Taupō

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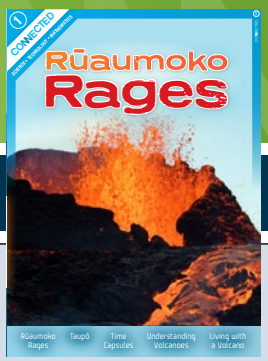
CONNECTED 1
SCIENCE • TECHNOLOGY • MATHEMATICS



Overview

This article describes what we know about the huge volcanic explosion that formed Lake Taupō. It looks at some of the effects of this eruption that can be seen in the landscape and how scientists piece together the evidence about this eruption.

Curriculum context

SCIENCE

PLANET EARTH AND BEYOND

Earth systems

Achievement objective

L1 and 2: Students will explore and describe natural features and resources.

Key ideas

- When a volcano erupts, it can affect the atmosphere, living things, and landscapes.
- Volcanic activity shapes many of the features on Earth's surface.
- There are different kinds of volcanoes, and the material from them forms different kinds of rocks.

Learning goals (to be shared with your students)

In this activity, we are learning:

- to represent height, depth, and volume and to make comparisons
- to use timelines to show relationships between periods of time.

MATHEMATICS

MEASUREMENT

Ideas

Achievement objective

L2 Students will order and compare objects or events by length, area, volume and capacity, weight, turn, temperature, and time.

Key idea

- Scientists use measurements to work out the volumes of erupted materials, and the areas affected.

Learning goals (to be shared with your students)

In this activity, we are learning:

- to represent height, depth and volume and make comparisons
- to use timelines to show relationships between periods of time.

ENGLISH

READING

Ideas

Achievement objective

L3: Students will show a developing understanding of ideas within, across, and beyond texts.

Indicators

- Uses their personal experience and world and literacy knowledge confidently to make meaning from texts.
- Starts to make connections by thinking about underlying ideas in and between texts.
- Makes meaning of increasingly complex texts by identifying main and subsidiary ideas in them.

Structure

Achievement objective

L3: Students will show a developing understanding of text structure.

Indicator

- Understands that the order and organisation of words, sentences, paragraphs, and images contribute to and affect text meaning.

The Literacy Learning Progressions

The relevant knowledge, skills, and attitudes for students at this level are described in the The Literacy Learning Progressions.

Suggestions for providing literacy support for the key ideas

The following strategies will support students to engage with the ideas and information as they use the text for particular curriculum purposes.

The *Connected* series includes a range of texts that provide opportunities for students to locate, evaluate, integrate, and synthesise information and ideas.

It is expected that students will read across the range of texts in this *Connected* to develop their literacy skills and their understanding of the topic.

Text characteristics

- Technical and subject-specific vocabulary
- A map, photographs, captions, diagrams, and illustrations
- Concepts of time (the "recent" Taupō eruption was 1800 years ago)
- Factual information, organised into paragraphs and text boxes.

1. FINDING THE MAIN IDEAS

This article describes the eruptions that have resulted in the formation of Lake Taupō. Readers are provided with facts and figures, as well as human interest information, such as the impact on people around the world, the impact on New Zealand inhabitants, and the work of scientists to find out more about volcanoes.

The main ideas in the text include:

- Lake Taupō was formed by two massive volcanic eruptions.
- The first Taupō eruption occurred many thousands of years ago.
- The eruptions were so big that they affected the world's climate.
- Volcanic rocks vary according to their chemical make-up and their history.
- Scientists measure layers of ash to help work out the size and direction of eruptions that occurred long ago.
- Throughout New Zealand's human history, people have lived, worked, and played around Lake Taupō.

REVIEW what students know about Lake Taupō and where it is. (Lake Taupō is the largest freshwater lake in Oceania; perimeter of 193 kilometres; area of 616 square kilometres; and maximum width of 33 kilometres.) Make connections to distances that students know well.

PROMPT the students' prior knowledge of information texts.

What kind of text structure and language features might we expect to find in an article?

How are we going to find the main ideas?

ASK QUESTIONS to prompt students to infer information from the photographs and illustrations.

What does the picture of the moa on page 12 suggest about the most recent Taupō eruption?

What does the photograph on page 11 say about how far the material from the eruption spread?

MODEL ways in which the students can organise and compare the information about the effects of the eruptions. For example:

The Ōruanui eruption	The Taupō eruption, AD 186
darkened skies all over the world for several years	the Sun blocked out in China and Europe
stopped plants from growing	crops didn't ripen
meant there was not much food for people and animals	all living things destroyed in the central North Island
sent ash as far as Chile and the Chathams	
made a huge hole in Earth's crust that became Lake Taupō	

2. LOCATING AND USING INFORMATION FROM MAPS, DIAGRAMS, AND TABLES

This article includes:

- a simple map of the North Island, showing the Taupō volcanic zone
- a stylised diagram to show the relative sizes of a variety of volcanic eruptions
- a table showing the variety of volcanic rocks that came from the Taupō eruptions.

Discuss the simple map of the North Island and the shaded area, showing the location of volcanoes.

EXPLAIN how the diagram on pages 12 and 13 shows the relative sizes of various eruptions.

Have the students **SCAN** the table listing volcanic rocks to locate specific information.

Put your finger on the heading Obsidian. Read on and find out what obsidian was used for.

One of the rocks is unusual: it floats! Skim through the information and see if you can find out the name of the floating rock.

3. DEALING WITH UNFAMILIAR VOCABULARY

IDENTIFY the language that is typical of scientific explanations, such as the conditional verbs describing processes, would have stopped growing, would have had, would not have known, and the passive voice, has been found, was thrown out.

The topic-specific vocabulary will provide the greatest challenge. Students can be supported by a possible classification of words, such as:

- place names: Ōruanui, Chile, Chatham Islands
- people: Chinese, Roman, Polynesian, Ngāti Tūwharetoa
- volcanoes: eruption, geologists, molten, crust, debris, lahar, lava
- maths and science: centimetres, force, measuring, kilometres, chemicals.

MAKE LINKS to prior knowledge of processing and comprehension strategies, prompting the students to recall what readers do when they meet words that are unfamiliar. *What are some useful strategies for working out unfamiliar vocabulary?*

MODEL these strategies:

Let's see how that works for specific vocabulary about volcanic eruptions. Look at the word "volcanologist". I'm going to break it into chunks … there are some parts that look familiar – "volcano" – and I know that words that end in "–ologist" are usually some sort of scientist, like a biologist or geologist. A volcanologist must be a scientist who studies volcanoes.

NOTE: The text refers to the parekawakawa the people of Tūwharetoa wore (page 15). You may wish to explain to students that parekawakawa are a sign of mourning and are generally worn by older women (and by men in some areas) at funerals. They have more significance than being merely hats or visors. For more on this topic, you could refer to Barlow, Cleve (1991). *Tikanga Whakaaro: Key Concepts in Māori Culture.* Melbourne: Oxford University Press.

Exploring the science

The following activities and suggestions are designed as a guide for supporting students to develop scientific understanding as they explore natural features of planet Earth.

Key ideas

- When a volcano erupts, it can affect the atmosphere, living things, and landscapes.
- Volcanic activity shapes many of the features on Earth's surface.
- There are different kinds of volcanoes, and the material from them forms different kinds of rocks.

Activity 1: *Representing periods of time*

The purpose of this activity is to represent long passages of time by presenting them on a timeline. The timeline will cover the period from the first Taupō eruption to the present day.

- 26 500 years ago = the first Taupō eruption
- 1800 years ago = the most recent Taupō eruption
- 700 years ago = Polynesian people settle in NZ (see note below)
- 240 years ago = European people settle in NZ

As a class or in groups, the students can construct the timeline on a school field or on an outdoor court, using the scale of 100 centimetres = 1000 years. Measure out 2650 centimetres or 26.5 metres representing 26 500 years. Plot points, at 180 centimetres (1800 years), 70 centimetres (700 years), and 24 centimetres (240 years).

now	240 yrs	700 yrs	1800 yrs	26 500 yrs
0	24 cm	70 cm	180 cm	2650 cm
0	0.24 m	0.7 m	1.8 m	26.5 m

The students can plot the measurements and physically stand on the points that indicate the dates. Alternatively, they can use symbols or words to indicate the timing of these events.

Students can then decide how to record their own timeline. They can then draw and label it.

Discuss the fact that no people died in the first and the most recent eruptions. Question: *Why was this the case?*

Discuss the effects of such huge eruptions if they had occurred in the last one hundred years.

NOTE: The article does not state when the Polynesian people settled in New Zealand. You will need to explain that the debate regarding dates is ongoing and dependent on the collection of evidence. Some sources agree that the first mass settlement of Polynesians arrived in New Zealand in 1350 AD, or about 700 years ago.

Activity 2: *Measuring the effects*

In this activity, students will identify the vast area that the Ōruanui eruption affected.

Provide the students with a world map, preferably one that shows New Zealand in the centre, or work on the floor with one large map.

Have the students locate Lake Taupō and Chile.

Using a compass (or pin, pencil, and string), they can fix the point on Lake Taupō, and place the pencil on Chile. Then they can draw a circle, keeping the radius equal to the distance on the map from Lake Taupō to Chile.

Students will be able to see the number of countries that were likely to have been affected by volcanic ash. Discuss the likelihood that people populated these places at the time and the impact the eruption may have had on them. Refer back to the article to find and check information. Questions could include:

If the ash reached Chile, is it likely to have travelled a similar distance in all directions?

Were these areas populated 26 500 years ago? How can we find out?

If scientists find volcanic ash, what do they do to discover where it has come from?

How might winds have affected the volcanic ash?

Activity 3: *Examining rocks*

Students will need a variety of rocks for this activity. Provide a selection of rocks, for example, limestone, sandstone, scoria, pumice, greywacke, granite, and river stone. The students could also collect rocks from their local area, but it is unlikely that they will be able to collect a sufficient variety.

Have the students draw up a table with the headings Rock Type and Properties. Give them guidance about the properties to look for. Advise them to use their senses, through their eyes, nose, fingers, and ears, to make physical observations.

They could use subheadings such as:

- What does it look like?
- What does it sound like when I bang it with a spoon?
- How does it feel: hard, soft, rough, smooth?
- What do I think the rock is made of?
- How was it made?

For example:

Rock	Properties	Inferences
limestone	brown, soft, easily scratched, gritty	It's made up of sand grains. It has never been heated.

The students could decide which rocks might be volcanic by discussing the conditions inside a volcano (heat, pressure, and movement of particles), as well as the effect of being blasted out during an eruption. They could also discuss other factors that might have affected the rocks, such as rolling around in rivers or being blown by wind.

Have them classify the rocks according to size, colour, shape, and other simple properties, such as how hard they are, whether they can scratch hard surfaces, how strong they are (*Do they break easily? How do they break?*), whether they are small or large pieces, and whether they have sharp or smooth edges.

They could also weigh the rocks. This will prompt good discussion, especially if you have samples of pumice. *Do the rocks sink or float in water?* This could lead to a discussion of the concept of density.

Discuss and compare the photographs of the volcanic rocks on page 14 with the rock samples.

Activity 4: *Layering materials*

To describe the layering on Earth's surface, the students can construct a model, layering a variety of natural materials. This can be done as a class activity, using an empty terrarium, or individually or in pairs, using empty glass jars.

Provide the students with a variety of materials, such as sand, pebbles, shells, seaweed, rocks, leaves/twigs, mud, and clay.

The students carefully arrange the materials, placing them layer upon layer in the container so that the layers can be viewed through the glass.

Discuss the impact of time on the different materials.

- Why do you think the Earth has layers of different materials?
- What will happen to the materials that are getting pressed down?
- How do scientists know where to find different rocks?

Make connections to the information in the article by emphasising that the students' containers are models and that volcanoes deposit layers. They should be able to see that if the model were Earth, the layers that were deposited first can be accessed by digging down. On Earth, the greater the depth, the older the material.

The students could also visit a cutting to look at layering if there is one near your school.

Another activity could be to bake a slice with a base, a filling, and icing and to cut it to show the layers. An investigation could be carried out to see what happens when pressure is applied or the slice is heated after it has been iced. See also *Making Better Sense of Planet Earth and Beyond*, pages 34 and 42.

Activity 5: *Making hokey pokey*

Hokey pokey has a texture similar to pumice and scoria.

Provide the ingredients and a recipe for hokey pokey and make it as a class or in groups.

When the hokey pokey is cool, break it into chunks and distribute it among the students along with samples of pumice and scoria.

Use questioning and discussion to:

- compare the hokey pokey with the rocks
- recall that pumice and scoria are formed when the frothy lava cools and hardens
- identify that the holes formed by gas bubbles in the froth give pumice and scoria its light, crunchy texture
- recall that pumice and scoria are formed in explosive eruptions.

For a recipe for hokey pokey, see *Connected* 3 1998 and Building Science Concepts Book 12: *Volcanoes*, page 19.

Exploring the mathematics

This text provides opportunity for rich mathematical discussion. It gives information about the sizes of the Ōruanui and the Taupō eruptions. Students can investigate further to compare their relative sizes. They can also be introduced to the concept of scale.

In this article, students are introduced to the comparative sizes of volcanic eruptions. The magnitude of an eruption can be measured in terms of cubic kilometres of tephra (ash), which is a three-dimensional unit.

Key idea

- Scientists use measurements to work out the volumes of material ereupted.

MATHEMATICAL IDEAS AND LANGUAGE

- Comparing volumes
- Time in years

FOCUS QUESTION

- How does the size of the AD 186 Taupō eruption compare to other famous eruptions?

Activity: *Comparing Eruptions*

Ash from the AD 186 Taupō eruption covered large areas of the North Island. The volume of ash is measured in cubic kilometres. Scientists use estimates of measurements to compare the sizes of volcanic eruptions.

Estimates of the volume for four volcanic eruptions are provided below. Model these volumes using sand to give students a sense of the relative scale of the four eruptions.

Eruption	Tephra (ash) in km^3	Scaled volume 1 mL = 0.1 km^3
Vesuvius AD 79	3 km^3	300 mL
Taupō AD 186	45 km^3	4.5 L
Tarawera 1886	1 km^3	100 mL
Ruapēhū 1995/96	0.001 km^3	1 mL

Use a 1 litre graduated jug to measure the volume of sand.

Pour each measurement of sand onto a large sheet of paper. The sand does not need to be evenly distributed because layers of volcanic ash will be thicker close to the volcano.

The activity can be extended by drawing a line around the border of the sand before removing the sand. Students can compare the area within each border by filling it with counters or by counting squares.

MINISTRY OF EDUCATION RESOURCES

- *School Journal*, Part 4 Number 3, 2004, "A Bit of a Bang"
- *Connected* 2 2000, "Jago Descends"
- Building Science Concepts (BSC series):
  - Book 12: *Volcanoes*; Book 41: *Fossils*.
  - *Fossils Picture Pack* (2003). Wellington: Learning Media.