Picturing puzzle structures

Visualise and draw sedimentary structures from a verbal description

Encourage pupils to look carefully at sedimentary structures and to describe them verbally so that another person can visualise them from the description.

Seat pupils in pairs, with each person holding half of the photograph cards showing sedimentary structures, printed off from those shown below. They should NOT show each other what cards they have in their hands.

Pupil A then examines one photograph and describes it as fully as possible to Pupil B, who listens carefully and then tries to draw it. Pupil B must listen in silence and not ask any questions. Pupil B then takes a turn with another card, with Pupil A doing the drawing, also in silence. Neither person should use any technical terms which describe the structure, e.g. ‘cross-bedding’, but they may use more general words, such as ‘beds’, ‘lamination’, ‘grains’. Pupils should then compare their hand-drawn efforts with the photographs.

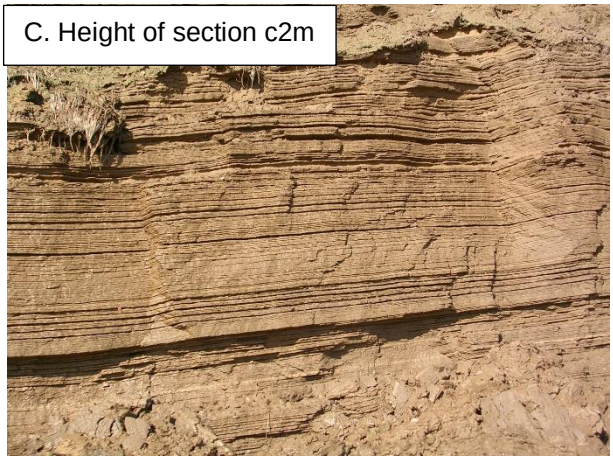
This first round should be tried without any guidance. Then give each participant the Prompt Card, to encourage them to be more specific in further descriptions, and ask them to work through the remaining photographs, comparing their drawings with the photographs after each round. Note that some structures are repeated on different photographs.

When all have finished, give out the descriptive cards and ask pupils to match the descriptions to the photographs which they have been using.

A.

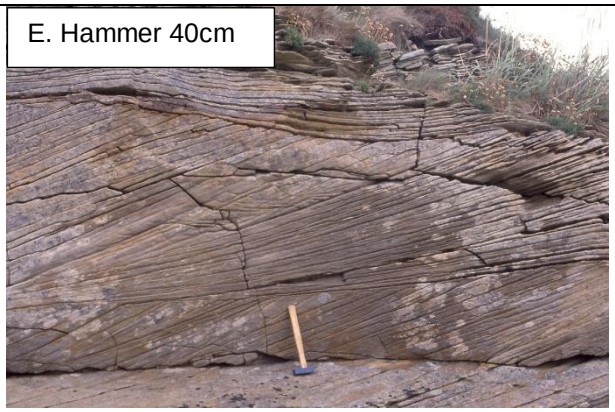
B.

C. Height of section c2m



D. Lens cap 50mm

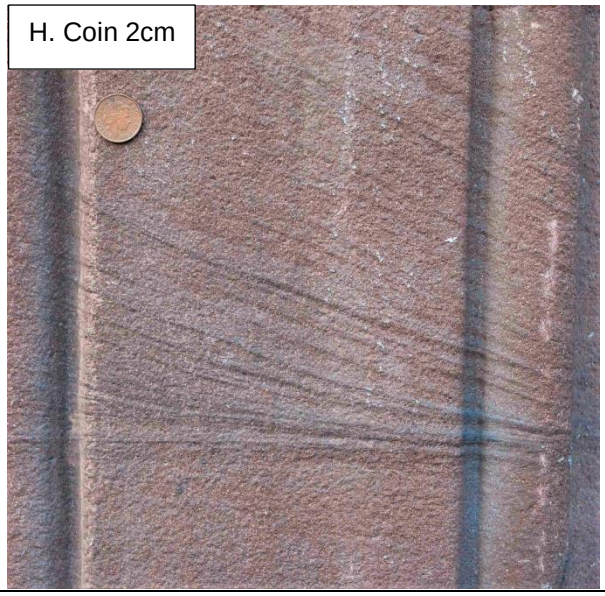
E. Hammer 40cm



F. Coin 2cm

G.

H. Coin 2cm

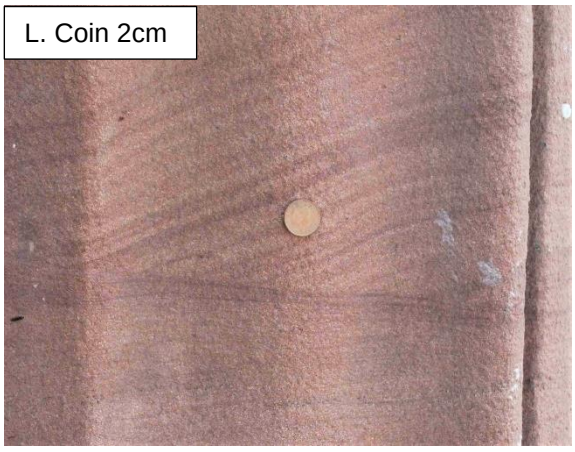


I.

J.

K.

L. Coin 2cm



Descriptions of the photographs (Note that directions are only seen in two dimensions in the photos, so should be regarded as "apparent" directions.) Some specimens are upside down, so these notes must be read accordingly.

1. Volcanic agglomerate showing graded bedding, ranging from 1cm fragments near the base to 1mm or so at the top. The fragments are of varied composition and were produced by one phase of explosive volcanic activity, but they settled in water from one act of deposition, so there are no bedding planes within the specimen.	7. Cross-bedding in a red sandstone in a building stone (the same building as card 6) except that here the block has been placed upside down compared to its situation in the quarry. The cross-beds stop abruptly at a near-horizontal plane, just below the coin. This is a truncation plane (flat surface), showing where erosion had removed part of the cross-beds lying beneath, when it was loose sediment on a river bed.
2. Load cast. You are seeing the base of the specimen: it is upside down. The visible grain size is that of very coarse sand (and becomes smaller towards the true top of the specimen, although this cannot be seen in the photo). The sand was brought into a body of water by a turbidity current and settled out, pressing into the underlying beds as it did so, producing pillow-shaped load casts under its own weight.	8. Plane laminations in a fine-grained deposit, resulting from many phases of deposition in low-energy conditions. The layers are picked out by subtle changes in colour, which indicate a rhythmic variation in grain size from clay to silt. These are varves, deposited in a glacial lake, with coarser material settling out in the summer melt and finer particles in the frozen winter.
3. Desiccation cracks in a fine-grained sandstone, seen at the base of the specimen: it is upside down. Some of the cracks are polygonal. These were produced as water evaporated from the upper surface of a muddy-grade sediment which shrank and cracked. The next flood of water deposited sand in the cracks. The whole sequence later lithified into sedimentary rock.	9. Flute casts in a greywacke. You are looking at the base of the specimen. A strong turbidity current flowed from the right, eroding hollows in a mud layer beneath, and sand settled out into the hollows as the current passed. The hollows were shaped by sand caught up in eddies in the current, losing energy as they travelled, resulting in a deep scour at the start, gradually becoming shallower and wider down-current.
4. Imbricate fabric: angular cobbles are lying at an angle to the horizontal, resting partly on each other. They slope to the left indicating that water flowed strongly from that direction. The angularity of the fragments, the poor sorting of grain sizes and the red colour suggests that the sediment was deposited by a flash flood in tropical, probably semi-arid conditions.	10. Cross-bedding in sandstones. The cross-beds slope down to the left throughout most of the section, indicating a current flow from the right. Higher up, there is a curved truncation plane (erosion surface) and further cross-beds, apparently from a different direction.
5. Asymmetrical ripple marks in a red sandstone, of uniform grain size. The steeper face of each ripple mark faces to the right, indicating a steady water current flowing from the left. The red colour suggests tropical, probably semi-arid conditions.	11. Cross-lamination deposited by asymmetrical ripples (ripple-drift lamination) in a very fine-grained sandstone. The specimen shows several sets of cross laminae and truncation planes, produced by underwater ripples moving with the current from right to left. The top surfaces of each ripple would have looked like the ones in Photo A, with the steep face facing left, not right. These were planed off as each truncation (erosion) event occurred.
6. Cross-bedding in a red sandstone in a building stone (the same building as card 7). The cross-beds slope down to the right, indicating a current of water flowing from the left. The beds are gently concave upwards, showing that the block has been emplaced the right way up. The red colour and very well-sorted sand grain size (from washed-out sand dunes) suggest semi-arid conditions.	12. Symmetrical ripple marks in a sandstone, produced by a two-way water current. These are formed on coasts and lake shores as the wind-produced waves reach shallow water. The crests of the ripples generally lie parallel to the ancient shore at that point.

Prompt Card
Use this card as a check list to aid your verbal description of your photographs to your partner
What is the size of the specimen, or of the sequence of rocks in the field?
Comment, where appropriate, on features seen: **in** the bed; **on** the bed; **under** the bed
What is the grain size of the rock?
Does the grain size vary from bottom to top of the rocks in the photograph?
What is the shape and rounding of the grains?
Does the colour give any clues?
Is there evidence of the way-up of the specimen or rock sequence?
Are there clues about the direction of flow and the strength of the current which deposited the loose sediment?
Are there features which formed after the original sediment was laid down?
Name the rock (but NOT the structure).

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The back up

Title: Picturing puzzle structures

Subtitle: Visualise and draw sedimentary structures from a verbal description

Topic: Enhancing pupils' skills of description and interpretation using photographs of sedimentary structures

Age range of pupils: 14 years upwards

Time needed to complete activity: About 30 minutes, depending on depth of discussion

Pupil learning outcomes: Pupils can:
- examine photographs of sedimentary structures carefully and describe them intelligibly;
- listen carefully to a verbal description and interpret it in a drawing;
- demonstrate their understanding of the nature and origin of sedimentary structures;
- recognise that some structures in the photographs are upside down;
- enhance their observational skills as a prelude to field work.

Context: This could form a useful revision activity, once pupils have studied sedimentary rocks.
Answers to the matching exercise are:

A5	B3	C8	D4	E10	F9
G1	H6	I11	J2	K12	L7

Following up the activity:
- Adopt the same approach to real specimens, if you have them, or to photographs of other items of geological significance.
- Ensure that pupils use the same careful description and interpretation approach to geology in the field.

Underlying principles:
- Sedimentary structures provide essential clues to their environments of deposition.
- This strategy provides training in careful observation and interpretation of all relevant features.
- Being obliged to give a verbal description encourages careful observation, to ensure that clues are not missed.

Thinking skill development:
Verbal dexterity and metacognition are encouraged by the need to give intelligible verbal descriptions and to interpret from them**.** Mental patterns are constructed of the relationship between sedimentary structures and their origins. Applying the activity to real specimens or to the field situation is a bridging activity.

Resource list:
- Card sets of Photographs, Prompt Cards and Description Cards, cut out from those shown above.
- If real specimens are available these may be used instead, with appropriate matching descriptions drawn up by the teacher (although it is harder to hide real specimens from each other).
- A ruler and protractor per pair might encourage accurate observation and description.

Useful links: Search for "sedimentary structures" on www.earthlearningidea.com
See the table below for other Earthlearningidea activities in the "Picturing" series.

Source: Written by Peter Kennett of the Earthlearningidea Team. Photos by P. Kennett.

Picturing……

Earthlearningidea has compiled a series of activities involving examination of photographs of geological interest and their careful verbal description to others. This table will be updated as fresh activities are added. All titles begin with: “Picturing……”

Title	Sub-title
Puzzle structures	Visualise and draw sedimentary structures from a verbal description
Trace fossils and other strange shapes	Visualise and draw trace fossils and sedimentary structures from a verbal description
Igneous rocks – 1	Visualise and draw igneous rocks from a verbal description
Igneous rocks – 2	Visualise and draw igneous rocks from a verbal description
Metamorphic rocks	Visualise and draw metamorphic rocks from a verbal description
Tectonic structures – 1 faulting	Visualise and draw fault structures from a verbal description
Tectonic structures – 2 folding	Visualise and draw fold structures from a verbal description
Minerals -1	Visualise and draw minerals from a verbal description
Minerals -2	Visualise and draw minerals from a verbal description
Fossils -1	Visualise and draw fossils from a verbal description
Fossils -2	Visualise and draw fossils from a verbal description
Landforms 1	Visualise and draw landforms from a verbal description
Landforms 2	Visualise and draw landforms from a verbal description

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