might fit this description? (*Photographs B, D and arguably photo A may have been staged and photographed later than suggested, making them ‘derived fossils’*).

## The back up

**Title:** 'Photo dating'

**Subtitle:** Using photos to simulate the relative dating of the rock record

**Topic:** A simulation of relative dating using historic photos to represent key geological events and fossils.

**Age range of pupils:** 10 – 18 years

**Time needed to complete activity:** 10 minutes

**Pupil learning outcomes:** Pupils can:

- appreciate the use of time dependent zone fossils to divide geological time;
- understand that geological time scales are only relevant when illustrated by meaningful reference points;
- explain that 'derived fossils' might lead to a misinterpretation of a particular time frame.

### Context:

This activity has been devised to demonstrate the principles behind relative dating using zone fossils by substituting photographs, taken over a period of time within the experience of the students.

**Following up the activity:** Use the internet to research zone fossils that have been used in stratigraphy – e.g. graptolites and cephalopods. Study further Earthlearningideas – 'Washing line of Time', 'Abyss of time' and 'William Smith – The Father of English Geology' (See useful links below).

### Underlying principles:

The relative age of the photos from oldest to youngest is B, F, D, A, E. (Photo C could have been taken any time after the invention of colour photography)

- Photo B. This picture of a Victorian lady suggests it is the oldest from the clothes she is wearing. We can be sure it was taken after 1826 as this is the date when the first photo was taken by French physicist Joseph Nicéphore Niépce. This image was of a fieldtrip at Ravenscar, Robin Hood's Bay, Yorkshire, taken around 1900. This gives a range of dates from 1826 to c1901 (i.e. mostly during the Victorian era) but fashions persisted for some time after.
- Photo F: An excellent 'zone fossil'. This picture of Queen Elizabeth II presenting the FIFA World Cup trophy to the England captain, Bobby Moore, was taken on 30<sup>th</sup> July 1966 at about 5.40pm at Wembley Stadium, London.

- Photo D – Man on the Moon. The Apollo moon missions started on 20<sup>th</sup> July 1969, beginning with Neil Armstrong and Buzz Aldrin on Apollo 11, and ending on 14<sup>th</sup> December 1972 with Gene Cernan and Harrison Schmitt on Apollo 17. This photo was of Buzz Aldrin during the first Apollo 11 landing on July 21<sup>st</sup> 1969 but of the thousands of similar photos taken by the astronauts over the 41 month period it could have been any date during that period.
- Photo A: Another excellent 'zone fossil' as it shows a single moment in time that is readily identified as a hijacked plane hit the Twin Towers, New York, at 9.03 am (Eastern time) on Sept 11<sup>th</sup> 2001.
- Photo C: This photo (taken in 2015) is easily recognisable as the Grand Canyon, Arizona, USA, but there is no indication of the date it was taken as this view would have remained relatively unchanged for hundreds, if not thousands of years. Therefore, a poor 'fossil' to indicate a particular time period, though a minimum age might be suggested from the colour photography which became more common after the 1950s.
- Photo E: Barack Obama is sworn in as the 44<sup>th</sup> President of the United States of America in Washington, D.C. on January 20<sup>th</sup> 2009. Obama and the date of the event are easily recognisable making this a good 'zone' fossil.
- Pupils should be warned that "fake" photographs are becoming more frequent on the media.

### Thinking skill development:

Using evidenced based observational skills to construct reasoned, relative ages from faunal succession principles. Cognitive conflict comes from lack of evidence and the possibility of 'derived' fossils. Metacognition through discussion requires the development of bridging skills between the simulation and reality.

### Resource list:

- Photographs (Appendix 1 or alternatives)

### Useful links:

[https://www.earthlearningidea.com/PDF/Washing\\_line\\_time.pdf](https://www.earthlearningidea.com/PDF/Washing_line_time.pdf)  
[https://www.earthlearningidea.com/PDF/453\\_Abyss\\_time.pdf](https://www.earthlearningidea.com/PDF/453_Abyss_time.pdf)  
[https://www.earthlearningidea.com/PDF/109\\_William\\_Smith.pdf](https://www.earthlearningidea.com/PDF/109_William_Smith.pdf)

**Source:** Written by Pete Loader of the Earthlearningidea team.

## Appendix 1



### Photos

A: Explosion following the plane impact into the South Tower on 9/11/2001- This photo is in the public domain.

B: Field trip to Ravenscar, Robin Hood's Bay, Yorkshire c1900. © Geologists' Association

C: Grand Canyon, Arizona, USA – 2015 © Pete Loader

D: Apollo 11 moon landing -1969 -This photo is the original work of NASA and is in the public domain

E: US President Barack Obama taking his Oath of Office – 2009 -This photo is in the public domain.

F: The Queen presents the 1966 FIFA World Cup to England Captain, Bobby Moore -This photo is in the public domain.

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