Weathering- rocks breaking up and breaking down

Matching pictures and descriptions of weathered rocks with the processes of weathering that formed them

Explain to your pupils that the term ‘weathering’ has a precise meaning. It refers only to the break down of rocks in place and does not include the removal of the broken-down rock fragments (this is called ‘erosion’).
Show the pupils the photographs on this sheet and invite them to match the pictures to a) the descriptions and b) the explanations of the weathering processes.

Photograph 1(*All photos are by P. Kennett, except where stated)*

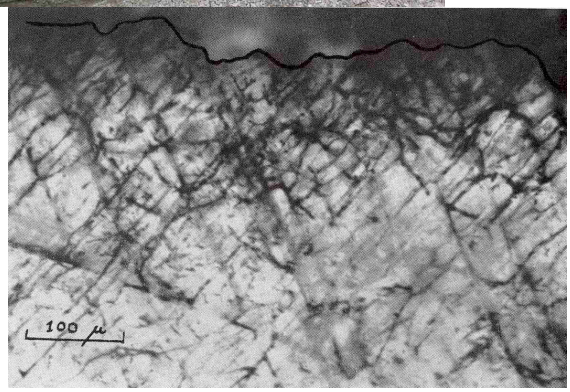
Photograph 2

Photograph 3

Photograph 4 (The lens cap is 50mm across)

Photograph 5 (Height of section about 3m)

Photograph 6a



Photograph 6b The scale bar is 0.1mm long
Photo: Dr R.J. Jones

Photograph 7

Photograph 8

Photograph 9 (The hammer is 40 cm long)

Descriptions of photographs (not in order**)**

- a grave slab cut from pink and white gypsum, now with a rough, cracked surface
- a large boulder with a tree growing out of a joint in it
- sharp fragments of limestone forming a sloping scree beneath a rock face above
- rounded blocks of dark igneous rock with loose brown material around them
- a level surface of grey limestone with deep gullies crossing it in a rectangular pattern
- speckled dark grey and white lava flows, with a red-brown band between them
- a creamy coloured, porous limestone block, with loose weathered material around it
- a block of sandstone, with the front surface flaking off, in the wall of an old building
- yellow lichens on a gatepost, with a view down a microscope showing the lichen's 'rootlets'

Explanations of the weathering processes that have produced the features in the photographs (not in order**)**

- Tree roots have expanded as they have grown in a natural crack in the rock, forcing the solid rock apart.
- The porous rock has soaked up rain water. This has then repeatedly frozen and thawed, forcing the rock to break up and the outer layers to flake off around it.
- Water trickling down the wall has met water that has risen up from the ground through the pore spaces in the rocks. The chemicals in the waters have reacted with the minerals in the rock, causing the outer face of the block to loosen.
- Water has trickled down the natural joints in the rock, which are roughly rectangular. Chemical reactions have been fastest on the corners of the joints, leading to rounded (spheroidal) blocks being formed.
- The top of a lava flow was exposed to weathering under a hot, wet climate which caused iron-rich minerals to 'rust'. Another lava flow later covered the weathered one.
- Rainwater falling on a flat polished surface over a period of 50 years has dissolved the surface of the rock, leaving tiny channels and grooves.
- Over thousands of years, the acids in the rain have reacted with the calcite mineral which makes up the limestone – notably in the cracks in the rock, called joints. The dissolved products have been carried away in solution, resulting in deep grooves with a rectangular pattern.
- 'Rootlets' of lichens have found their way along the natural cleavage planes of the calcite mineral that makes up the rock. This opens up the rock to other weathering agencies.
- Water has repeatedly frozen and thawed in cracks in the rocks in the hillside above made of limestone. This has forced blocks to break away and fall down, to pile up as a scree slope. The process of falling is the start of **erosion** of the limestone, which is the next step after the weathering itself.

The back up

Title: Weathering - rocks breaking up and breaking down

Subtitle: Matching pictures and descriptions of weathered rocks with the processes of weathering that formed them

Topic: Studying the appearance of weathered rocks and understanding the processes which produce weathering.

Age range of pupils: 11 -18 years

Time needed to complete activity: 15 mins

Pupil learning outcomes: Pupils can:

- recognise the effects of different processes of weathering;
- appreciate that a range of processes may act together to break down rock material;
- know which weathering processes are mainly physical and which are chemical or biological;
- understand that weathering involves the physical break up and chemical break down of rock material, which normally precedes its removal by erosion;
- be encouraged to look at rocks and buildings around them for signs of weathering.

Context: Weathering occurs all around us, and in all climates. It affects construction materials as well as natural exposures of rocks. Weathering contributes to the concentration of economic resources, such as china clay and bauxite and is very important in the formation of soil. It probably plays a vital role in climate change as well.

Answers to the matching exercise.

Photo	Description	Weathering processes
1	sharp fragments of limestone forming a sloping scree beneath a rock face above	Water has repeatedly frozen and thawed in cracks in the rocks in the hillside above made of limestone. This has forced blocks to break away (mainly physical weathering), and to fall down, to pile up as a scree slope. The process of falling is the start of **erosion** of the limestone, which is the next step after the weathering itself
2	a block of sandstone, with the front surface flaking off, in the wall of an old building	Water trickling down the wall has met water that has risen up from the ground through the pore spaces in the rocks. The chemicals in the waters have reacted with the minerals in the rock, causing the outer face of the block to loosen (mainly chemical weathering).
3	a grave slab cut from pink and white gypsum, now with a rough, cracked surface	Rainwater falling on a flat polished surface over a period of 50 years has dissolved the surface of the rock, leaving tiny channels and grooves (mainly chemical weathering).
4	a creamy coloured, porous limestone block, with loose weathered material around it	The porous rock has soaked up rain water. This has then repeatedly frozen and thawed, forcing the rock to break up and the outer layers to flake off around it (mainly physical weathering).
5	rounded blocks of dark igneous rock with loose brown material around them	Water has trickled down the natural joints in the rock, which are roughly rectangular. Chemical reactions have been fastest on the corners of the joints, leading to rounded (spheroidal) blocks being formed (mainly chemical weathering).
6	6a - yellow lichens on a gatepost, with 6b – a view down a microscope showing the lichen's 'rootlets'	'Rootlets' of lichens have found their way along the natural cleavage planes of the calcite mineral that makes up the rock. This opens up the rock to other weathering agencies. (i.e. this is biological weathering, accompanied by physical and chemical weathering').
7	a level surface of grey limestone with deep gullies crossing it in a rectangular pattern	Over thousands of years, the acids in the rain have reacted with the calcite mineral which makes up the limestone – notably in the cracks in the rock, called joints. The dissolved products have been carried away in solution, resulting in deep grooves with a rectangular pattern (mainly chemical weathering).
8	a large boulder with a tree growing out of a joint in it	Tree roots have expanded as they have grown in a natural crack in the rock, forcing the solid rock apart (i.e. biological weathering, accompanied by physical and chemical weathering).
9	speckled dark grey and white lava flows, with a red-brown band between them	The top of a lava flow was exposed to weathering under a hot, wet climate which has caused iron-rich minerals to 'rust' (mainly chemical weathering). Another lava flow later covered the weathered one.

Following up the activity:
Try asking your pupils to conduct a survey of the outside of their own school building or home, to look for evidence of weathering. This is not

confined to natural rocks but also occurs in bricks, concrete blocks, etc. Graveyards and tombstones provide much scope for investigations into weathering. There may be many different types of rock used, all of them conveniently dated! Investigations can include the effect of the aspect of the stone (e.g. west facing), whether it is vertical or lying flat, etc.

Underlying principles:

- Weathering is the decay and disintegration of rock *in situ* at the Earth's surface, without the removal of solid rock fragments.
- Material carried away in solution is regarded as an aspect of weathering, rather than erosion.
- Weathering processes are often grouped into three:-
  physical weathering (the effects of freeze/thaw action; alternating heat and cold, or wetting and drying etc):
  chemical weathering (e.g. oxidation; the dissolving of soluble minerals like gypsum in rainwater; carbonation-solution of limestones by the action of natural acids derived from the atmosphere, from plants and from soil etc);
  biological weathering (e.g. the action of plants and animals, mostly allowing the other processes more access to the rock mass – so biological agents have physical and chemical effects).
- These weathering processes usually act together, and are only separated as a matter of convenience.
- The action of microbes in weathering e.g. in soil formation, has been recognised as of great importance. Some think that microbes are involved in the 'growth' of gold nuggets from tiny particles of gold.
- Weathering rates are probably linked to global climate change.

Thinking skill development:
Pupils establish a pattern from their examination of the photographs and move on to bridging, with reference to their own locality.

Resource list:

- large copies of the photographs on page 1and 2
- copies of the descriptions of the photographs and of the weathering processes. These could be printed onto card and cut out for pupils to arrange in order.

Useful links: Try the Earthlearningidea activities: 'Darwin's problem', on the development of soil from weathered rock; also 'Rock, rattle and roll', dealing with erosion of rock fragments after they have been loosened by weathering.

Source: This activity was devised by Peter Kennett of the Earthlearningidea team.