**Using models to understand how craters are formed**

**Levels:** 4-6  
**NoS achievement aims:** Understanding about science, Investigating in science   
**Contextual strands:** Planet Earth and beyond   
**Topic:** Space

**Rationale**

Craters are landscape features that can be formed by two different types of geological processes – volcanic processes, and impact from space objects.

Students use models to investigate different crater types and critically consider the results of their investigations.

**What you need**

* A variety of pictures showing crater-like holes caused by:
  + volcanic activity (for example, Lake Taupo)
  + impact (for example, craters on Mars, the Moon, and on Earth in Siberia, Arizona and Tapanui (NZ)).
* For modelling impact craters:
  + flour or other light-coloured material to represent layers (If only white sand is available to represent bedrock, use a dark powder for the layers, such as flour mixed with cocoa or paint powder.)
  + a bag of dark-coloured sand (to represent bedrock)
  + newspaper
  + a shallow box
  + a knife or spoon for levelling
  + a sieve
  + two chairs
  + various-sized objects, such as marbles and golf balls (to act as meteorites).
* Activity resources (Optional) – see below

**Focus**

* Where do we see craters in New Zealand?
* How do we recognise craters in the landscape?
* How do craters get formed?
* Can craters change over time?
* What would you like to know about craters?

**Exploration**

1. Show students the crater pictures and discuss what the pictures have in common, and ways in which the pictures differ from each other.
2. Ask:
   * How do you think the various craters formed?
   * Do you think it is possible to tell the volcanic craters from the impact craters? If so, how?
3. Then carry out the following activity to model the effect of an impact.

* Place newspaper over the working area of the floor.
* Put the box in the centre of the working area.
* Fill the box with dark-coloured sand (bedrock) to a depth of 4 centimetres. Lightly compact it and smooth with the levelling tool.
* Use the sieve to sprinkle a thin layer of the surface material over the bedrock material.
* Choose one student to stand on a chair and drop a ‘meteorite’ on to the landscape.

1. Ask:
   * What pattern is made by the flying debris?
   * Can you see layers of bedrock and surface material in the crater walls?
   * Get the students to investigate the effects of the meteorites hitting various multi-layered surfaces at different speeds and angles.

Then:

* + Have the students look again at the pictures of craters.

Ask:

* + What similarities do you notice between the craters you have made and the ones in the pictures?
  + What new questions do you have about craters?

Challenge students to make a list of the features of the two crater types – volcanic and impact.

**Reflection**

* How can modelling activities help scientists test their theories?
* Scientists used to think that the Moon’s craters were volcanic. What helped them change their theories?
* What did you learn about craters from the modelling activity? What new questions did you develop?
* How can your list of features help sort the impact craters from the volcanic ones?
* How does the different ways craters form contribute to the differences in their observable features?

**Activity resources**

* [GeoNet](http://www.geonet.org.nz/) is a project to build and operate a modern geological hazard monitoring system in New Zealand. It comprises of a network of geophysical instruments, automated software applications and skilled staff to detect, analyse and respond to earthquakes, volcanic activity, large landslides, tsunami and the slow deformation that precedes large earthquakes.
* Ministry of Education (1999). Making Better Sense of Planet Earth and Beyond. Wellington: Learning Media.
* SLH resource Volcanoes resources – planning pathways <https://www.sciencelearn.org.nz/resources/2525-volcanoes-resources-planning-pathways>
* Volcanoes, Building Science Concepts, Book 12 .