Creating Science – Sedimentary Sculptures

How do rocks grow? How do we know about the history of the earth and what once lived here?

#CreatingScienceSedimentarySculptures

Suggested Outcomes

(NOTE: This is by no means an exhaustive list of possible outcomes, neither is it intended that ONLY these outcomes can or should be met. Science is a deeply interrelated activity, and you may find cross curriculum links you can and should use.)

Science understanding

- Earth and space science 4: Earth's surface changes over time as a result of natural processes and human activity (ACSSU075)
- Earth and space science 8: Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales.

Science inquiry skills

- Processing and analysing data and information 4:Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS068)
- Communicating 4: Represent and communicate observations, ideas and findings using formal and informal representations (ACSIS071)

Science as a human endeavour

- Nature and development of science 4: Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE134)

Cross curricular outcomes

Visual arts: Years 5 and 6 Content:

- Develop and apply techniques and processes when making their artworks (ACAVAM115)
- Plan the display of artworks to enhance their meaning for an audience (ACAVAM116)

Science vocabulary words

Tier 1 (Everyday words) Rock, sand, rain.

Tier 3 (Specialised vocabulary)

- Sediment – materials that settle to the bottom of a liquid, the 'dregs'.
- Sedimentary – a rock that has formed out of sediments.

Warning

- This activity involves going outside to dig a hole in the ground. Remember to prepare learners, and to choose a spot carefully, and to refill the hole carefully afterwards.
- Sand gets in eyes, BE CAREFUL!

Preparation

- Choose an appropriate piece of ground to dig down in. it doesn't have to be too deep, just 30 centimetres or so, to illustrate that the ground comes in layers. A garden can often work well. If you like, you can water the garden beforehand – thus it will be seen that the water does not go all the way into the ground.

Suggestions for other year levels

As always, more material is presented here than can be used by the average class during the average lesson time. However, since the students' questions can and should guide student learning, more material is presented for your convenience. Remember, it is not uncommon for students to only remember those points which answered their personal questions.

Younger:

This activity is not suited to this age group. Children at this age can have difficulty with focus. Avoid tangents if you're attempting to make a key point.

Middle:

This activity is well suited to this age group.

Teen:

This activity in itself is not expected to challenge this age group. You may want to help them research various sedimentary rocks and rank them by hardness, or challenge them to find such rocks online or in their own local environment. They might like to find out what various sedimentary rocks can turn in to, for instance, we're not 100% certain how plants and dinosaurs turned into fossil fuels – can they propose a theory?

Learning Intent (student friendly)

'We are learning to' (WALT) – understand, examine, build and display sedimentary rocks.

Success criteria

'What I'm looking for' (WILF) – a great Sedimentary Sculpture and clear explanation.

Student learning goals

Help students make a self-monitored learning goal for this lesson, such as to find out how some rocks or made, or learn how we know dinosaurs once existed.

Evidence of learning

How will you know when the learning goal is achieved?

- Students are able to present and explain their sculpture, perhaps using diagrams, a slideshow, or video presentation.

Engage

Bring along some interesting rocks for students to explore and discuss. Discuss what they already know, and write down any questions they may have.

Ask: how do you think rocks are formed? (And if they know that science classes all rocks into three general categories). Congratulate them and ask what they think it mean?)

Explore

Explain that scientists generally group rocks into three main categories, Igneous, Metamorphic and Sedimentary. Today we are going to learn about sedimentary rocks.

(In all my studies, I was unable to locate who came up with this threefold classification scheme, but it is prolific in the literature. Perhaps, like many old and effective ideas, it grew in the scientific community over time, and we're not exactly sure who to give the credit to – just like the idea of air pressure).

With a shovel, take the class outside and choose an appropriate piece of ground.

- Ask: what do you think is on the ground right at this spot?
- Ask: what do you think is underneath this spot?

Keep digging, removing layers, you may find:

- Soil – full of living things, like bacteria or the roots of plants. Chemicals necessary for maintaining life on earth can be found here. You may notice that it tends to get harder and drier the further down you go (in Australia, at least).

- Gravel – small, hard stones. These are often placed by people to support the soil.
- Bedrock – Solid stone, very difficult to cut through.

Ask students why they think there are different layers in the soil.

Explain that the earth's surface is gradually changing, usually in ways we cannot see. One way that it's changing is that the soil tends to get thicker. Plants drop leaves which become soil, tiny dust floats in from space, a flood or volcano might deposit a huge layer of silt or stone, and so on. Much of the earth's soil is getting thicker all the time (but usually very, very slowly).

- Ask: what do you suppose might happen over millions of millions of years[1]?

Explain

Explain – over time the earth builds up layers, and it is believed that we can find out about the past by digging down and into those layers. For example:

- Around the 66 million years mark there is a short, worldwide layer of sediment. Above that line there are no (non-avian) dinosaur fossils, and below there are. Scientists interpret this as indicating there was some form of global catastrophe that wiped most large lifeforms, out – a meteorite and/or volcanic eruptions. It is called the K-T event.

Sedimentary rocks and layers are formed when new and different earth piles on top of old layers. Over time these can become incredibly thick – kilometres, even – which compresses the lower layers and, over millions of years with heat and pressure, changes them.

Instruct the students that today we are going to make our own sedimentary layers.

[1] The atmosphere is always above the ground, so while the earth gets larger the ground does not end up poking into space – just in case anyone was wondering. The atmosphere, including wind and rain, also wears down the ground so that it tends not to pile up too high.

Activity: Sedimentary sculptures

Try out the attached student sheet "Activity – sedimentary layers." Each coloured layer can represent an historical stage the Earth went though. You might like to take the chance to share the 'sedimentary story' below.

- Red - Earth is made up of many layers. When it comes to the crust of the earth, the deepest layer is the magma layer. Here the liquid magma flows underneath the earth, about 10 kilometres down. Its slow flowing is what pushes the tectonic plates around, causing earthquakes and volcanoes.
- Brown – as we get higher in the earth's crust, the temperature begins to cool. The rocks go from being liquid like water, too thick like honey/syrup/treacle, to solid. These rocks, born from fire, form the bedrock on which everything else can gather.
- Black – over time, layers tend to accumulate. The first and thickest layer had no life in it at all, but represents the earth in its early formation.
- Yellow – by far the longest life that has ever been on earth would be the microbes, comprising over 4/5^{ths} of the history of life on earth! Life began with simple cells, then complex cells, then eventually multicellular life clinging together for mutual support.
- White - The world changes all the time. The South Pole once had forests, and the forests may have once been deserts. It's quite possible that an area that was once a salt water lake can dry up and become something else. But the salt rich layer might still remain. 100 million years ago this happened in Australia, and the salt layer can still be found lying around in places of central Australia.
- Green – From around 700 to about 66 million years ago, plant life thrived. Higher oxygen allowed larger lifeforms, such as dinosaurs. All life from this time has been pressed down and changed, and some theorists believe that the plants and animals of the time may be the coal and oil we dig up today.
- Maroon – as dirt is blown in from other areas, falls down from outer space, or is brought by floods and other natural means, different layers are formed, pressing down on the layers below.
- Grey - The bottom of the ocean has a layer of dead matter.
- Blue – the surface of the earth, which is 75% water, still only makes up a very small part of the earth's crust OR Dark Green - the top of the crust contains over 99% of the life on earth in only a few meters!

Elaborate

The surface of the earth is changing all the time, but usually that change is very, very slow. So slow that we cannot even notice it - some changes might take even more than our lifetime!

- Australia is drifting north about 1.3 centimetres every year. In your entire lifetime of around 80 years your home will have moved around 3 meters from where it started (when compared with the centre of the earth). That's about as long as your fingernails will grow in the same amount of time.

You can expand the activity by inviting students to add little paper 'fossils', stick a wire 'drill' into the sand to represent oil drilling, or push down the sand in artistic patterns. (Notice how the further down you push, the harder it is to push down. This is an excellent representation of how the pressure and hardness of the stones typically increases the further down we drill.)

Extra activities

If time permits, you can try out the following recipes to represent the three kinds of stone.

Points to make:

- Most rocks start out as igneous rocks.
- Magma is different from lava for several reasons. 1/ Magma is inside the earth, and it becomes lava once it gets out. 2/ Once it gets out, much of the gas inside the magma can escape, making it chemically different to lava as well.
- Metamorphic rocks are formed when igneous or sedimentary rocks are changed by heat, pressure and time.

Recipes: cooking up a rock (see appendix)

- Sedimentary rocks – coconut slice, rocky road.
- Igneous rocks – boiled lollies, marshmallows.
- Metamorphic rocks – cakes, cookies.

Or try the amazing recipes from "Science Rocks" page over (Reference: Queensland resources council (2005), Science rocks. ISBN 0 957870140)

Evaluate

Have students provide a self-evaluation of the scientific principles, and the artistic merits, of their 'sedimentary layers'.

Success criteria

⇨ Review the Learning Intentions of this lesson with students. Was it met?

At the end of each class, review the learning objective to see how we did. Ask:

⇨ Did you achieve your learning goal?
⇨ What did You learn?

Assessment

Prior learning

Find out what students already know about rocks. Bring some into explore, and help them share their ideas and ask questions.

Write up a KWL = three large pieces of paper that all students can write on (or use sticky notes) to during the exploration to write down;

- What they **know** about rocks.
- What they **want** to know about rocks.
- What they have **learnt** about rocks.

Formative

As students develop their models, perhaps during the planning phase, ask them what each layer means, and help them choose a personally representative colour to express that meaning.

Summative

Help students consider ways they can communicate their new understanding to others, just as scientists need to do. Have them display their work and explain it, for example, using an online presentation, poster, or slideshow presentation.

So what?

- The earth, at least the immediate area, is made of layers.
- The further down you go, the older the layers are (typically).
- Digging down and making sense of what is down there can teach us about the past.

Creating science

Science understanding

As we learned how sedimentary rocks form, and what they can teach us about the history of the earth, we saw that;

- Earth and space science 4: Earth's surface changes over time as a result of natural processes and human activity (ACSSU075)
- Earth and space science 8: Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales.

Science inquiry skills

As we built sedimentary sculptures and used them to display our scientific knowledge, we learnt that;

- Processing and analysing data and information 4:Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS068)
- Communicating 4: Represent and communicate observations, ideas and findings using formal and informal representations (ACSIS071)

Science as a human endeavour

As we use the modern classification scheme to identify rocks and understand the history of the earth, we learnt that;

- Nature and development of science 4: Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE134)

Cross curricular outcomes

As we made some beautiful sedimentary sculptures, and prepared them for presentation to an audience, we had the chance to:

Visual arts: Years 5 and 6 Content:

- Develop and apply techniques and processes when making their artworks (ACAVAM115)
- Plan the display of artworks to enhance their meaning for an audience (ACAVAM116)

Appendix- Rock Recipes

Metamorphic munchies

Purpose

To demonstrate how metamorphic rocks are formed.

Ingredients

- 4 cups flour
- 2 teaspoons baking powder
- 1/2 teaspoon salt
- 2 cups sugar
- 4 eggs
- 3/4 cup oil
- 1 teaspoon vanilla

Procedure

1. Mix flour, baking powder and salt together in a mixing bowl.
2. Beat the eggs in a large bowl and add sugar, oil and vanilla.
3. Add the flour mixture, a little at a time, to the egg mixture. It will get very stiff.
4. Empty the mixture onto a floured surface. Shape the dough into six balls.
5. Grease two baking trays or line with oven paper.
6. Roll each ball into a 'snake' as long as the baking trays and lay three snakes on each tray. Flatten them with your fingers.
7. Bake at 180°C for 25 minutes. Remove from oven and let them cool.
8. Cut the long biscuits in diagonal slices so that there is one for everyone. Cut each of these in half and give one to each person.
9. Place the remaining halves back on the baking tray and bake for an additional 10 minutes.
10. Let these biscuits cool before giving one to each person.

Source: http://www.bbc.co.uk/education/rocks/ primer.shtml

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Resource 9 Rocky recipes

Igneous rock lollies

Purpose

To demonstrate how igneous rocks are formed.

Ingredients

- 1 cup sugar
- 1/2 cup liquid glucose
- 1/2 cup water
- 1 tablespoon butter
- 1 teaspoon bicarbonate of soda

Procedure

1. Put sugar, liquid glucose, water and butter in a heavy pan.
2. Heat gently until dissolved and then boil for about 6 minutes, until it all turns light golden brown.
3. Pour half into a cold oiled baking tray and watch it flow and set like lava.
4. Into the remaining half, add a teaspoonful of bicarbonate of soda. This releases carbon dioxide into the mixture in lots of little bubbles—you will need to pour it in a tin quickly before it sets. This is like pumice.
5. Both can be broken with a hammer when set, forming the similar patterns of cracks you find in rocks after earthquakes.

Source: http://www.bbc.co.uk/education/rocks/ primer.shtml

Sedimentary slice

Purpose

To understand how sedimentary rocks are formed.

Ingredients

- 125 g butter
- 1 1/2 cups wafer crumbs
- 400 ml tin of condensed milk
- 1 cup choc chips
- 1 1/4 cups coconut
- 1 cup chopped nuts

Procedure

1. Melt the butter and pour into a greased clear rectangular cake/loaf pan.
2. Crush wafer biscuits and sprinkle the crumbs over the butter.
3. Pour the condensed milk evenly over the crumbs.
4. Layer the nuts then the choc chips evenly and press down gently.
5. Bake at 180° for 20–25 minutes.
6. Cool, cut into bars and serve.

Source: Moore, J E 1998, *Geology*, Science Works for Kids, Evan-Moor Corp., Monterey CA USA.

(Reference: Queensland resources council (2005), Science rocks. ISBN 0 957870140)

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