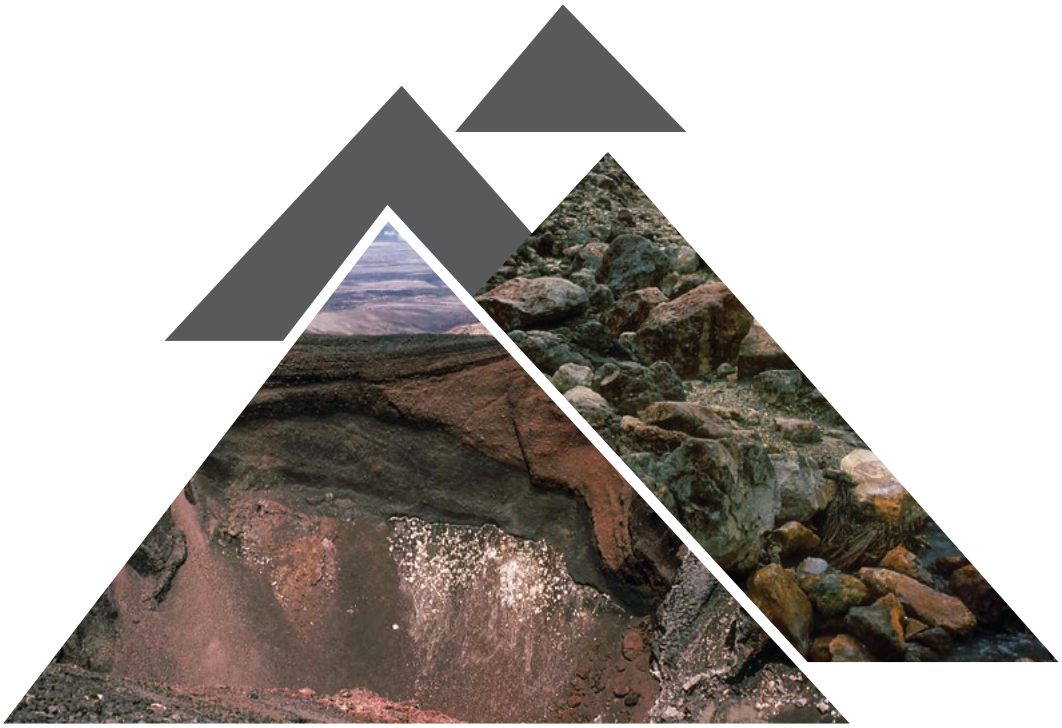
SECTION 7

APPENDIX



Red Crater and Ketetahi Hot Springs. *Photos: Janette Asche*

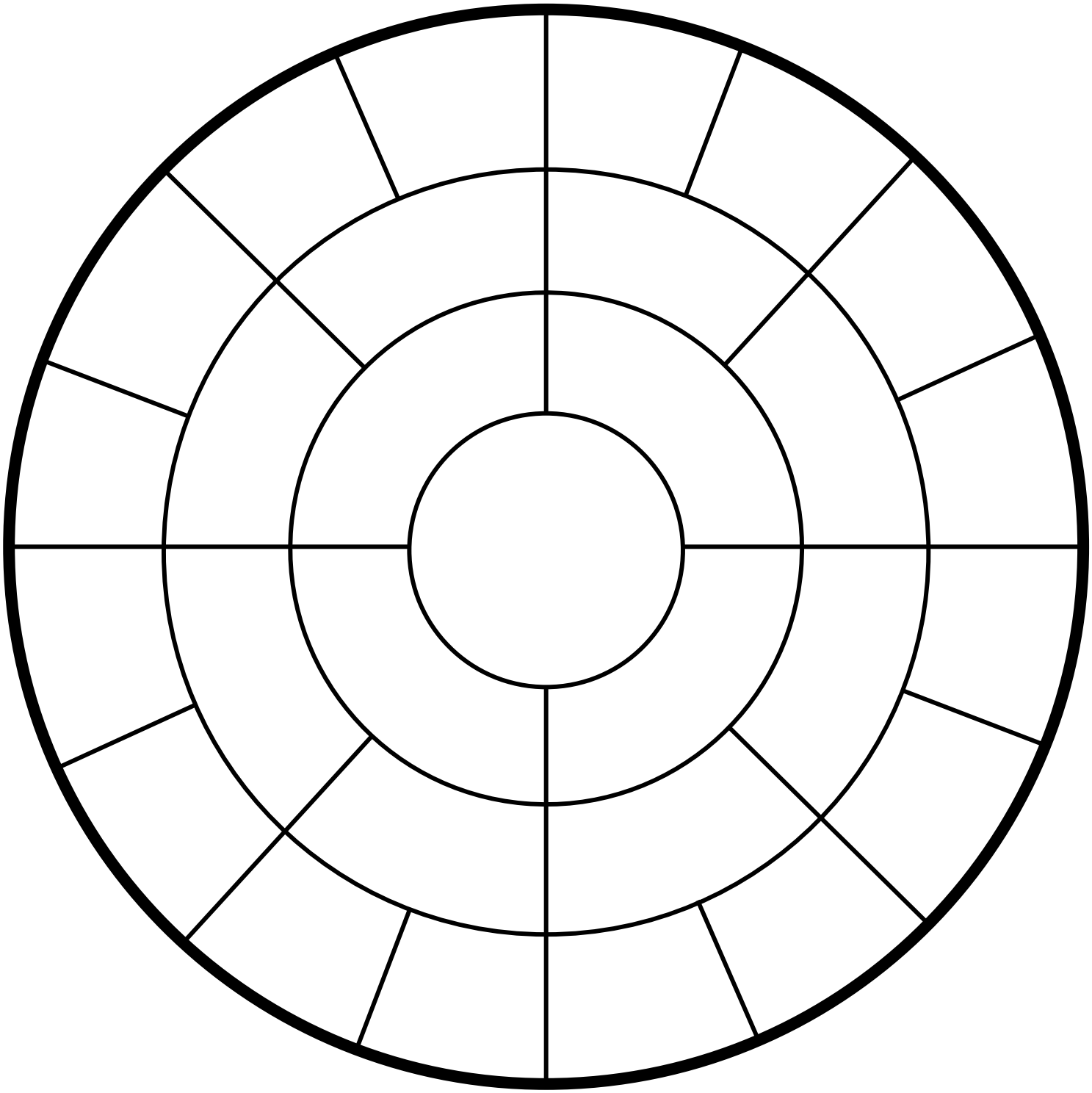
COOPERATIVE GRID WORKSHEET

Find activity instructions in Section 2, page 4.

QUESTIONS	ME	OTHERS	OTHERS	OTHERS
Some facts I know about the history of Tongariro National Park				
Some facts I know about what visitors can do in the park				

CONSEQUENCE WHEEL

Find activity instructions in Section 2, page 6.



SAY-IT GRIDS

Find activity instructions in Section 2, page 7.

Say-it Grid 1

1. Number yourselves 1–4.
2. Imagine it is the 1970s in New Zealand.
3. Look at your role from the numbered box. Your task is to speak for 2 minutes as that person.
4. Spend time during the next 2 days researching your part and practising your speech. What might your character want right now? In the future? What are the values and attitudes that affect their actions? Decide how you will speak from that person's perspective.
5. At the given time, you will each have 2 minutes to speak, uninterrupted by any other speaker. Each person may ask one question each after the speaker has finished.

1. You are Jane, a keen skier who has returned from Europe eager to see more facilities at Whakapapa.	2. You are George, the owner of a motel keen to see more people coming to the mountain all year-round.
3. You are Natana, a local who has close iwi ties to the mountain and is keen to see it under Māori management.	4. You are Mary, a botanist, concerned about the effect of construction and more visitors on the flora of the mountain.

Say-it Grid 2

1. Number yourselves 1–4.
2. Imagine it is the 1970s in New Zealand.
3. Look at your role from the numbered box. Your task is to speak for 2 minutes as that person.
4. Spend time during the next 2 days researching your part and practising your speech. What might your character want right now? In the future? What are the values and attitudes that affect their actions? Decide how you will speak from that person's perspective.
5. At the given time, you will each have 2 minutes to speak, uninterrupted by any other speaker. Each person may ask one question each after the speaker has finished.

1. You are John, a member of Parliament keen to see New Zealand have a World Heritage site.	2. You are Hazel, the owner of a motel keen to see more people coming to the mountain year-round.
3. You are Rangimarie, a local who has close iwi ties to the mountain and is unsure of what World Heritage status will mean.	4. You are David a keen hunter who would like more open access within the park.

Say-it Grid 3

1. Number yourselves 1–4.
2. Imagine it is the 1970s in New Zealand.
3. Look at your role from the numbered box. Your task is to speak for 2 minutes as that person.
4. Spend time during the next 2 days researching your part and practising your speech. What might your character want right now? In the future? What are the values and attitudes that affect their actions? Decide how you will speak from that person's perspective.
5. At the given time, you will each have 2 minutes to speak, uninterrupted by any other speaker. Each person may ask one question each after the speaker has finished.

1. You are John, a keen tramper who wants to see more walking tracks and other areas without tracks opened up for trampers	2. You are Tom, a motel-owner keen to build more units and see more people coming to the mountain year-round.
3. You are Lee, a tourist from China keen to stay several days to go tramping and learn to ski	4. You are Sue, a zoologist concerned about the effect of more visitors, particularly walkers, on the fauna and flora of the mountain

Say-it Grid 4

1. Number yourselves 1–4.
2. Imagine it is the 1970s in New Zealand.
3. Look at your role from the numbered box. Your task is to speak for 2 minutes as that person.
4. Spend time during the next 2 days researching your part and practising your speech. What might your character want right now? In the future? What are the values and attitudes that affect their actions? Decide how you will speak from that person's perspective.
5. At the given time, you will each have 2 minutes to speak, uninterrupted by any other speaker. Each person may ask one question each after the speaker has finished.

1. You are Frank, the president of a skiing club arguing for your club's historical rights to keep their hut on the mountain.	2. You are Tom, a motel-owner who has been told his motel must be demolished as there is to be no accommodation, apart from the Chateau, on the mountain.
3. You are Brian, a tourist from China keen to stay several days to go tramping and learn to ski.	4. You are Rachel, a DOC ranger concerned about the waste issue on the mountain. You want to increase visitor awareness about the 'pack in, pack out' message.

Say-it grid 5

1. Number yourselves 1–4.
2. Imagine it is 2017 in New Zealand.
3. Look at your role from the numbered box. Your task is to speak for 2 minutes as that person.
4. Spend time during the next two days researching your part and practicing your speech. What might your character want right now? In the future? What are the values and attitudes that affect their actions? Decide how you will speak from that person's perspective.
5. At the given time, you will each have two minutes to speak, uninterrupted by any other speaker. Each person may ask one question each after the speaker has finished.

1. You are Bruce, a keen deer hunter worried that using 1080 will mean there are no deer for him to shoot.	2. You are Tama, a DOC ranger, keen to see native species protected and feel that 1080 is the most cost-effective tool for controlling pests in large, inaccessible areas.
3. You are Mary, and you want to be able to walk your dogs in areas of the park.	4. You are Sue, a University student studying biology, concerned about whio and kiwi in the park.

Find activity instructions in 'People and Alpine Environments' in Section 2, page 9.

Perspectives on Tongariro National Park

Tourism is good for the area, it brings employment and money to the area. New developments mean more interim jobs but also new permanent jobs once the buildings and activities are established. I have five kids to feed I need to think about myself.

Richard Smith: Builder

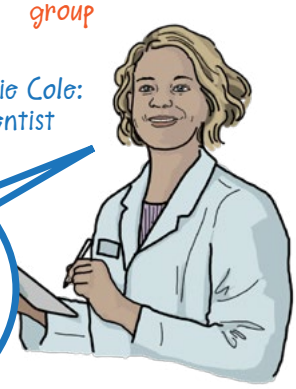
At present issues of conservation are far more pressing than issues of development. We should be looking at protecting our native flora and fauna, not destroying their habitats.

Local Environmental group

Judy O'Connor: Skier

Skiers have been enjoying the slopes of the park since the early 1900s and we need more space. If the park opened more land up for development more tourists would come it's that simple. At present most of the most desirable ski areas are only available via helicopter for those willing to pay the price.

Rosie Cole: Scientist

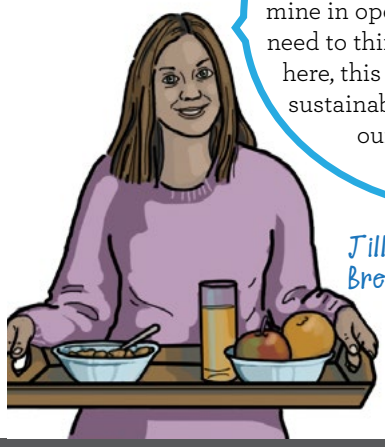


The mountains can tell us so much about past volcanic eruptions, past climate and processes occurring deep within the Earth. Once we understand this, we can be more prepared for future events and help protect the people who live on, visit and depend on both the mountains and the plains below.

We want to see people enjoy the mountain, but we do not want it desecrated. As kaitiaki, our role is to protect the mauri of this place and keep our connections with it strong. We work to protect the air, water, land, native plants and animals and the health of our people. Our belief is that we must look to the past to help make good decisions for future generations.

Local Iwi representative

When tourists visit the park, they invest in the local economy. This has a flow on effect that keeps small businesses like mine in operation. Although, we do need to think about the wider picture here, this development needs to be sustainable to ensure that we keep our clean green image



Jill: Local Bed and Breakfast Owner

We have been learning about unique plants and animals that live in the park. Some of them are only found in New Zealand!! They should be protected. .

Local school students

CUT AND PASTE VOLCANIC INFORMATION

Find activity instructions in Section 2, page 10.

Volcanoes in New Zealand are formed when magma is produced as the Pacific Plate is forced below the Indo-Australian plate. This process is known as subduction.

Tongariro means ‘fire carried away’ or ‘seized by the cold south wind’.

Altitude, steep slopes, ‘fresh’ volcanic material and erosion prevent vegetation growing on most parts of the Tongariro complex.

Pyroclastic falls and flows, andesite lava flows, blocks and bombs are widespread over the volcanic complex.

Mt Tongariro is monitored by 5 seismographs, 3 microphones, chemical analysis of water and gases, 5 continuous GPS stations, and 2 web cameras facing the northern flank and Te Maari Crater, all used to observe activity.

There are 3 types of volcanoes. The third group of volcanoes or ‘andesitic volcanoes’ contain magma that is intermediate in viscosity and explosiveness. These volcanoes usually erupt both volcanic ash (fragmented magma and rock) and lava, forming composite (layered) cone-shaped mountains such as Mounts Taranaki, Ruapehu, Tongariro and Ngauruhoe.

Tongariro is a massive complex of cones formed by eruptions from at least 12 vents over more than 275,000 years.

This area is created by subduction of the Pacific Plate below the Indo-Australian Plate. The Earth’s crust is stretched and thinned in the entire Taupo Volcanic Zone by the movement of the plates.

The Taupo Volcanic Zone is extremely active on a world scale and includes three frequently active cone volcanoes: Ruapehu, Tongariro, Ngauruhoe

Tectonic plates are huge slabs of the Earth’s crust that float on the hot, partially molten rock of the underlying mantle.

As the plates move around, they split apart at mid-ocean ridges, creating new crust; in other areas they collide.

Mt Ruapehu, now the highest point in the North Island, first became volcanically active at least 250,000 years ago. It has hazardous eruptions every 10 years on average. The active vent is occupied by Crater Lake, a hot, acidic lake near the summit.

Tongariro is New Zealand’s oldest national park and a dual World Heritage area. This status recognises the park’s important Māori cultural and spiritual associations as well as its outstanding volcanic features.

Ngauruhoe is the youngest cone at 2,500 years old and is the most active vent.

Tongariro is an active stratovolcano (also called a composite cone volcano). It is made up of alternating layers of pyroclastic material and mainly andesite lava flows.

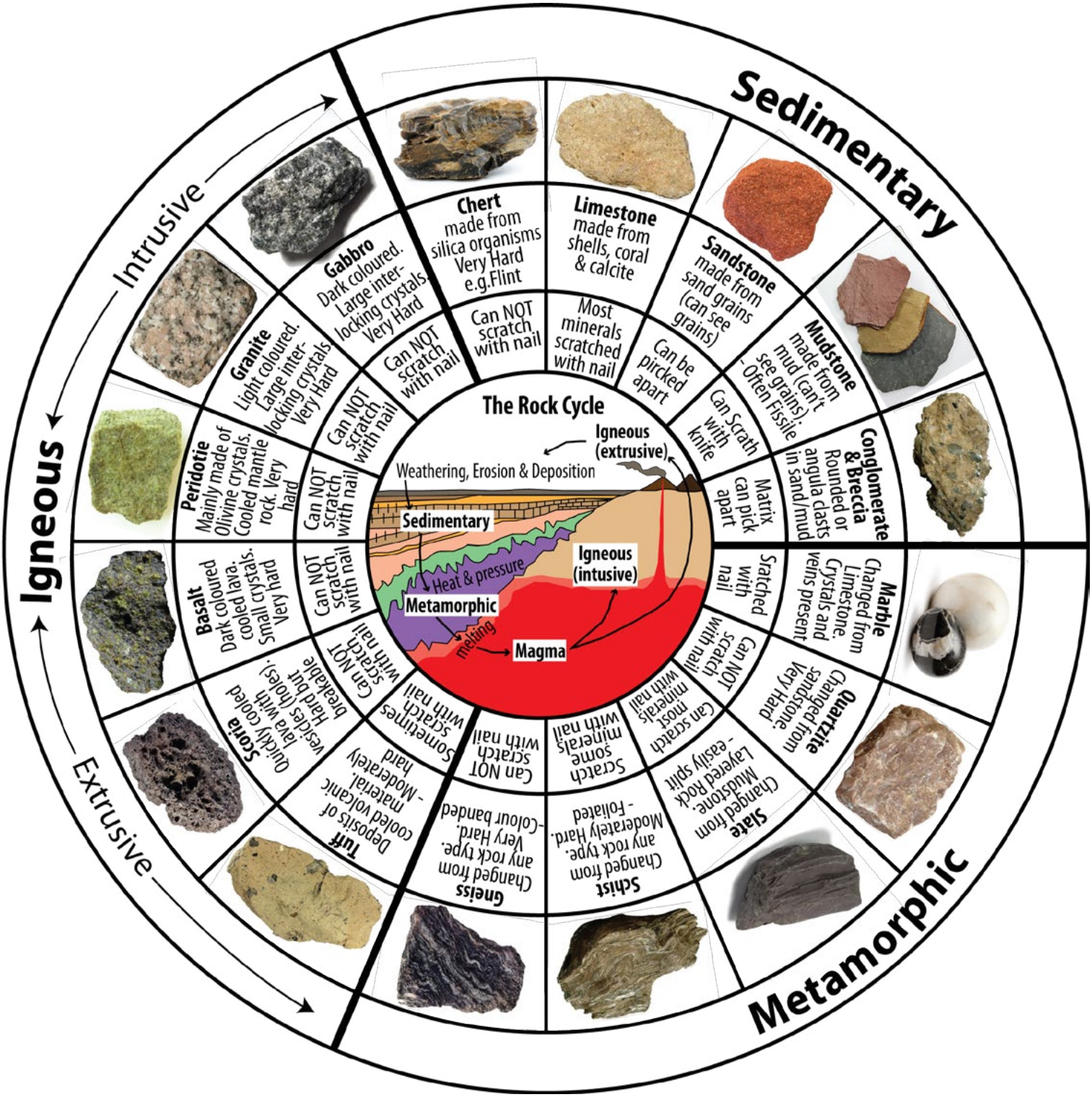
Plate tectonics explain why the New Zealand volcanoes are part of a long chain of active volcanoes known as the ‘Pacific Ring of Fire’.

The latest Ruapehu eruptions were from 1995–98. in 1945, water in Crater Lake was expelled by a rising dome of lava. This was then destroyed by violent explosions, generating ash that fell as far away as Wellington (250 km). Within 7 years, water had refilled the crater.

On 24 December 1953, a debris dam near the lake outlet collapsed, sending an ash-laden lahar (volcanic debris mud flow) down the Whangaehu valley. The lahar swept away the Tangiwai rail bridge, causing a train to plunge into the swollen river, killing 151 people.

WHAT ROCKS WHAT?

Find activity instructions in Section 2, page 10.



What rocks what? information table.

General rock type	Texture – average size of minerals	General colour	Any other features	Rock name
IGNEOUS ROCKS Interlocking homogenous crystalline texture – no preferred orientation to the mineral grains	Fine grained Extrusive, volcanic	Felsic – Light coloured	Often shows flow banding	**Rhyolite**
		Intermediate	Often green in colour	**Andesite**
		Mafic – Dark coloured	Sometimes contains green crystals called olivine	**Basalt**
	Medium grained Dikes, sills, etc.	Intermediate	Some crystals	**Dacite**
		Mafic – Dark coloured	Larger crystals of mainly quartz	**Diabase**
	Coarse grained Generally intrusive	Felsic – Light coloured	Very hard and often pinky	**Granite**
		Intermediate	Speckled black and white	**Diorite**
		Mafic – Dark coloured	Speckled black with little white	**Gabbro**
		Ultramafic	Lots of green crystals called olivine	**Peridotite**
	Glassy	Dark to black	Black glass	**Obsidian**
	Frothy/vesicular	Felsic – Light coloured	Like meringue	**Pumice**
		Mafic – Dark coloured	Often has a reddy tinge	**Scoria**

What rocks what? information table.

General rock type	Texture – average size of minerals	General colour	Any other features	Rock name
SEDIMENTARY ROCKS **Consolidated detrital clasts, chemical precipitates and/or biological residue**	Coarse fragments	Varied	Rounded clasts (one or many types of rock)	**Conglomerate**
		Varied	Angular clasts (one or many types of rock)	**Breccia**
	Sand-sized fragments	Varied	Clean quartz or feldspar i.e. like sand	**Sandstone**
		Varied but often a grey colour	Dirty w/rock fragments & clay	**Greywacke**
	Fine grained – cannot see individual clasts	Varied but often grey	Non-foliated but often fissile	**Siltstone**
		Varied but often grey	Foliated i.e. very compact	**Shale**
	Chemical – fine grain	Varied depending on how pure the limestone is Pure – white Non-pure – grey	Soft – passes fizz test contains calcite from lots of fossil fragments	**Limestone**
		Varied depending on how pure the limestone is Pure – white Non-pure – grey	Soft – passes fizz test contains calcite from lots of fossil fragments	**Chert**
	Fossiliferous	Varied	Mostly shell fragments	**Coquina**

What rocks what? information table.

General rock type		Texture – average size of minerals	General colour	Any other features	Rock name
METAMORPHIC ROCKS **Interlocking non-homogenous crystalline texture – commonly with a preferred orientation to the mineral grains**	FOLIATED	Very fine grained – no visible minerals	Mafic dull grey-green	Weakly foliated – think of slate	**Slate**
			Mafic grey to green but has a shimmer	Foliated, shiny due to incr. size of mica	**Phyllite**
		Medium to coarse grain	Mafic grey to green with shimmer and crystals	Individual mineral grains visible Strong foliation	**Schist**
		Colour banded	Alternating layers of light (felsic) & dark (mafic) minerals	Bands look like bedding made of crystals	**Gneiss**
		Distinct layering - often highly folded	Layers of felsic igneous rock (light) and mafic gneiss (dark)	Often very deformed	**Migmatite**
	NON-FOLIATED	Non-foliated, with non-oriented grains	Based on purity of host, for example pure limestone = white marble	Soft – passes fizz test	**Marble**
			Varied – based on host	Hard – fails fizz test	**Quartzite**
			Mafic – often green colour	Interlocking hornblende crystals	**Amphibolite**

Examples of how to describe a rock

Example 1: Sedimentary

The rock sample is an orange colour with patches of grey in places. The sample is well-sorted and the dominant grain-size is medium-grained (roughly 300 um). The grains are sub-rounded but fairly spherical.

The grains themselves are very hard and likely made of quartz. Grains however flake off from the sample when I run my fingers over them so the rock is not well-cemented. I do not see any examples of fossils and there is no layering within the rock so can be described at massive. Therefore, I believe a good name for this rock is:

– *A massive, well-sorted medium-grained sandstone*
– *Possible environment: Beach or lower regions of a river or delta.*

Example 2: Igneous

The rock sample is 90% mafic (dark-coloured) and 10% felsic (light-coloured). The crystals within the sample are too fine to see with the naked eye, meaning it has an aphanitic groundmass. There are green olivine phenocrysts and a small amount of felsic feldspar phenocrysts. No vesicles present. Therefore, I believe a good name for this rock is:

– *Olivine and minor feldspar- bearing basalt.*

Example 3: Metamorphic

This rock is 50% felsic and 50% mafic. The crystals are all angular but fairly uniform in shape and size (between 2–3mm in size). They are closely packed together. The crystals are in bands of light and dark so the texture is banded but bands are deformed. Therefore, a good name for this rock is:

– *Banded Gneiss.*

What rocks what? glossary

Felsic	a term used to describe a light-coloured rock.
Mafic	a term used to describe a dark-coloured rock.
Sorting	the arrangement of sediment within a rock. The rock is well sorted when all the clasts are the same size and poorly sorted if it contains fine-grained (small) material and pebble-sized clasts.
Clasts	a rock fragment formed by the breakdown of larger rocks.
Cemented	when all the pieces in the rock are well-glued together and not crumbly.
Matrix	the area of finer grained material around larger grains.
Lamination	a small-scale sequence of fine layers that is found in sedimentary rocks.
Massive	when the rock has no features present, for example, no lamination.
Graded bedding	a systematic change in clast size within a sedimentary unit.
Fissile	when a sedimentary rock is flaky.
Fossils	the remains or traces of an ancient living organism.
Silica organisms	organisms that build their skeletons from silica instead of carbon.
Quartz	a colourless to white felsic mineral with a vitreous lustre.
Biotite	a black pearly transparent mineral, that forms in thin sheets.
Feldspar	a white/grey or pink mineral; similar to quartz but has twinning.
Olivine	a light green mineral found in Igneous rocks.
Aphanitic groundmass	when the crystals are too small to see with the naked eye.
Phenocryst	a crystal distinctly larger than the rest of the grains that make up the rock groundmass within an igneous rock.
Vesicles	holes made by bubbles of gas when the volcanic rock was erupting.
Foliation / Foliated	repetitive layering in metamorphic rocks. Each layer may be as thin as a sheet of paper, or over a metre in thickness.

Project planning inquiry cycle

1. Identify an issue

- What do you already know?
- What learning have you already done that will be useful to use?

2. Ask the questions – find the underlying causes of your issue

- What questions do you need answers to?

3. Investigate – understand the issue better

- Find out more information.
- Sort and organise the information you collate.

4. Extend your thinking

- What haven't you already thought about?
- Who else could help?
- Where would you find information from a different perspective?

5. Decide on meaningful, effective action

- What are you going to do? Why?
- How will it benefit the environment?
- Set goals and have a common vision.

6. Plan your environmental action

- How are you going to do this?
- What do you need?
- Who can help?
- When will it be done?

7. Implement your action – working alongside your community

8.Monitor and review

- What worked? What didn't?
- What would you do differently next time?
- What new learning have you done?
- Was your action successful? How?

9. Share your action successes and next steps

Note: sharing can happen at any stage of your action project. It can be worthwhile sharing your action plans with your community at the start of your project, to encourage people to support you.