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VOLCANOES AND EARTHQUAKES

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The islands of Aotearoa New Zealand lie across one of the most active volcanic zones in the world. They contain wonders such as hot springs and coloured terraces — but we also have to live with mountains that can spew ash and lava, and the ever-present threat of earthquakes. *Volcanoes and Earthquakes* uncovers the seismic forces that have created Aotearoa, the range of beautiful landforms created by volcanic activity, and how eruptions and earthquakes have affected the lives of New Zealanders for hundreds of years.

TOPIC

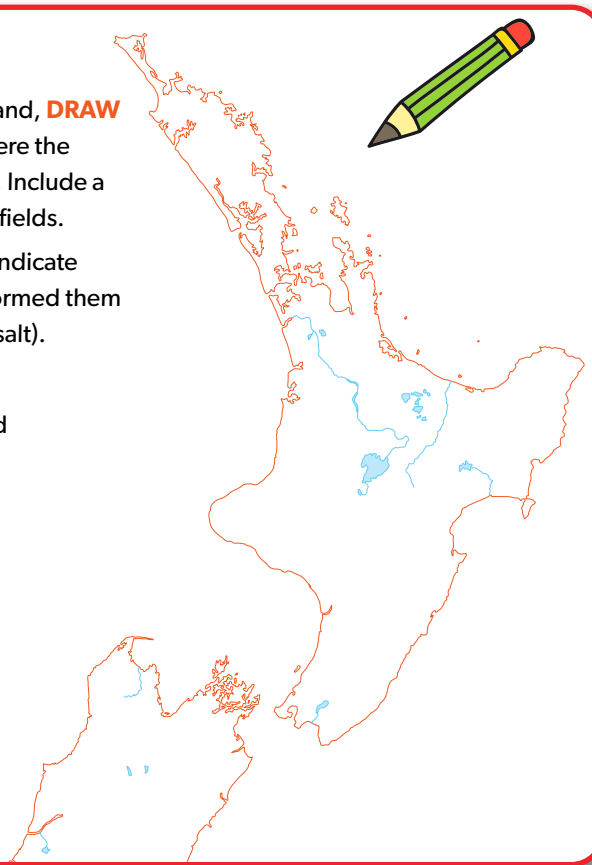
NEW ZEALAND IS A LAND OF VOLCANIC, TECTONIC, AND GEOTHERMAL ACTIVITY

ACTIVITY 1

On a blank map of the North Island, **DRAW SMALL CIRCLES** to indicate where the volcanoes in the list are located. Include a large circle around the volcanic fields.

COLOUR CODE your circles to indicate the different kinds of lava that formed them (● andesite, ● rhyolite, ● basalt).

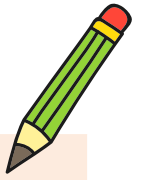
- Auckland Volcanic Field
- Northland Volcanic Field
- Edgecumbe
- Mayor Island
- Ngauruhoe
- Ruapehu
- Taranaki
- Tarawera
- Taupo
- Tongariro
- Whakaari/White Island



ACTIVITY 2

UNSCRAMBLE the following terms and write a definition for each one.*

GAAMM		
LENTAM		
REOC		
STRUC		
NICETTOC		
NICCALVO		



*answers on last page

ACTIVITY 3 – RING OF FIRE (PAGE 10)

Using the diagram on page 10 of the book, **DRAW THE PLATES** on the blank map.

Label the countries and the directions of the plate movements.

Use the text to help you **write annotations on your diagram** to explain the plate movements and the volcanic activity.

QUICK QUIZ 1

Active volcano A volcano that erupts _____.

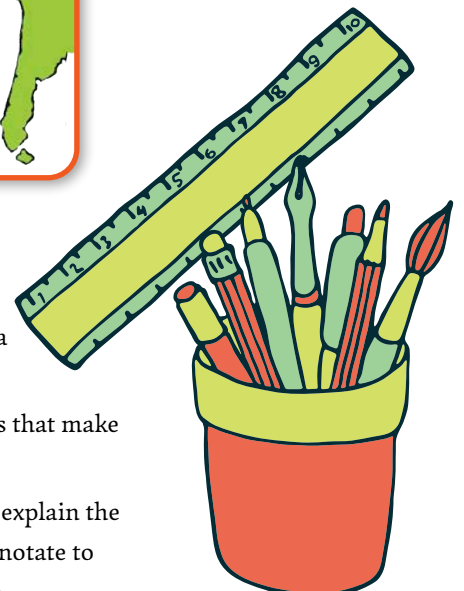
Dormant volcano An active volcano that is not _____, but is supposed to _____ again.

Extinct volcano A volcano that nobody expects ever to _____ again.



HOW TO ANNOTATE DIAGRAMS IN GEOGRAPHY

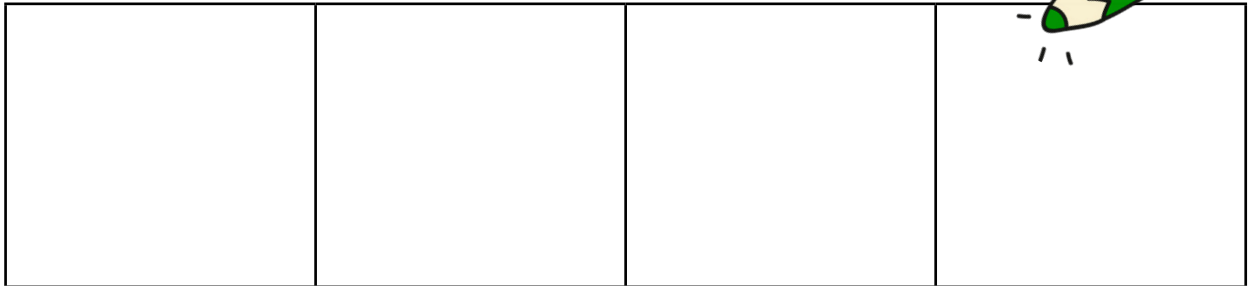
- Draw your base diagram.** This might be a map, a cross-section of a volcano, or a diagram showing how earthquakes occur.
- Add labels to your diagram.** This includes headings and any labels that make clear what each part of the diagram is (e.g. layers of the earth).
- Add annotations to your diagram.** These are comments that help explain the significance or meaning of each part of the diagram. You might annotate to explain how magma is produced, or how houses are affected by ash.



ACTIVITY 4 – MĀORI LEGENDS (PAGES 12-14)

Why are volcanoes important in Māori culture?

DRAW one of the legends mentioned in the text in a brief storyboard or comic strip. Underneath your storyboard, **explain how** the volcano was formed.



TOPIC VOLCANIC ERUPTIONS

ACTIVITY 1 – (PAGES 15-20)

Use the diagram on page 16 as a reference and **DRAW YOUR OWN DIAGRAM** of how a volcano works.

For each of the following, explain its role in a volcanic eruption:

- Molten rock
- Tephra
- Gases
- Ash
- Lahars



ACTIVITY 2 – VOLCANIC SHAPES (PAGES 19-20)

WRITE an explanation and give examples of **cone** and **shield** volcanoes.

Use play-doh to create the different shapes of volcanoes! As an extra challenge, try to use different colours to mimic the different layers of the earth.

TOPIC VOLCANIC FEATURES

ACTIVITY 1 – GEYSERS (PAGES 21-25)

Read the text on pages 21-25 and **WRITE A SHORT SUMMARY** explaining how geysers work.

Here is a **word bank** to help you — try to include as many as possible in your summary.



Superheated	Vent
Spray	Pressure
Boiling point	Temperature
Rotorua-Taupo	Soaping
Reservoir	Steam

ACTIVITY 2 – HOT SPRINGS AND MUD POOLS (PAGES 25–32)

CREATE A POSTER, including diagrams and images, to convey:

- how hot springs and mud pools work
- where they are found
- why they are tourist attractions.



QUICK QUIZ 2

- Mt Ruapehu lies on the _____ plate.
 To the east of Mt Ruapehu is the _____ plate.
 Mt Ruapehu was formed _____ years ago.
 Mt Ruapehu has continued to erupt. The most recent eruption was in _____.
 Mt Ruapehu is called a _____ volcano.

ACTIVITY 3 – TERRACES (PAGES 37–38)

How were the Pink and White Terraces formed?

DESCRIBE what the Pink and White Terraces at Tarawera looked like. Consider including a sketch.

DESCRIBE what role the Pink and White Terraces played in early tourism in New Zealand

How were the terraces destroyed?

Return to your map of the volcanoes of the North Island.

Use pages 47–66 to find key facts to annotate the following volcanoes:

- | | |
|------------------------|-----------------|
| Tongariro | Auckland |
| Ruapehu | Taupo |
| Ngauruhoe | Banks Peninsula |
| Whakaari/ White Island | Rotorua |
| Taranaki | |

TIP Use the 'fact files' at the end of each of the volcano sections to find important facts to annotate your map

ACTIVITY 4 – MATCH THAT FACT

Temperature of the inner core

25–70 km

1000

Temperature of the outer core

2007

Temperature of the mantle

5–10 km

The thickness of the continental crust

4800

The thickness of the oceanic crust

250,000

The number of years since the first eruption of Mt Ruapehu

7000

When Mt Ruapehu last erupted

TOPIC LIVING WITH VOLCANOES (PAGES 39-43)

ACTIVITY 1

WRITE A PAMPHLET informing people of the dangers to be aware of when visiting volcanic areas. Include reasons to be cautious and recommended precautions.

Copy and complete the chart to show how thermal areas are used in the following areas:

Energy	Tourism	Rocks	Chemicals

ACTIVITY 2

WRITE A PARAGRAPH summarising the Earth's structure. Begin with: 'The Earth is made up of four layers ...'

See if you can do it in ten sentences.

Use lots of **detail** (e.g. temperature, thickness, etc.)

QUICK QUIZ 3

How many layers does the Earth have?
 How hot is the inner core?
 What are the names of the two types of crust?
 Which type of crust is more dense (heavy)?
 What happens to something that is heated?
 What happens to something that is cooled?
 What would happen to you if you tried to walk on something that had NO friction?

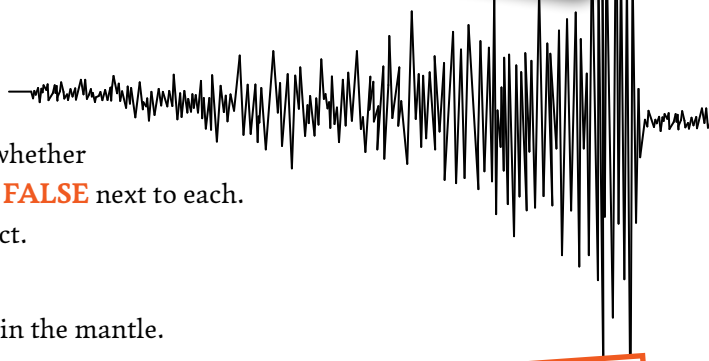
TOPIC EARTHQUAKES

ACTIVITY 1

COPY THESE STATEMENTS. Decide whether each statement is true or false and write **TRUE** or **FALSE** next to each.

If FALSE, explain why the statements are incorrect.

- The earth's core is made up of magma.
- Plate movement causes convection currents in the mantle.
- Most earthquakes occur next to plate boundaries.
- An earthquake is the sudden release of stress energy.
- Secondary waves travel faster than primary waves.
- Transform/conservative plate boundaries usually produce shallow earthquakes.



TOPIC HOW EARTHQUAKES HAPPEN (PAGES 74-77)

Pressure
Crust
Transform
Float
Rock

Australian
Convection currents
Pacific
Northeast

Faultlines
Rock
Energy
Alpine
Directions

ACTIVITY 1

FILL IN THE BLANKS using the **word bank**.

Heated _____ rises towards the surface, then cools and sinks causing _____.

The _____ is broken into tectonic plates that _____ on and move with the convection currents. Earthquakes mostly occur where two _____ meet, or a plate boundary. New Zealand sits on the boundary of the _____ and _____ plates, and the type of boundary is a _____ boundary where the two plates are moving in different _____ past each other.

The _____ Fault runs through the South Island. The Pacific Plate is moving southwest, while the Australian Plate is moving _____. The stress of this movement causes the crust to break or fault, creating _____. Tectonic movement builds _____ along the faultlines. Sudden movement of the fault releases the stored pressure or _____ as seismic waves and an earthquake occurs.

TOPIC MEASURING AN EARTHQUAKE (PAGES 78-77)

DISCUSSION

- What is the Richter Scale?
- When and why was it replaced with the Moment Magnitude Scale?
- What is the Mercalli Scale and why do more scientists use it as a reference?

Richter Scale

How many times more powerful is a magnitude 9 earthquake compared to a

- a. Magnitude 8 earthquake?
- b. Magnitude 6 earthquake?
- c. Magnitude 3 earthquakes?

Modified Mercalli Scale

At what level of the Modified Mercalli Scale would you expect:

- d. Hanging objects to swing?
- e. People to be afraid?
- f. A civil emergency to be declared for the affected area?

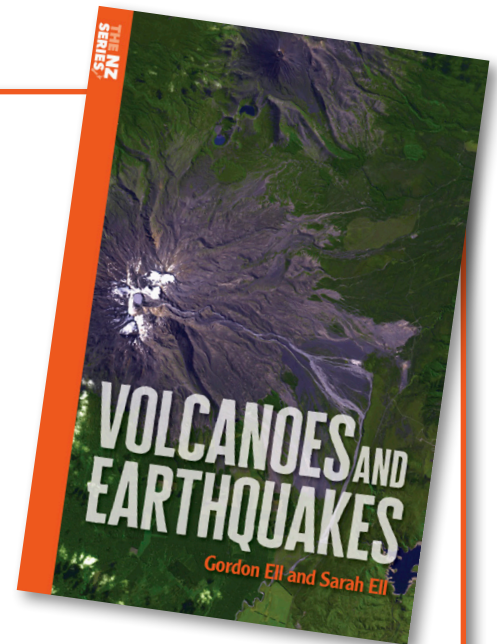
TOPIC EARTHQUAKES IN THE SHAKY ISLES (PAGES 87-98)

In groups, divide up the different case studies in this chapter. For each one, **COMPLETE THE TABLE** to show how it happened, the level of impact, the effects on place, and the effects on people. Consider adding illustrations to your notes as well as specific information.

	How it happened	Level of impact	Effects on place	Effects on people
1931 Napier Earthquake				
2010 and 2011 Canterbury Earthquakes				
2016 Kaikoura Earthquake				

USING THIS RESOURCE IN THE AOTEAROA NEW ZEALAND CLASSROOM

This resource is anticipated to be most helpful for use in the Year 11 **Geography** curriculum, in particular to support both AS 91007 – Demonstrate Geographic understanding of environments that have been shaped by extreme natural event(s), and the refreshed standard AS91934 – Demonstrate understanding of how aspects of natural processes shape an environment. It could also be used in Science classrooms for Year 10 students as part of level 5 of the **Science** curriculum.



UNDERSTAND

The material covered is particularly relevant to the Big Ideas of the refreshed Geography curriculum, addressing how the taiao/earth is shaped by natural processes, and how people and place are connected. It also addresses the current Science curriculum strands of Making Sense of Planet Earth and Beyond, and Making Sense of the Physical World, which require students to ‘investigate the composition of planet Earth and gain an understanding of the processes which shape it; investigate the geological history of planet Earth and understand that our planet has a long past and has undergone many changes’. At Level 5 of the curriculum students can examine earthquakes, volcanoes and plate tectonics as a part of these strands.

KNOW

The material will allow students to be able to examine the following key Thinking in the refresh of the Geography curriculum:

- tease out cause and effect connections in physical and human environments
- understand the relationship between geography and indigenous knowledges
- acknowledge global geographic practices and processes, and consider these within the idea that environments shape people and people shape environments.

DO

The activities in this resource encourage students to think conceptually, communicate ideas using geographic terminology, use maps to process information, use data to draw conclusions about processes that shape natural and cultural environments, and write concise summaries. It is not envisioned that students would necessarily complete every single task in this resource — rather it is left to the teacher to decide how best their akonga learn, giving flexibility to be used in a range of ways and for a range of purposes.



THE NZ
SERIES

Introducing New Zealand society,
history, science and geography
to general readers and students.

*Answers to scramble activity: magma; mantle; core; crust; tectonic; volcanic.