

Hastings Cave and Thermal Springs



Activity Sheet - Eggshells, caves, acids and acid rain

- **Curriculum Strands:** HE, BK – Matter, Living Things, Earth and Space
- **Stages:** 5–15

You probably already know that a liquid called an acid can dissolve limestone and dolomite rock, but did you know a very common household acid, vinegar, can dissolve eggshell?

Equipment

You will need:

- 1 ½ cups of white vinegar
- 1 uncooked egg
- 1 glass jar

Method

Place a raw egg in a glass or jar, cover it completely with vinegar and leave it for two to three days. What happens?

Careful observation is needed! Can you see any evidence of changes happening while the experiment is taking place? For instance, what do you notice on the surface of the egg as it sits in the vinegar?

So what's going on? And what does this have to do with caves, kettle scale and acid rain?

The disappearing eggshell

On the surface of the shell you may see bubbles of the gas **carbon dioxide**. We breathe out carbon dioxide and the same gas is produced by burning wood or fossil fuels such as coal and petrol.

But where has this carbon dioxide come from? The eggshell itself. The hard shell is made of a material called a **carbonate**, which contains both carbon and oxygen atoms (calcium carbonate CaCO_3)

Acids such as vinegar (acetic acid) break up the carbonates, releasing the carbon dioxide, which bubbles up to the surface of the glass.

Try this experiment: add another acid, such as lime, lemon or orange juice to another raw egg in a glass or jar, or try a fizzy drink like Coke.

What has this to do with caves and acid rain?

Limestone and dolomite rocks are made from a form of calcium carbonate (mainly as a mineral known as calcite), which is similar to eggshell. In fact, most of these rocks began their lives as the shells of marine animals and plants which accumulated to huge depths at the bottom of ancient oceans. Compressed into rocks over millions of years and raised upwards, they now occur in the Hastings area.

Like eggshell then, limestone is attacked by acids.

Rain water is acidic because the carbon dioxide gas in the atmosphere, and carbon dioxide released by rotting plants on the forest floor, dissolve in the rain water to make a weak acid called **carbonic acid**, H_2CO_3 .

The action of this acid causes the limestone itself to dissolve slightly, releasing carbon dioxide into the atmosphere and minerals into the water, and creating a number geological features typical of limestone country such as caves, stalactites and stalagmites.

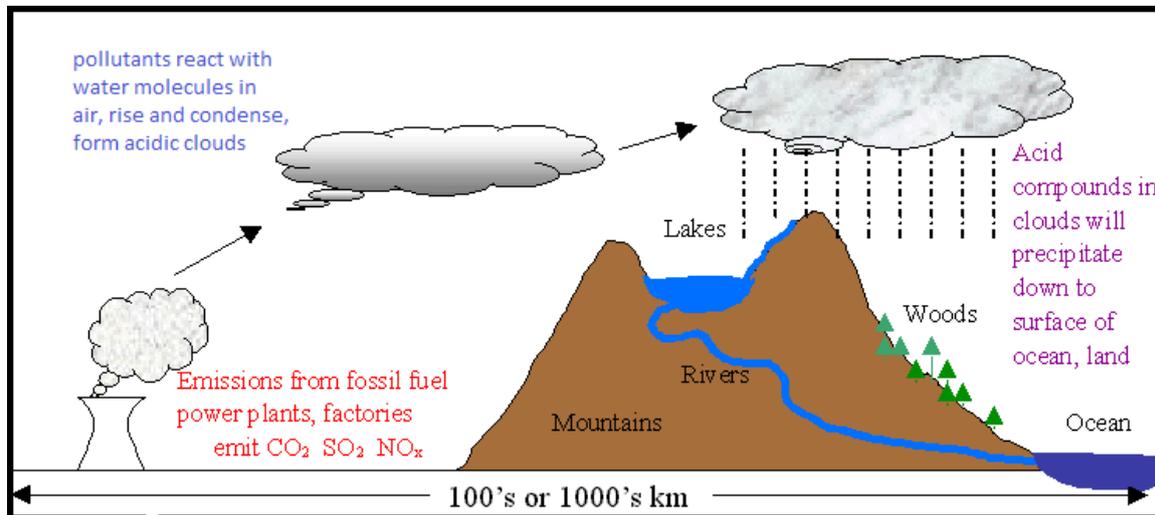


The formation of stalactites demonstrates that the process of dissolving limestone is reversible. When the water drips off the end of the stalactite, a little of the calcium carbonate is left behind as the water evaporates. Over time, that builds up as a straw or as a stalactite.

Acid rain

The acidity of rain water can also be increased by atmospheric pollution from cars, industry and power stations burning fossil fuels. These produce gases containing sulphur or nitrogen atoms in combination with oxygen atoms, which are more acidic than carbon dioxide when added to water.

Rain that has become acidic because of such pollution is described as **acid rain** and has a significant effect on the environment, including killing trees and polluting lakes and streams. Can you think of what effect it might have on caves?



Source: Google Images

For more information see:

<http://www.york.ac.uk/res/sots/activities/eggs.htm>

<http://www.exploratorium.edu/cooking/eggs/activity-naked.html>

http://en.wikipedia.org/wiki/Acid_rain

<http://www.ausetute.com.au/acidrain.html>