6. Investigating Muddy Surfaces

1 hour

Children investigate what patterns are left when objects are dropped onto a wet surface. They compare these with images of craters on Mars and discuss whether this is evidence that previously there was water on Mars.

OBJECTIVES

- Identifying scientific evidence that has been used to support or refute ideas or arguments
- To know that science is about thinking creatively to try to explain how living and non-living things work, and to establish links between causes and effects.
- To know that comparing Mars' key landscape features with similar features on Earth can help us to understand their formation.

RESOURCES

(Per group of 4 children unless otherwise stated)

- Activity sheet 8 cut into cards
- A variety of 'meteorites' (eg marbles/rubber balls/stones).
- Tube for safely directing dropping/rolling 'meteorites'
- Mud
- Large sheet of paper/card
- Ruler
- Metre stick

ACTIVITY

The children are challenged to predict what patterns might be produced if meteorites had landed onto a wet Martian surface. They can prepare a mix of soil and water. The mud should be sufficiently sloppy to eject mud splats when the mass is dropped! The mud is placed into the middle of a large sheet of paper or card. The children drop a variety of 'meteorites' into the mud from different heights and observe the patterns produced. They measure the distance travelled by the mud ejected on impact.

PLENARY

The teacher shows the children the information about Tooting Crater provided by the experts (Activity sheet 12). The children look again at the images L and M of Tooting Crater and look for similarities between the images and the patterns they produced in their investigations. Teachers can ask the following questions:

- *Did they find a link between the heights of drop and distance the mud travelled or size/weight of body dropped and the area covered by the splats?*
- *What do they think produced the patterns in the images?*
- *Do their conclusions agree with those of the experts?*

EXTENSION

The children could be encouraged to discover more about the key landscape features of Mars and reinforce their understanding by further reading or through internet-based research.

SAFETY NOTES, PRACTICAL TIPS AND GUIDANCE

It is advisable to use soil rather than compost and to conduct this investigation outdoors. Dropping masses onto mud and observing ejecta would simulate meteorites landing in wet terrain. Allowing the splattered surface to dry would enable further observations and comparisons to be made between the images of Martian channels and the patterns produced. Children should wash their hands thoroughly after handling soil or wear protective gloves during the activity. For further information, see ASE's Be Safe![1]

BACKGROUND INFORMATION FOR TEACHERS

An object's weight depends upon gravity. Since this investigation is taking place under the same gravitational conditions, we can use either weight or mass, depending upon the level of understanding of the children. The higher the drop, the greater the speed on impact. The greater the speed, the larger the impact crater. When dropped from a given height, the greater the mass (weight) the larger the crater. When dropped from a given height, the greater the size (volume), the larger the crater.

Impact craters are caused when a body (**bolide**) collides with a planet. It may be composed from rock (**meteorite**) or ice or a mixture of the two (**comet**). A crater's size and features depend on the nature of the surface and the speed, size and mass of the body. The speed of the balls dropped in this case is low. In real impacts, compression shock waves run through the bolide and the surface; the body or meteorite would vaporise or be broken into small pieces. The target material is melted or fractured. Rebounds of the bolide cause further excavation of the surface and possible collapse caused by gravity. Secondary craters can be formed and material can be ejected on impact.

1 For further information regarding safety in the classroom see Be Safe – Health and Safety in School Science and Technology, available from the Association for Science Education.

Mars is densely cratered. Some Martian craters have central peaks; some are surrounded by material that has been ejected, called the **ejecta blanket**. Impact craters are interesting to study and provide insights into the age and geology of a planet's surface. They can give a view of the types of subsurface rock. Scientists hypothesise that large craters may create a **transient atmosphere** that may have induced rainfall in the past. Images from Mars suggest that there may have been water on or under the surface at some time in the past. Certainly, some patterns are just like those made when rocks are thrown into mud! Impact craters on Earth older than about 200,000 years are worn by weathering, **erosion**, and **plate tectonics**. Lack of these events on Mars leaves craters in their original form.

Tooting Crater image taken from orbiting spacecraft

Landscape

Images can be downloaded from www.cciproject.org/topicbank/space.htm

Image K

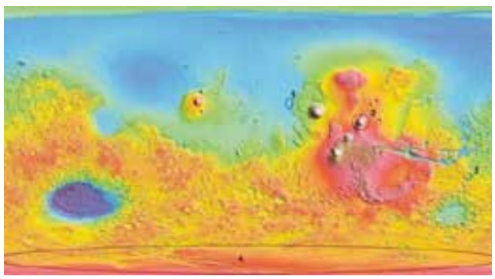


Image of Mars with landscape features for pupils

Image Q

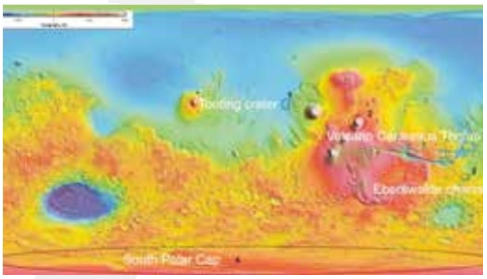
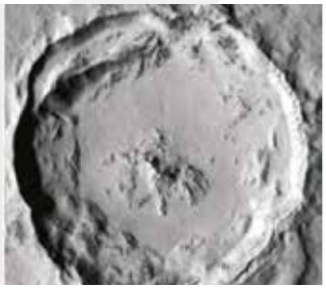


Image of Mars with landscape features marked and named for teachers pupils

Image L

Tooting Crater

Image M

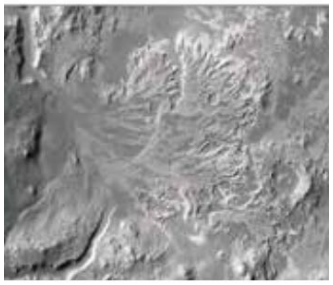


Tooting Crater close up

Image N

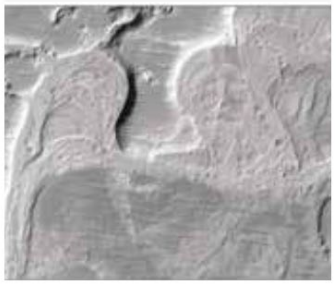
Volcano Ceraunius Tholus

Image O



Eberswalde Channels

Image P



Eberswalde Channels close up

Image R

Crater on Earth viewed from space

Image S

Volcano on Earth

Image T

Water channels on Earth

Image U

River delta on Earth viewed from space