Chemical Weathering - Acid Rain

Although our atmosphere is mostly nitrogen and oxygen, it usually also has about 1/100th or 1% water vapour at sea level. Water can dissolve naturally occurring gases such as carbon dioxide, sulphur dioxide and nitrous oxide to create acids, which can eat away lime rich rocks such as limestone and marble.

Carbon dioxide + water = carbonic acid
Sulphur dioxide + water = sulphuric acid
Nitrous oxide + water = nitric acid

When we place limestone in acid two ***process*** can be observed.

1. The limestone ***dissolves*** in the acid
2. A gas ***evolves***. Carbon dioxide gas can be seen to bubble through the acid. This is also called ***effervescence***.

If we burn fossil fuels we increase levels of these acid forming gases and the acid rain weathering process is sped up. Limestone is commonly used to build walls and houses. Many of Fremantle's early houses were built of limestone blocks.

The limestone prison, retaining walls and tunnel in Fremantle

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Chemical Weathering - Teacher's Notes

Overseas, in Rome and Athens, very much older cities that were built of marble or limestone, have been extensively damaged due to acid rain. The famous statue of David by Michelangelo has been replaced by a replica to stop the damaging effects of acid rain. Traffic is excluded from some town centres because car exhaust creates acid forming gases.

NOTE: most of our coastal limestone is sandy limestone. When the acid dissolves lime the sand falls out.

Materials

- Two lumps of limestone (or cement can be used as it is partly made from limestone)
- Two clear drinking glasses, jam jars or Petri dishes
- 2 cups of vinegar (acetic acid)

Method

1. Place the first piece of limestone in plain water. This is the **CONTROL** against which any change is measured
2. Place the second piece of limestone in vinegar to the same height as the first. This is the experiment where we expect change.
3. Leave the experiment for 5 minutes so that the acid can fill any air spaces in the rocks.
4. Observe any changes
5. Leave for a day and repeat your observations

Chemical Weathering - Teacher's Notes

Limestone & water **limestone & acetic acid** **Cement & acetic acid**

Observations

Limestone/cement and water The limestone/cement did not dissolve and the water remained still.

Limestone/cement and acid The limestone started to dissolve in the acid. Sand grains fell out and fell to the bottom of the glass. Bubbles of gas rose to the surface/ the limestone effervesced.

Discussion

Why are ancient Greek marble statues removed from their temples, replaced by copies and kept in closed rooms in museums? They were being damaged by acid rain.

Acid rain also kills growing plants and harms animals, including humans.

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