Rock Detective: Sandstone Teacher Notes

Aim

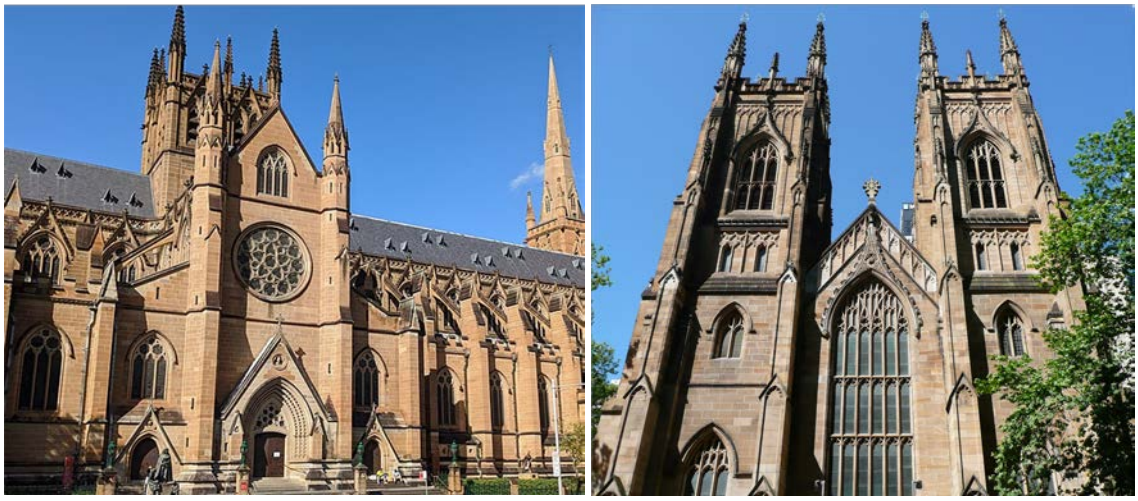
These activities encourage students to investigate real-world rock structures using scientific skills. Students become rock detectives in the suggested exercises and can extend their new skills to investigations of local geology or their favourite rocks.

Background

Have you ever noticed there is a lot of sandstone around Sydney? From beautiful sandstone cliffs and headlands to the rock of choice for building stone among many of our oldest buildings.

The most distinctive and highly sought after sandstone of Sydney is known as 'yellow block'. This sandstone is grey when cut, but weathers to a yellow-brown colour because it contains an iron carbonate mineral called siderite. It was quarried in Pyrmont, Ultimo, the CBD, Paddington, Bondi and Maroubra. Yellow block sandstone can be seen in public buildings such as the Australian Museum, Sydney Central Railway Building, St Mary's Cathedral and many others.

More common quartz-rich sandstones (that lack siderite) are grey to white and remain this colour after quarrying. This sandstone is found on the Sydney Observatory, St Andrew's Cathedral and Fort Denison. This more common sandstone is quarried in many locations around Sydney.



St Mary's Cathedral (left) is built of yellow block sandstone. St Andrew's Cathedral (right) is built of quartz-rich sandstone. (St Mary's by MDRX 2020, St Andrews by Hermione9753 2010, Creative Commons)

The activities and experiments below focus on weathering and erosion for Year 4. They can be completed in the school classroom or during a visit to one of many sandstone outcrops anywhere in the Sydney region.

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Possible fieldwork

There are many sandstone outcrops in Sydney and almost all outcropping rocks within the greater Sydney region are sandstone. Classes can visit some excellent outcrops at any of Sydney's beaches, along the harbour at locations like Taronga Zoo, the Botanic Gardens and Mrs Macquarie's Point, The Gap, and all other harbour and coastal headlands. There are also excellent exposures at cliffs and road cuttings away from the coast, with notable examples at Hickson Road in The Rocks. The Blue Mountains are predominantly sandstone, as are all other hills and escarpments around Sydney, including in Ku-ring-gai Chase and Royal National Parks.

Activity 1 – Class discussion about rocks

Find out what students know about rocks. You may have a junior expert who can share their enthusiasm with classmates. You might like to run a show and tell activity. Suggested questions:

- Do students have a collection of rocks and/or crystals at home?
- What rocks are near school or home?
- Do students know the names of different rock types and/or how they form?
- Has anyone seen interesting rocks on holidays?

Activity 2 – Rounding Rocks

Students explore the process of physical weathering using gravel and chalk pieces. See the AusEarthEd Rounding Rocks video for instructions.

Materials:

2 jars with lids | Water | Fine and coarse gravel | Chalk pieces

Method

1. Roughly chop or break chalk into pieces
2. Fill each jar approximately ¾ full of water
3. Add fine gravel to one jar and coarse gravel to the other
4. Reserve a few chalk pieces for comparison
5. Add chalk to each jar
6. Shake each jar for 1 minute
7. Drain the water and separate the gravel and chalk
8. Return half of the chalk and gravel to the jar and fill with water again (save the other half for comparison)
9. Shake each jar for 1 minute
10. Drain the water and separate the gravel and chalk
11. Lay out the original, 1 minute and 2 minute products for comparison

Discussion

- What were the variables (things we changed) in this experiment?
- What did we keep the same to make a fair test?
- How does shaking with water and gravel affect the shape of the chalk?

- Does longer shaking have a greater effect?
- Does the size of the gravel affect the final shape?

Alternative activities – This WASP experiment models the effect of transport on sediments using plasticine, but you can also try this with rock (be sure to use a tough plastic jar and not a glass one!). Discuss as for the experiment above.

Activity 3 – The rock mystery: sandstone weathering

1. Watch Rock Detective videos about the sandstone in Sydney
    a. *Where are we?*
    b. *Sandstone: A rock made of sand??*
    c. *Sandstone: Why is this rock special?*
    d. *Sandstone: Making caves and habitats*
    e. *Sandstone: For the keen geologists* (optional)

Activity 4 – Physical weathering

Students explore the process of physical weathering using sandstone. See the PALMS Physical Weathering video for instructions.

Materials:

2 plastic cups Water Marking pen Sandstone pieces Freezer

Method 1: Expanding water

1. Fill each cup approximately 2/3 full of water
2. Mark the level of the water in each cup and write *Start* next to this
3. Place one cup in a freezer overnight; leave the other on a counter overnight
4. Mark the level of the water in each cup the next day.

Method 2: Freezing rock

1. Place a piece of sandstone in each cup
2. Label the cups *Freezer* and *Room*
3. Fill both cups 3/4 full of water
4. Place the Freezer cup in a freezer overnight; leave the Room cup on a counter overnight
5. Thaw the frozen water before examining the rock in each cup

Discussion

- What were the variables (things we changed) in this experiment?
- Why was one cup left on the counter for each experiment?
- How does the expanding water experiment help you to understand sandstone weathering?
- In the Rock Detective video *Making caves and habitats*, the geologist explains how salt

expands in the rock and causes it to weaken. In light of the experiment freezing rocks and this information about salt, where would you expect to see the quickest weathering of sandstone?

Activity 5 – Ripples and storms

Watch the *Sandstone: Why is this rock special?* video.
Students use the Worksheet to mark horizontal lines and diagonal lines. (Option – measure the angle of the diagonal lines). Use a colour to mark where the tops of diagonal lines are cut off by a horizontal line.

The diagonal lines in the sandstone are the edges of ripples that were in the sand when it was first dropped out of water. When there is a storm with big waves, it washes away the tops of the ripples and makes a flat line. By marking the places where the horizontal lines cut off the diagonals, students are figuring out when there were storms in the time of the dinosaurs!

Additional activities

Explore the erosive forces of wind and water in this PALMS activity.
You can learn more about weathering in this AusEarthEd blog post.
Explore the role of water and wind in erosion.

References:

Franklin B (2000). Stone: the role of petrography in the selection of sandstone for repair. NSW Heritage Office. Accessed from: https://www.environment.nsw.gov.au/resources/heritagebranch/heritage/franklin.pdf

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