Meagan Thompson found this lesson on-line and altered to meet our students needs.

Sugar Cube Karst

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Grade Level: K- 3

Subject(s): Science/Geology

Duration: 1 day

Description: Sinkholes, caves, and underground drainages, sometimes along with steep-sided pinnacles, are typical of the karst topography that forms in soluble rocklayers like limestone. In many part of the country, rivers or streams "disappear" into sinks, only to reappear again in springs downstream. Here's a very simple (and fairly simplistic) model of karst formations for younger kids.

Goal: The purpose of this activity is to explore the way water moves through a porous, soluble substance and to observe the development of pits and channels as the substance dissolves in water.

Objective(s): Student will learn:

1. what is karst?
2. how is karst formed.
3. what are pits and channels?

Teacher Background:
Karst is a type of topography that is formed over limestone, dolomite or gypsum by dissolution of the material, and is characterized by sinkholes, caves, karst towers, and underground drainage. The karst topography usually forms by the flow of groundwater though areas of these soluble rocks. This activity will illustrate the dissolution

Materials
(For each child)

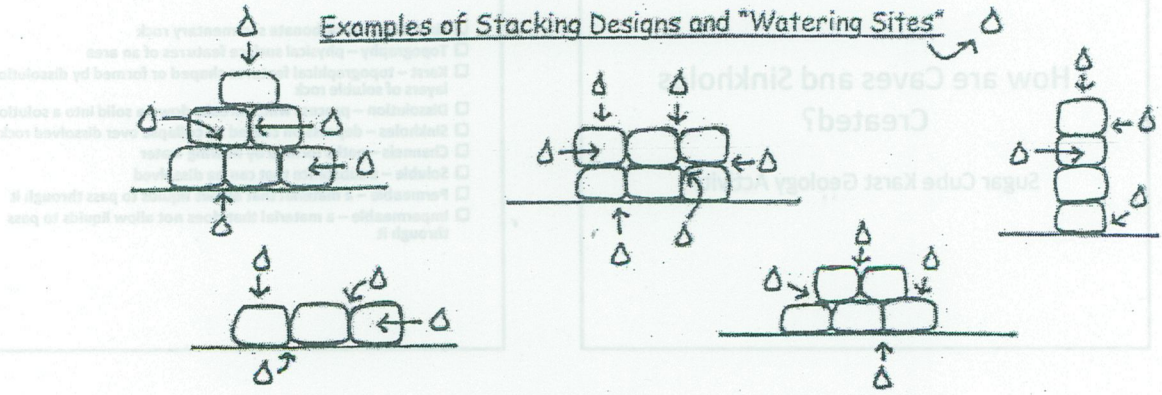
- ✓ A pile of sugar cubes (at least half a dozen)
- ✓ An eyedropper (thin straw will work in a pinch, so to speak)
- ✓ A small container of colored water (blue works well); you may wish to use sugar water to slow the dissolution process, but that does make the activity stickier
- ✓ A tray or other easily cleaned surface to work on

Procedure

Teacher note: Depending on what you wish to accomplish, this particular activity can require some pre-activity discussion of goals and expectations with the kids - otherwise you may end up with thirty little piles of blue sugar water on thirty little desks fifteen seconds into the activity.

1. Stack the sugar cubes on the tray.
2. Put a tiny bit of colored water on top of one of the cubes.
3. Observe where the water moves the cube and how the shapes of the cube change.
4. Add water at a crack between two cubes, a tiny bit at a time.
5. Observe where the water moves through the cubes and how the shapes of the cubes change.
6. Repeat steps 2 through 5 until you make a hole clear through or the sugar cubes collapse.

There are a zillion variations to this activity. You might want students to draw and/or take notes on their observations at each step. You may want to challenge students to form specific "karst" features (sinkholes, towers, caves, etc.) For more advanced students, you might want to add impermeable layers of clay (or another material) between some cubes or layers. You could have them glue together cubes into larger structures or shapes. The glue will stay behind in the shape they made. You might wish to assign different stacking and/or soaking patterns to different students or groups:



A couple of the many possible topics for follow-up discussion include:

1. A comparison of students' results (how do different stacking patterns affect the results? How do different "watering" sites affect dissolution?)
2. Links between the model and the real world (how do fractures in rock layers affect the formation of caves and other dissolution features? how are real rock layers different from the sugar cubes in the model? Where does the water that travels through rock layers come from? how is it different from the water in our model?)

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Powerpoint

How are Caves and Sinkholes Created?

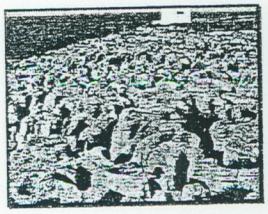
Sugar Cube Karst Geology Activity

Vocabulary

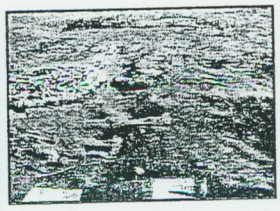
- Limestone – a carbonate sedimentary rock
- Topography – physical surface features of an area
- Karst – topographical features shaped or formed by dissolution of layers of soluble rock
- Dissolution – process which breaks down a solid into a solution
- Sinkholes – depression caused by collapse over dissolved rock
- Channels – paths formed by flowing water
- Soluble – a substance that can be dissolved
- Permeable – a material that allows liquids to pass through it
- Impermeable – a material that does not allow liquids to pass through it

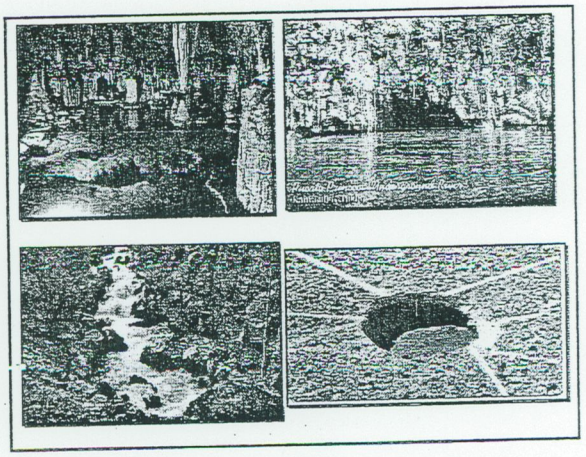
Karst Topography

Old, exposed limestone karst

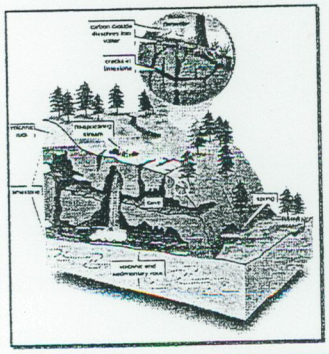


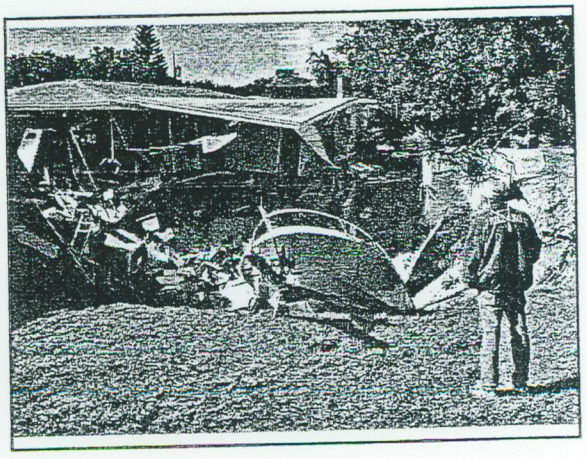
Young, buried limestone karst





What's going on?





This is the student sheet that goes with the lesson.

Sugar Cube Karst

Description: Sinkholes, caves, and underground rivers are typical of the *karst topography* that forms in *soluble* rock layers, like *limestone*. In many parts of the world, rivers or streams disappear into sinkholes at the surface and reappear later as downstream springs. This activity explores how dissolution creates karst features using sugar cubes and colored water.

Vocabulary:

Limestone – a sedimentary rock

Topography – physical or natural features of an area

Karst – topographical features shaped or formed by dissolution of layers of soluble rock

Dissolution – process in which solids are dissolved into a solution

Soluble – a substance that can be dissolved

Pits – holes in the ground

Channels – paths formed by flowing water

Permeable – a material that allows liquids to pass through it

Impermeable – a material that does not allow liquids to pass through it

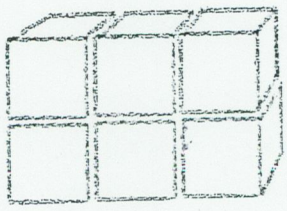
Materials

- Sturdy paper plates
- Sugar Cubes
- Water
- Droppers
- Clay
- Soil/sand

Creating Karst Features, Part 1

Instructions

1) Build a sugar cube rock unit using 6 sugar cubes, stacked as shown:



2) Using your dropper bottle, add water 1 drop at a time to the face of a sugar cube

3) Observe how the water moves and how the shape of the cube changes as you drop the water. Draw a picture:

4) Using your dropper bottle, add water 1 drop at a time to a crack between 2 sugar cubes

5) Observe how the water moves and how the shapes of the cubes change as you drop the water. Draw a picture:

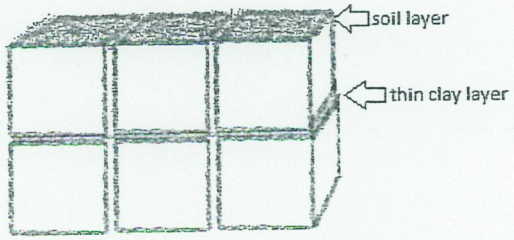
Questions to ponder: How is our model different from reality? How could we change the model to be a more accurate representation of rock units we might find in the real world?

Creating Karst Features, Part 2

Yesterday, we created a simple model of a limestone unit and observed how the unit changed as water was added to it. At the conclusion of our exercise, we talked about ways in which we could add complexity to the model so it would be a more accurate representation of the real world. Today, we will build models that include soil and impermeable layers. Based on your experience from yesterday, how do you think these new layers will affect the outcome of our experiment?

Instructions

1) Build a sugar cube rock unit like the one you built yesterday, except include a soil/sand layer and a clay impermeable layer as shown:



2) Using your dropper bottle, add water 1 drop at a time to any part of your rock unit.

3) Observe how the water moves and how the shape of the cube changes as you drop the water. Were there any differences between the simple model and the complex model?

4) Build another sugar cube rock unit like the one above. Place an object under one edge of the plate to create an inclined plane. Repeat the experiment. (Note: you might need to make a layer of clay under the sugar cubes so they don't slide away.) Did the features change? How?