

Volcanoes

What is a volcano and where are New Zealand's volcanoes?

Introduction

Discuss in pairs, groups or as a class

Features they know on the surface of the Earth

Islands, continents, hills, mountains, valleys, rivers, lakes, caves, oceans, beaches...

Do these features change over time and what causes the changes?

All parts of the Earth's surface change over time. Changes caused by volcanoes, earthquakes and landslides can be fast, noisy, unpredictable, dramatic and dangerous. Changes are caused by forces on the Earth's surface such as weathering and erosion due to climate, or forces below the surface such as the movement of hot rock.

Activity

Assess existing knowledge by asking each student to draw a volcano, encourage students to show what is inside the volcano. Share drawings and discuss ideas.

Discuss

How do volcanoes change the landscape?

The material produced in volcanic eruptions can create a volcanic cone and can also spread over a wide area of the surrounding landscape. A more violent explosion can collapse the surrounding area and leave a crater, which may fill with water such as Lakes Taupo and Rotorua. The interaction between volcanoes and water can lead to landscape features such as hot springs and geysers. Some volcanic rocks break down to form fertile soil.

What can volcanoes produce and where does this material come from?

Volcanoes can produce ash, lava, rocks of many sizes, steam and gases. Volcanic ash is not the burnt remains of a fire, it is rock that has been fragmented into smaller parts.

Magma is a very hot mixture of melted rock, dissolved gases, and solid crystals or rock fragments suspended in the liquid. Different combinations of magma components cause different types of eruptions, but magma is not always ejected in an eruption. Some eruptions such as the small Ruapehu eruption in 2007, involve only magmatic gases and crater lake contents.

Where are NZ's active volcanoes, do they all look the same?

NZ's active volcanoes are all in the North Island. The three main areas are the Taupo Volcanic Zone (TVZ) which extends from Ruapehu to White Island, the Auckland Volcanic Field and Taranaki. All volcanoes look different because the processes creating them vary. The size, type and frequency of eruptions varies, they are different ages and they are also affected by external forces such as erosion caused by water, ice and wind.

Does NZ have undersea volcanoes?

There are at least 30 submarine volcanic centres in the Kermadec Arc which extends from White Island to Tonga. Many of these volcanoes are active and they are formed by the same process that creates the Taupo Volcanic Zone.

Activity Instructions

- Print out, view and discuss the posters of NZ volcanoes.
- Mark the location of these volcanoes on a NZ map either as a class or on individual maps
 - Use red pins/markers for active volcanoes and a different colour for extinct volcanoes such as Dunedin and Banks Peninsula.
 - Label the Taupo Volcanic Zone, the Auckland Volcanic Field and Taranaki
- Discuss the shapes of the different volcanoes and possible ideas on why they are that shape.
- Discuss the vocabulary necessary for the volcano diagram and complete the activity sheet.

Learning Intentions

- recognise that the surface of the earth changes over time
- learn that some mountains and hills are volcanoes but not all volcanoes look like mountains
- understand that volcanoes have been built up by eruptions.
- realise that volcanoes can be extinct, dormant or active.

Success Criteria

Students can

- Identify, locate and name some active NZ volcanoes.
- Show an understanding of how volcanoes are created and destroyed over time.
- Use correct vocabulary to label the main features of a volcano.

Resources

- 7 Poster Series
- NZ Wall Map or individual maps & coloured pins
- Volcano diagram activity sheet

Vocabulary

volcano, eruption, extinct, dormant, active, cone, vent, crater, magma, lava, layer, eruption plume

Volcanoes

What is a volcano and where are New Zealand's volcanoes?



Most children understand that the Earth moves around the Sun and the moon moves around the Earth, however many do not realise that the surface of the Earth is also slowly moving and changing over time.

The size and permanence of the landforms they see each day encourages them to believe that what they see has always been there and will continue unchanged.

An understanding of volcanoes will enable children to see the connection between visible features on the surface of the Earth and the invisible processes happening under the surface. Then the concept of the Earth's surface changing over time becomes easier to grasp. Put simply a volcano marks the point where molten rock from deep within the Earth has reached the surface.

New Zealand has a unique place on the Earth's surface. The forces which have created our dramatic and beautiful landscapes also make New Zealand extremely prone to natural hazards such as volcanoes, earthquakes, tsunamis, floods and landslides. Our volcanoes are world beaters, both in frequency of eruptions and volumes of material ejected.

Most New Zealand children will already have heard of or experienced at least one natural hazard and may have some idea of how to prepare for natural disasters. They are probably not so aware of the role NZ scientists play in investigating these natural processes in order to better predict future events and limit damage to people, property and the economy.

Many NZ volcanoes such as Taranaki and Ngauruhoe have the classic cone shape children expect but other active volcanoes are harder to identify by shape. Tarawera appears to be a collection of hills with flat tops rather than a volcano that 'blew its top'. One of the most active and violent volcanoes in the world is concealed beneath one of our major tourist attractions, Lake Taupo.

Drawing a volcano and discussing the volcano photos will allow students to share what they already know and provide useful formative assessment. Identifying their locations will show that our active volcanoes are not randomly spread around the country. Although the South Island now has no volcanic activity, South Island students should not feel deprived when they see the remains of ancient volcanoes in the landscapes of Dunedin and Banks Peninsula.

The huge time scales involved in changes to the Earth's surface are difficult to understand but children can see that some NZ volcanoes are 'young and active' while others are extinct and slowly disappearing.

A simple diagram can be used to show that a cone volcano is built up layer by layer through repeated eruptions. What is built up can also be eroded down or altered by further eruptions. Many children imagine the heat source is within the cone of a volcano rather than deep underground. Lesson 2 explains this heat source by examining the structure of the Earth.

Curriculum Links

Planet Earth and Beyond

Science Concept	NOS
Earth Systems L1/2 –explore and describe natural features and resources	Investigating in Science-extend their personal explanations of the natural world.
Interacting Systems L1/2 -describe how natural features are changed and resources affected by natural events	Communicating in Science-build language.

Assessment

Formative assessment of existing knowledge by

- Drawing and labelling a volcano
- Contributions to discussions

Volcanoes

What is a volcano and where are New Zealand's volcanoes?

Which New Zealand volcanoes are active?

All of New Zealand's active volcanoes are in the North Island but the remains of extinct South Island volcanoes are easy to spot in places such as Dunedin and Banks Peninsula.

White Island in the Bay of Plenty is New Zealand's most continuously active volcano. When it is not erupting there is a constant plume of steam from fumaroles on the crater floor. Fumaroles are vents that emit steam and other gases.

The Taupo Volcanic Zone contains many active volcanoes of different types, some are cones such as Ruapehu, Tongariro, and Ngauruhoe. Others are calderas-large basin shaped depressions caused by the collapse of a volcano after a violent explosion. Two calderas are currently active, Taupo and Okataina. Mt Tarawera is part of the Okataina caldera and produced New Zealand's deadliest eruption since European settlement in 1886.

Egmont Volcano in Taranaki has been created by the same processes as the cone volcanoes of the Taupo Volcanic Zone and is still considered active.

Auckland city is built on a field of about 50 small, young, volcanic cones. The most recent eruptions formed Rangitoto Island about 600 years ago. Future eruptions in the Auckland area are likely to be at new sites rather than from existing cones because of the particular type of volcanism involved.

A line of active undersea volcanoes called the Kermadec Arc extends over 1000km north east from the Bay of Plenty coast. It includes both cone and caldera volcano types.

For the current state of NZ's active volcanoes see www.geonet.org.nz

What's the difference between active, dormant and extinct?

If a volcano has erupted in about the last 100,000 years, scientists consider it to be active. It is difficult to decide when a volcano is extinct (dead) because volcanoes can be dormant (sleeping) for tens of thousands of years. Dunedin Volcano last erupted 10 million years ago and is extinct. Taupo last erupted over 1800 years ago but is not extinct because it is of a type that can have thousands of years between eruptions.

Why does NZ have so many volcanoes and why are all the active ones in the North Island?

It's all to do with the structure of the Earth and plate tectonics- see Lessons 2&3

When are we going to make a volcano?

See Lesson 9

Are there volcanoes on other planets?

Mars, Venus and Jupiter's moons have many volcanoes. So does Earth's moon.

The largest volcano in our solar system is Olympus Mons on Mars. The most volcanically active part of the solar system is Io, one of Jupiter's moons.

For more information on solar system volcanoes see www.geology.sdsu.edu/how_volcanoes_work/

What's the biggest active volcano in the world?

Mauna Loa covers half the island of Hawaii and is the Earth's largest (but not tallest) volcano. It rises 4km above sea level and it is another 5km from sea level down to the sea floor. Because it is so large it pushes the sea floor down by another 8km. This makes the volcano's summit 17km above its base! It has erupted over 30 times in the last 150 years.

Are New Zealand eruptions as big as other countries?

Yes, the Taupo eruption 1800 years ago is the second largest and most violent eruption anywhere in the world in the last 5000 years.

Could a volcanic eruption reach me?

Yes, even areas a long way from active volcanoes can be affected by fall out of volcanic dust and ash from the atmosphere.

Can you tell when a volcano is going to erupt?

Scientists cannot predict exactly when a volcanic eruption is going to occur but they can look for warning signs such as earthquakes, changes in gases coming from the volcano and changes in the shape of the land. Using these signs they may forecast the possibility of an eruption. However volcanoes are unpredictable, a small Ruapehu eruption in 2007 was a "blue sky event", there were no warning signs.

Could new volcanoes pop up in places where there are no volcanoes now?

Yes, scientists think Wanganui is a likely spot but probably not any time soon! In Auckland more volcanoes will be produced at new spots within the volcanic field.

For a comprehensive site with many sections useful for the following lessons and simple clear animations see

<http://www.msnuclous.org/membership/html/k-6/pt/index.html>

For further information on the Taupo Volcanic Zone see:

<http://csl.doc.govt.nz/parks-and-recreation/national-parks/tongariro/features/central-north-island-volcanoes/>

<http://www.geonet.org.nz/volcano/our-volcanoes/index.html>

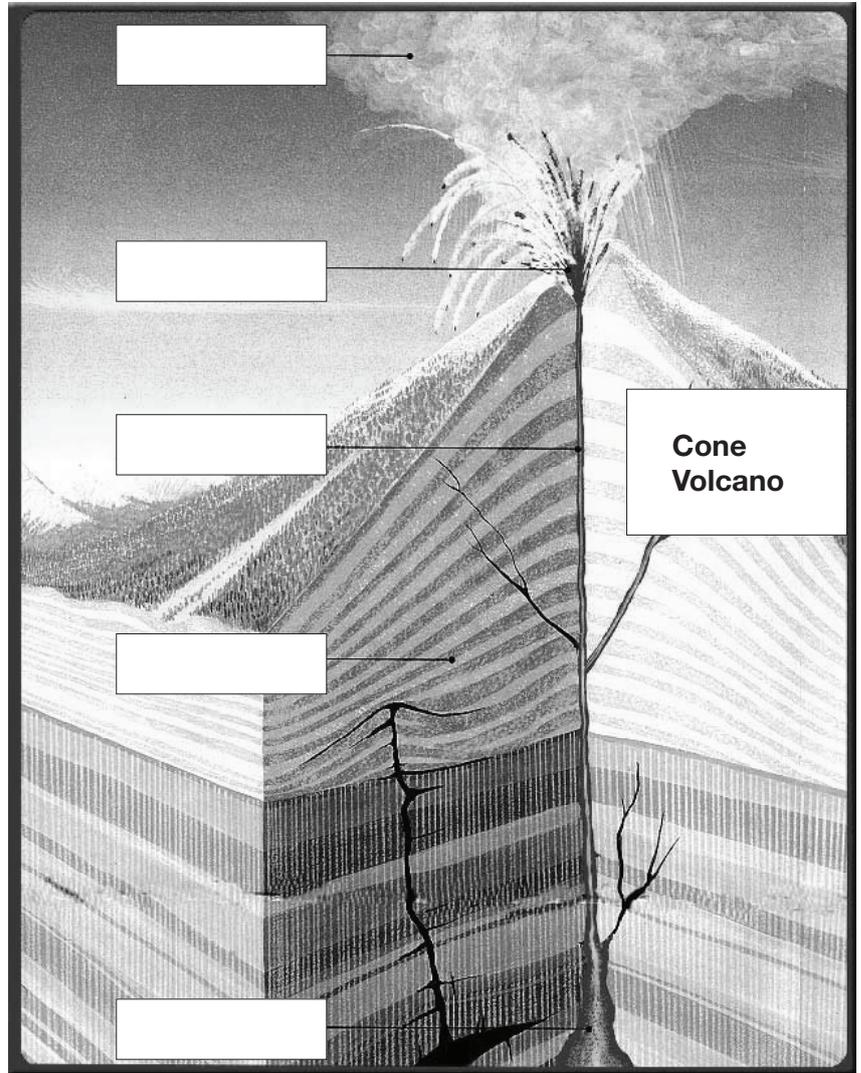
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Volcanoes

What is a volcano and where are New Zealand's volcanoes?

What is a volcano?

1. Put the following labels in the correct boxes on the diagram.
magma pipe, magma chamber, cone, vent, eruption plume
2. Add a small lava flow to your diagram and label it.
3. If the main magma pipe became blocked, mark with an X where another vent might develop.
4. Why is the cone of the volcano made up of layers?



USGS

What shapes can volcanoes be?

1. Use the following labels to name each volcano type.
cone volcano, caldera volcano, volcanic field
2. Name a New Zealand volcano of each type.

