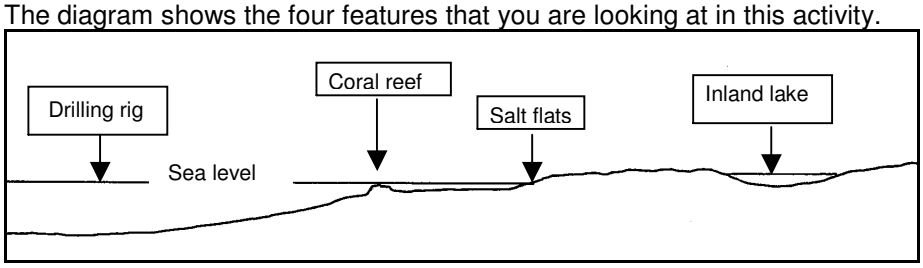
Environmental detective

Imagining how the evidence of modern environments could become preserved

The diagram shows the four features that you are looking at in this activity.



- Imagine you are standing on the edge of a lake in a hot dry country. It is the only fresh water for miles around. Footprints in the mud show where animals have come down to drink.
- Now imagine that you have walked to the sea shore of that hot dry country. It is very flat and the water's edge is hundreds of metres away. You are surrounded by dried up mud flats, glistening with white salt crystals where salt water has evaporated in the sun.
- Looking out to sea you can spot a boat with people diving from it. You can read the name of the owners, "EXPLORING CORAL REEFS PLC".
- Further out to sea, you can <u>just</u> pick out a drilling rig, drilling a borehole on the sea floor in the search for oil. Imagine that a helicopter from the rig lands beside you and that you can talk to the rig's engineer. He tells you that the rig is in deep water and that its long legs are resting on dark grey mud on the sea floor.

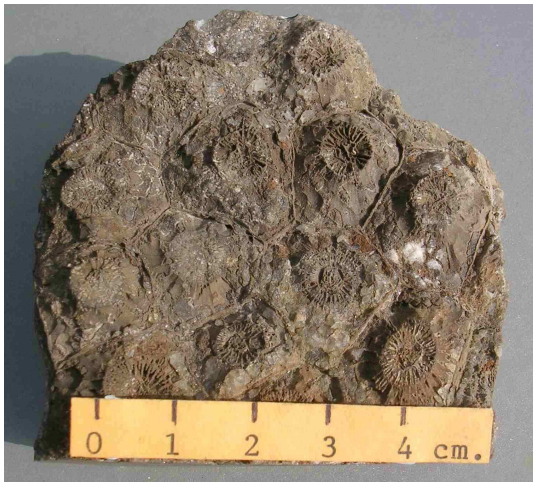
In your imagination, you have been looking at four different modern environments. All four of these existed millions of years ago, too (although there were no humans to see them then!).
In each environment, the sediments that were being deposited contain clues to that environment. This evidence may be preserved when the loose sediments are turned into rock.
So, we could expect to find:

- fossil footprints in mudstones from a former lake shore.
- fossil corals in limestones where a reef had been.
- marine fossils in mudstones from deeper water.
- preserved salt flats. In salt flats, it is possible for layers of salt to be preserved. However, if the sea level had risen slightly, the salt crystals could have dissolved leaving salt-crystal-sized hollow shapes. Mud could then settle out in the hollows and as it hardened, the mud would take the shape of the original salt crystals. Mudstones like these are often red in colour, because of the red desert dust that gets blown onto the sea shore in hot dry environments.

The photographs show rocks and fossils that have formed in one of each of the environments that you have been imagining. Match each photograph to the description of the environment and be ready to tell your teacher how you have done it.

Photograph 1

Photograph 2 - a plaster cast of the rock surface



Photograph 3

Photograph 4 (*All photographs are by Peter Kennett*)

The back up

Title: Environmental detective

Subtitle: Imagining how the evidence of modern environments could become preserved

Topic: An imaginative exercise in thinking about where different environments might occur on a tropical desert coast and how the evidence might become preserved in a sequence of rocks.

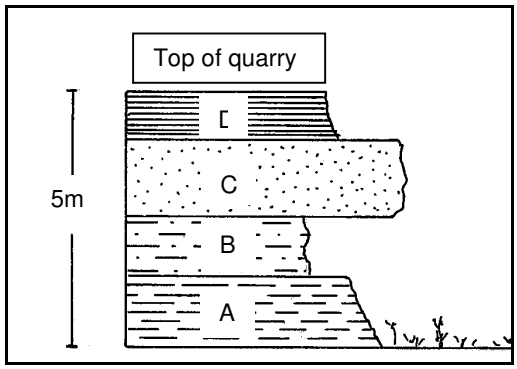
Age range of pupils: 11-18 years

Time needed to complete activity: 20 mins

Pupil learning outcomes: Pupils can:
- use their imagination to visualise what may be going on seen and unseen in a coastal desert environment;
- relate modern processes to the record of rocks and fossils.
- Able pupils may realise that a modern lateral sequence of environments may become preserved in a vertical succession.

Context: Answers to the questions asked during this activity are:
- Photograph 1 matches the deeper sea with grey mud, shown by the drilling rig. The fossil is an ammonite – an extinct relative of *Nautilus,* which only lives in marine conditions.
- Photograph 2 matches the inland lake shore, with the footprints of *Chierotherium,* a fossil reptile. The big print is of the back foot; the small print is the front foot.
- Photograph 3 matches the coral reef, with a colonial coral fossil preserved in limestone. (colonial – formed by lots of coral polyps growing together)
- Photograph 4 matches the salt flats, with the shapes of salt crystals preserved in red mudstone.

Following up the activity:
Imagining the vertical - Able pupils could be asked to visualise what might happen if the sea level were to rise gradually, so that the four different environments migrated slowly inland. This would produce a vertical succession in the resultant deposits, which would reflect the lateral succession that pupils have been asked to imagine. Explain this to the pupils and then ask them to carry out the following exercise:



The diagram shows a sequence of rocks in a modern quarry, one on top of the other. Match each photograph to the correct part of the quarry, so that the rocks and fossils tell the same story as in the first part of this activity (i.e. when you were imagining yourself in the hot dry country).
Answers: A = Photo 2; B = Photo 4; C = Photo 3; D = Photo 1.

A different horizontal sequence - You could prepare a similar activity yourself. Use any sedimentary rocks containing environmental clues and ask the class to work out what the palaeogeography (ancient geography) might have been like.

Underlying principles:
- 'The present is the key to the past' (Lyell's Principle)
- 'Sediments deposited in a lateral sequence may become preserved in a vertical succession' (Walther's Principle)

Thinking skill development:
- Pupils establish a pattern that characteristic sediments and fossils may be allocated to particular environments.
- Metacognition is involved in predicting the outcome of gradually changing environments.

Resource list:
- Print-outs of the sheets with the activity

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