How Snowy 2.0 unearthed an ancient mystery

Core sampling practical activity - Teacher guide

Background

Year Levels: 5-10
Group Size: groups of 2 are ideal for space and collaboration. 2-3 students
Duration: 30-40 minutes

In this activity, students work in small groups to simulate geological layers and hidden deposits like the coral reef found when digging tunnels for Snowy 2.0. Each group builds a "geological site" by layering soil or sand in a container and embedding playdough coral reefs and other features. Groups then swap containers and investigate each other's site using their strategies of a core sampling technique to try to locate all the deposits, just like geotechnical engineers exploring below the surface.
Students are encouraged to reflect on how accurate core sampling is, how to make this more accurate and the limitations of trying to fully understand what is below the Earth's surface.

Lab tech/teacher set up

Materials per group

- 1 container (e.g. shoebox, ice cream tub, takeaway containers or plastic storage container)
  - This should be labelled with grid coordinates prior to being provided to students. **See the core sampling maps (document 2a) to assist in labelling.**
  - Use masking tape and a marker to create coordinates on the edge of containers.
- Clean damp sand, soil, or a mix (~1.5–2kg)
  - Damp sand or soil works best so that it clumps when the core samples are taken. It may be harder to spread, but if students "pack down" after each layer, this will help.
  - You may like to have a spray bottle on hand to re-wet the sand or soil throughout the activity.
- Playdough - enough to create deposits that are between 15-20% of the area of the container being used.
  - Playdough works better than plasticine as it is soft enough for straws to go through
- Clear 5mm diameter straws. Provide one per group that will be reused up to 10 times.
  - We recommend 6mm plastic/clear vinyl tubing that can be purchased from a hardware store and cut into 20cm lengths.
- Printed deposit placement map (choose from 5 options from document 2b).
  - Delete rows 5 if your containers divide into 4×4 instead of 4×5
- Core sampling grid (document 2c) and pencils for mapping core samples.
- Student instructions (document 2c).
- **Optional:** lead pencil to help extract cores
- **Optional for the teacher**: spray bottle/water jug with water to moisten sand layers for students.

Preparation before the lesson

- Add a base layer of sand or soil (~2 cm) to each container ahead of time. This will help to show students the depths of layers they should create.
- Label the top of a container to help students orient the container.
- Have a full water spray bottle on hand for wetting sand during the practical.
- Apply masking tape along the top edge and left hand side edge of each container.
- Add lines to the masking tape to create the grid (4×5, 4×4, 2×4 depending on your container sizes),
- Label coordinates (e.g. A–D across top and 1–5 down side) as in the deposit maps and core sampling maps at the end of this guide.
    - Note that the deposit maps often leave row 5 blank to allow you to adjust for square containers.

Logistics tips:

- It will make the activity easier and run more smoothly if you set up the stations where students will create the deposits.
- If possible, creating an example of the play-doh reefs will look like as a reference to show beforehand can make this activity quicker.
- For part 1, have the students move to the set up stations with **only** the materials required for part 1.
    - Distribute only Part 1 on page 1 of the student instructions
    - **Ensure that you do not tell students they are doing a second part as this maintains the authenticity of finding unknown reef deposits.**
- For part 2, when swapping groups, move the students to another group's preparation bench rather than moving the containers.
    - Pass out the materials for part 2 at this time.
    - Distribute the student instructions for Part 2 on page 2 of the student instructions
- Taking the core samples works best with finer sand or soil. To make the soil layers even more compact for easy extraction in part 2, after students have completed part 1, spray a small amount of water onto the containers and encourage students to pack down further.

The practical activity

Part 1: Building an underground landscape

Mark the container

- Each group should go to their assigned bench with a base layer and labelled coordinates prepared on their container.
- Students label their container and the back of their printed map with group names.
- Groups should keep their maps separate from the container to be revealed later.

Create the deposits

- Each group selects one of five pre-designed deposit maps.
- The map shows a top-down (2D) view of where deposits should be placed. *Remind students that the map is 2D, but the model is 3D. Deposits can be placed at any depth, and must not be able to be viewed from the top.*
- Groups create the four deposits using different coloured playdough that are on their provided map. There should be: one large, two medium, one small in each template map. ***If you would like to give your students more of a challenge, they can create their own deposits in any shape they like, as long as they are ~20% of the area. Students will then need to create their own maps of the initial deposits to be compared to later. Use the blank template provided to do this.*
- Shapes (e.g. crescent, donut, semicircle, blob) should match their provided map in relative size and position, but exact accuracy is not required - close is good enough!

Add your deposits within the Earth's layers

Groups build up their geological column like this:

1. Place 1 or 2 deposits directly onto the base layer according to the map.
2. Add a layer of soil (~1.5–2 cm) to cover those deposits.
3. Pat down the sand or soil layer so that it is quite compact. Remember, we're making rocks!
4. Place the next or remaining deposits on top of that layer
5. Finish with a topsoil layer (~2 cm) to conceal everything.
6. Pat down the final layer to make it firm.
7. The full column should have at least 3 distinct layers, and deposits must be completely hidden.

Get ready to swap

- Students ensure their container and map are labelled with group names.
- Maps are kept separate from containers - maybe put them in the cover of your science book for safe keeping until the end of the lesson.
- Optional: Cover the container with a lid or paper to prevent early peeking.
- Containers are now ready to have students rotate/swap.

Part 2: Core sampling stage

Swap and Plan sampling strategy

- Groups swap containers with another group by moving to another group's bench.
- They become the exploration team, using core sampling to locate hidden deposits.
- The rules for core sampling:
    - You will start with 5 core samples
    - For each deposit you find, you'll earn 1 extra core sample that your team can choose to place anywhere.
    - Your aim is to create a map of the deposits that is as close to the true deposits as possible.

Allow for Strategy Planning (2 minutes):

- For **Years 7 - 9**, allow students to decide their approach.
- For **Years 5 - 6**, offer them the choice to:
    - Plan all 5 core sites before starting, or
    - Sample one at a time and adjust their plan based on findings.

Encourage students to think about:

- Spacing vs clustering
- Likely deposit locations
- Whether their plan changes after each core

How to core sample

- To core sample, push a straw vertically into a chosen grid square.
- Remove and inspect the straw to look for playdough or different soil types.
- Record each result on their group's mapping sheet.
    - If you did not find a deposit, record your core location with an X on your map.
    - If you did find a deposit, mark it on your map by shading with coloured pencil, but be careful to only mark where you *know* the deposit is.
- Keep tracking how many deposits are found, and use bonus cores accordingly.

Map the underground landscape

After you've taken all your core samples:

1. Use a different coloured pencil to shade in where you think the rest of the deposits are.
    - Try to match their shape, size, and position as best you can.
    - You might not know what shape the deposits actually are, but from your core sampling, make an estimate.
2. Use the coordinate grid to help you be as accurate as you can.
3. Your drawing should be a top-down (aerial) view, just like the deposit map.
4. When you're finished, your teacher will give you the original deposit map made by the other group.
5. Compare your map to the original group's deposit map. How close did you get?

Teacher Reflection Prompts

Use these questions to guide whole-class discussion:

- How many groups found something in at least 1, 2, 3, 4, or all 5 core samples?
    - You can ask for both the number of times that something was found as well as whether it was on the 1st, 2nd, 3rd etc... to talk about how their sampling method changed.
- How did you decide where to do your follow-up core(s)?
- If you had 10 core samples, would your strategy have changed?
- How accurate do you think your map is compared to the actual deposit layout