



Canadian Earth Science Teacher
Workshop Program

Bringing Earth Science to Life

Earth History

Geomorphology

Surface Processes

Soils

Rocks

Minerals

Tectonics

Using Natural Resources

Careers

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Modelling Rock Layers

Students simulate deformation of rock layers and study the resulting surface outcrop patterns.

Explanation

Earth scientists use the surface pattern of rocks to find out what the structure beneath the surface might be. This is important in the search for mineral and energy resources, and in the understanding of both groundwater flow and geological hazards.

Materials

Geological maps
Playdough or modelling clay in at least 3 colours
Thread
Paper
Coloured pencils

Cautions

None

Time

Short

Grouping

Individual, small groups, whole group

Preparation

Homemade playdough is very suitable for this activity and a sample recipe is provided below. Many variations are available online. Large batches can be made economically and will keep well stored in a refrigerator.

Prompt

Have students look at a selection of geological maps and the complex patterns found on them. Ask them to speculate as to possible causes of these patterns.

Delivery

Direct students to:



Modelling Rock Layers

1. Make a stack of 3 rock layers, each a different colour playdough and about 1 cm thick and 10 cm square.
2. Push on either edge of the stack to make it fold up in the middle.
3. Use the thread to cut across the top of the fold to simulate the effects of erosion. Do this on a slant or horizontally.
4. Sketch the pattern of rocks that appears on the surface.
5. Place a fourth layer of playdough on the eroded surface, and ask them to simulate another phase of erosion by slicing a slanted layer off the top.
6. Sketch the rock pattern that now appears on the surface.
7. Investigate other sequences of layers, folding and erosion. For example, make a river valley in the stack of playdough, or tilt the stack before eroding the top surface.

Question for Discussion

Return to the geological maps and ask the students if any of the surface rock patterns on the maps correlate to what they have discovered in their investigations.

Extension

Prepare a selection of surface outcrop patterns for the students to try to create using their rock layers.

Resources

Homemade Soft Playdough

Dry: 250 ml flour
125 ml salt
15 ml cream of tartar

Liquid: 250 ml water
15 ml vegetable oil
Colour (e.g. food colouring, paint, drink crystals)

Put dry ingredients in a saucepan. In another container, mix the liquids (colour blends better if done in two stages).

Over low heat, slowly add liquid to dry mixture, stirring all the time. It will be quite runny to start, like pancake batter.

As the heat spreads, the mixture will thicken into a paste. Keep stirring over the heat until it holds into one ball.

Remove from heat and transfer dough to a board, kneed gently to smooth.

Store in an airtight container or wrapped in cling film in the refrigerator.



Topographic Cross-Section

Students draw a cross-section diagram showing elevation changes along a straight line across a topographic map, allowing them to visualize landform features represented by contour lines.

Explanation

Topographic maps are used by a wide range of people, including Earth scientists, biologists, engineers and hikers. A topographic map uses contour lines to represent the shape and features of the Earth's surface on a flat surface. Contour lines connect places on the map that have the same elevation.

Materials

Topographic map
Pencil
Ruler
Paper
Scissors
Student Page

Cautions

None

Time

Short

Grouping

Individual, pairs

Preparation

Reproduce one map per student.

Prompt

Use a model house to show how different methods can represent a three-dimensional object on a flat surface: i.e. a sketch, a plan, a front or side view can all represent the house two-dimensionally. Explain that maps and cross-sections are ways of representing the three-dimensional surface of the Earth on a flat surface.



Topographic Cross-Section

Delivery

Hand out materials to each student. Students may need assistance with calculating the vertical scale and plotting values on an x-y graph.

Question for Discussion

Comparing the pattern of contours on the map to your cross-section diagram, describe the terrain in areas not covered by line A-B.

Extensions

Make three-dimensional models from a topographic map. Trace one contour layer at a time and cut the shapes out of foam board.

Make a model terrain using clay or foam board, then challenge students to make a topographic map of the terrain.

Create a large-scale terrain in class, for example with boxes and foam blocks draped with a plastic sheet. Students will use a simulated depth sounding method to make a topographic map of the terrain.



You are going to use the contour lines and elevations on a topographic map to recreate the landforms found in the region that the map is representing.

Materials

Topographic map
Pencil
Ruler
Paper
Scissors

Instructions

1. Draw a straight line, the same width as your piece of paper, across an area that interests you on your topographic map. Label one end of the line A and the other B.
2. Cut a rectangular strip of paper slightly longer than your A-B line.
3. Place the long edge of this paper along the length of the A-B line.
4. Using short ticks, mark on the edge of this paper every point where the A-B line crosses a contour line. Record the contour line elevation at each tick.
5. Draw a line across the bottom of a new piece of paper, the same length as the A-B line. This line is the x-axis.
6. Copy each elevation tick mark and value from the edge of your other piece of paper onto the x-axis.
7. Draw a y-axis vertically up from one end of the x-axis. Calculate a scale so that the bottom and top of the y-axis represent the minimum and maximum elevation values on the A-B line.
8. Above each tick mark along the x-axis, make a dot at its elevation according to the y-axis scale.
9. Join the dots



Landforms

Students match terms and definitions of landforms.

Explanation

The movement and action of ice over the past thousands of years has had a huge influence on shaping our present-day Canadian landscape.

Materials

Student Activity Page

Cautions

None

Time

Short

Grouping

Individual

Preparation

Reproduce one Student Page per person. This activity requires either prior knowledge of glacial landforms or reference materials for students to research the definitions.

Prompt

Use one of the demonstrations from the surface processes topic on glacial activity, e.g. how ice can crack open a piece of rock.

Delivery

Distribute a Student Page to each student and allow time for them to complete the challenge. Review the solution as a group.

Solution:

- 1 C
- 2 E
- 3 G
- 4 F



Landforms

5 I

6 H

7 B

8 A

9 D

Questions for Discussion

Could any of the definitions match more than one term?

What memory devices could help in remembering the terms?

Ask students to invent alternate names for the definitions.

Extensions

Have students make a drawing or model of the landforms.

Ask students to research additional landform definitions and devise their own matching challenges. Use the definitions as group quizzes and games.



Challenge: Match the terms about glaciers and landforms with the descriptions.

	Terms		Descriptions
1	Plucking	A	Material deposited directly by a glacier
2	Continental glacier	B	Rapid movement of a glacier
3	Drumlin	C	The process whereby a glacier loosens and lifts rocks into the ice
4	End moraine	D	Pulverized rock caused by a glacier's abrasion
5	Esker	E	Massive accumulations of ice that cover a large portion of a landmass
6	Kettle	F	Hilly ridge of material formed at the end of a valley glacier
7	Surge	G	An oval-shaped hill consisting of rock debris
8	Till	H	A depression left in part of a glacier formed by the melting of a block of ice
9	Rock flour	I	Ridges of sand and gravel deposited by flowing rivers of melted ice through a glacier

