Teachers Guide

Lava in the Lab

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Background

Volcanic activity produces a range of volcano types and extrusive igneous rocks (rocks formed from lava solidified on the surface of the Earth).

The viscosity of lava influences the character of eruptions and the types of volcanoes produced.

Eruption in low viscosity lava, Mauna Loa, Hawaii
Photo USGS

The viscosity of lava is determined partly by the amount of silica in the magma. Lava which contains a high percentage of silica is called **felsic**. If the lava contains around 50% silica, it is called **mafic** or **basaltic**. Felsic lavas tend to be more viscous than **basaltic** lavas.

Low viscosity (**basaltic**) lavas flow freely from volcanoes to form flat sheets of lava, which can cover large areas. As the gas trapped within the lava is released, fire fountains can be produced. These kinds of volcano have shallow slopes of 10o or less and are called **shield volcanoes**. Hawaii is made up of a series of shield volcanoes, one of which, Mauna Loa, is the tallest mountain on Earth - 9090 metres from the floor of the ocean to its peak.

High viscosity (**felsic**) magmas may be squeezed out of a vent, but often they solidify in the mouth of the volcano. Because they are so viscous, these lavas tend to trap gases that are present. The gas pressure gradually builds up behind the blockage until a catastrophic eruption blasts large blocks of lava and huge volumes of ash into the sky.

This material falls back to Earth producing **stratovolcanoes**: steep sided cones with slopes of 30o– 40o. There are many stratovolcanoes around the "Pacific Ring of Fire". This type of volcano can be dangerous!

Overview

The laboratory behaviour of treacle is used to model the characteristics of lava. The violence of volcanic eruptions and the resulting products is related to the viscosity of the lava. Students will discover that the viscosity of a liquid can be changed in a number of ways. The viscosity of lava and treacle is modified by changes in temperature, water content and concentration of solids e.g. crystals in lava, sand in treacle. The viscosity of lava influences the shape of volcanic landforms and the viscosity depends on the temperature of the lava and how much water it contains.

Key Question

Investigate the factors that influence the viscosity (runniness) of treacle. How does this relate to the different shapes of volcanoes that can be found on the Earth and on Mars?

Materials and Preparation

Students will need the following equipment available in order to design their experiment:

- Treacle
- Petri dishes or tiles with 'props' to allow tilting
- Test tubes
- Measuring cylinder/beaker
- Spatulas or teaspoons
- Stirring rods
- Stopwatch
- Bunsen burner
- Hot water bath
- Tripod and gauze
- Thermometer
- Teat pipette/ Syringe
- Sand
- Clamp stand and clamps
- Goggles, lab coats

Mayon Volcano, Indonesia, a stratovolcano.
Photo: Tomas Tam

Management

This activity should take a double lesson to complete – one lesson to design the experiment and the other lesson to carry it out. Students can either work on their own or in pairs.

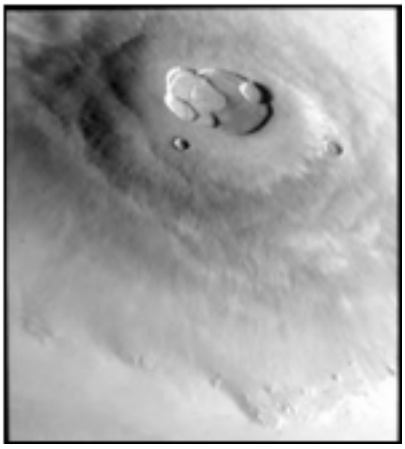
Introduce the activity with a brief discussion on lava and the different shapes of volcanoes that result from different types of lava involved. Then explain to students that they are to design an experiment that will enable them to change the viscosity of treacle and measure how runny it actually is.

Students can then be left to design their experiments and carry them out.

National Curriculum Links

Science Key Stage 3: Scientific Enquiry

Science Key Stage 4: Scientific Enquiry



The Olympus Mons volcano on Mars.

The large depression in the upper centre of the image is the caldera. The caldera is near the summit of the volcano and is 65 × 80 kilometres (40 × 50 miles) across. When magma erupted out of vents on the side of the volcano, the rock near the summit collapsed, producing the caldera.

Viking Orbiter image (641A52) courtesy of NASA.