1. Geology Rocks!
(1) Sinkhole in a Cup

Sinkholes *are formed by* ***groundwater*** *dissolving through layers of* ***gypsum*** *and* ***siltstone.*** *They help make Bottomless Lakes State Park truly unique. (Classroom / 30-45 minutes)*

Connecting with Science Standards			
Category/Strand	***Grade***	***Standard(s)***	***Benchmark(s)***
Earth & Space Science	4	Structure of earth/atmos.	Rock cycles
	5		Water & air relate to earth processes
Science & Society	4	Influences science/society	Pollutants
	5		Local & current issues

Goal: By creating simple models of sinkholes in the classroom before their fieldtrip, students will better understand how the lakes at Bottomless Lakes State Park were, and continue to be, formed.

Objective:

- Demonstrate how groundwater travels upward and dissolves **gypsum** and **siltstone** to form sinkholes.
- Observe how chemicals are absorbed into groundwater and pollute surface water.
- Understand how over-pumping groundwater affects sinkhole water levels.

Materials:

- 2-8 oz. Styrofoam or plastic cups per group
- a scouring pad or a thin sponge
- an empty 2-liter soda bottle
- sugar
- sand
- scissors
- empty paper towel or toilet paper tube
- empty plastic syringe
- food coloring

Background

The 'lakes' at Bottomless Lakes State Park are really steep-walled, water-filled sinkholes, known as ***cenotes*** in Spanish (se no' tes). Sinkholes are formed when groundwater dissolves rocks and minerals, creating underground **caverns**. Caverns may eventually become large enough that the ceiling above collapses.

You may be surprised to know that the water doesn't come from the nearby Pecos River but from water that traveled slowly underground from the Sacramento and Capitan Mountains sixty miles west of Roswell!

Cottonwood Lake is one of many sinkhole lakes, or cenotes, found at Bottomless Lakes State Park and Bitter Lakes National Wildlife Refuge.

Procedure 1

1. Poke a hole the size of your thumb in the bottom of the cup.
2. Cut a circle the size of the bottom of the cup out of the sponge and put it at the bottom of the cup.
3. Insert tube, it should be the height of the cup and half as wide. Place in the middle of the cup over the hole.
4. Fill the tube with sugar.
5. Surround it with sand.
6. Carefully take out the tube.
7. Put a thin layer of sand over the sugar.
8. Cut off the bottom of the coke bottle.
9. Fill it with water, about a third full. It will symbolize ground water.
10. Put the cup in the water.
11. Watch the water dissolve the sugar and collapse the sand above. You may need to take the cup out of the water to see the sinkhole form.

Procedure 2

1. Mix a few drops of food coloring with ½ cup of water. Add mixture to the 'groundwater' in the plastic bottle. The food coloring represents groundwater contaminants or chemicals.

2. Watch as the food coloring 'contaminants' are absorbed into the ground water and the sinkhole.

3. Have students discuss what kinds of chemicals might be found in ground water and how they could be prevented.

Procedure 3

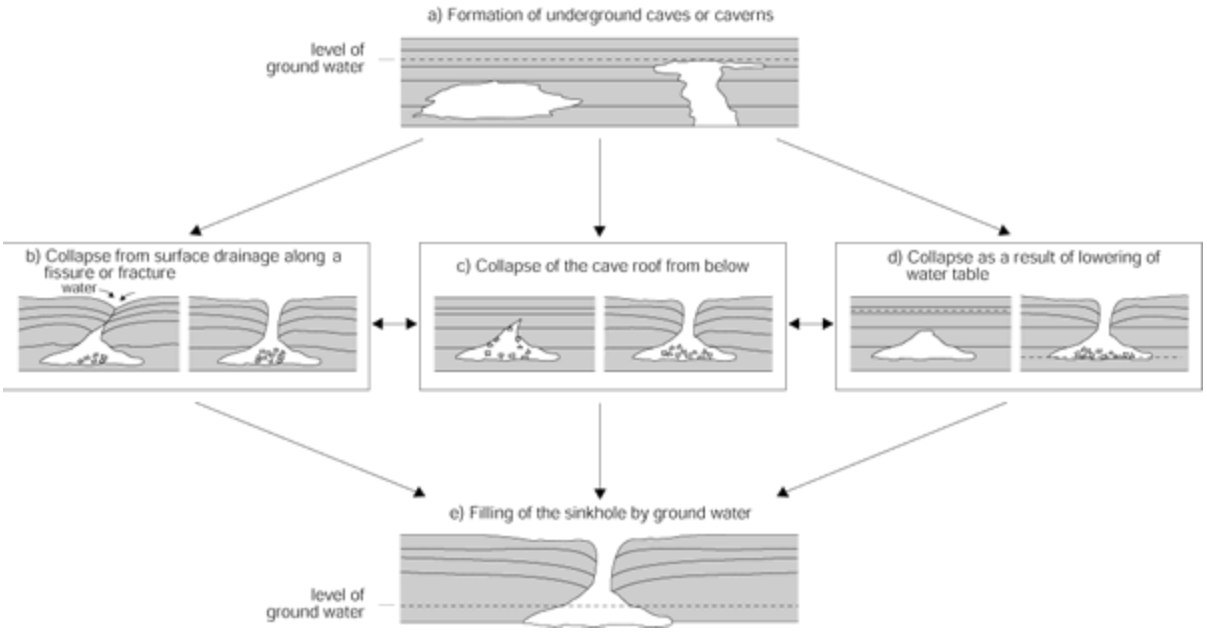
1. Take plastic syringe and place tip in 'groundwater'. Make sure plunger is pushed in all the way before placing in water.

2. Slowly pull up plunger, drawing out water and filling syringe. This represents groundwater being pumped out.

3. Observe what happens to the water level in the sinkhole.

4. Have students discuss impacts of excessive groundwater pumping and ways to reduce it.

How Sinkholes Are Formed



Graphic from the New Mexico Bureau of Geology and Mineral Resources - www.geoinfo.nmt.edu

GEOLOGY ROCKS! / Sinkhole in a Cup
Vocabulary

Caverns: or caves, are natural underground voids.

Groundwater: water located beneath the ground surface in soil pore spaces and in the fractures of underground formations.

Gypsum: a common mineral (calcium sulfate) formed usually by evaporation of sea water.

Sinkholes (aka, *cenotes* (se no' tes)): a depression formed by the collapse of an underground cavern caused by groundwater dissolving through porous rock layers (like gypsum).

Siltstone: rock formed from particles smaller than sand and larger than clay.

Definitions from Geology.com and Roadside Geology of New Mexico (Chronic, 1987).

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Teacher Evaluation

Your feedback will help make the Outdoor Classroom Program a long-lived success. Please help us improve this activity and the BWBL curriculum by taking a few minutes to provide some constructive answers to the questions below.

Date of field trip:_____ Location of field trip: _____

School/City: _____ Grade: _____ # students: _____

Your name: _____ Your phone or email: _____

1. In what capacity did you use this activity? (please check one) ____ field trip _____ classroom (pre- or post-field trip)
2. Who led the activity? (please check one) ____you _____another teacher _____agency staff
3. Please rate your overall impression of this activity.

1 2 3 4 5 6 7 8 9 10 (please circle one)
Poor Good Excellent

4. How well do you think it met the stated Goals/Objectives on the front page of the activity?

1 2 3 4 5 6 7 8 9 10 (please circle one)
Poorly Fairly well Right on target

5. How well did it compliment/support classroom study?

1 2 3 4 5 6 7 8 9 10 (please circle one)
Poorly Fairly well Right on target

E1. What do you believe your students gained from this activity in terms of learning?

E2. How did you assess learning from this activity?

E3. What would you suggest as a practical assessment for future revisions of this activity?

E4. What else would you suggest to improve this activity and/or the BWBL curriculum?

Please fax this completed form to (505) 476-3361, Attn: Outdoor Classroom Program