National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Exemplar for Internal Achievement Standard

Earth and Space Science Level 2

This exemplar supports assessment against:

Achievement Standard 91189

Investigate geological processes in a New Zealand locality

An annotated exemplar is an extract of student evidence, with a commentary, to explain key aspects of the standard. It assists assist teachers to make assessment judgements at the grade boundaries.

New Zealand Qualifications Authority

To support internal assessment

	Grade Boundary: Low Excellence
1.	For Excellence, the student needs to investigate comprehensively geological processes in a New Zealand locality. This involves discussing the link between plate tectonics and the rock cycle that have formed the rocks in a named locality, and linking this to the erosional forces that shape the current landforms in a named locality. This student has identified the key rock in the area, andesite, as an igneous rock, and explained how this rock was formed during plate tectonics (1). They have also given a comprehensive explanation as to how lahars are an erosional force on the shape of Mount Taranaki. There is a link between plate tectonic forces and erosional forces contributing to the final over steepened shape of Mount Taranaki (2). For a more secure Excellence, the student could explain in depth how Mount Taranaki is a combination of plate tectonic forces and erosional forces, and explain the way in which they contribute to the final shape. For example, the student could talk about the high erosive nature of a lahar over steepening the high cone.

The geology of Mount Taranaki/Egmont

Introduction:

In Māori *tara* means mountain peak and *naki* is thought to come from *ngaki* meaning shining - referring to the mountain's winter snow cover.

This volcanic peak stands in isolation to the west of the Central North Island volcanoes. At 2,518 metres high, it is the second highest peak in the North Island after Mount Ruapehu, and is New Zealand's largest mainland volcanic cone by volume.

It is a stratovolcano (also called a composite cone volcano) made of layers of mostly andesite lava flows and pyroclastic (ash) deposits. The summit crater is filled with ice and snow and has a lava dome in the centre. There is a secondary cone called Fantham's Peak on the south side. Volcanic debris from lahars and landslides covers the plains around the volcano. Past huge landslides have reached as far as 40km from the cone, with lava reaching 7 km and pyroclastic flows 15 km from the vent.

Taranaki began erupting about 130,000 years ago, with large eruptions occurring on average every 500 years and smaller eruptions about 90 years apart. An explosive medium-sized ash eruption occurred around 1755 AD and minor volcanic events (creation of a lava dome in the crater and its collapse) occurred in the 1800's. The last major eruption was around 1655 AD. (1)

At present the mountain is considered to be a "sleeping" active volcano that is likely to erupt again. There are significant potential hazards from lahars, debris avalanches, and floods.

The igneous rocks of Mount Taranaki and their origin.

Mount Taranaki is made up of an igneous rock called andesite. Andesite is a fine-grained volcanic rock that is found in stratovolcanic form volcanoes. These volcanoes have steep sides and look like how volcanoes are drawn.

Andesite is a mixture rock made where a subducting plate dips under a continental plate. For Mount Taranaki the subducting plate is the Pacific oceanic plate moving in a westerly direction and it dips under the Australian continental plate. As the Pacific plate moves westward it sinks under the Australian plate and as it sinks the rock melts as the temperature rises. The rock type on the subducting plate is basalt. As the basalt melts it rises as the density is reduced. As it rises to the surface it meets the solid continental rock and is trapped there. The heat from the molten basalt is transferred to the continental rock and helps to melt it. Molten continental rock melts to rhyolite. The molten rocks of basalt and rhyolite mix together and end up making andesite. This andesite migrates along the Egmont Fault and erupts to the surface at Mount Taranaki. (1)

Andesitic volcanoes produce lava that is fairly viscous and does not travel far. The maximum lava flow on Mount Taranaki is about 15 km long. Andesitic volcanoes are quite high and have steep sides because of the thick lava. When the volcano is not erupting lava it erupts ash deposits so the mountain is layered with ash layers and lava flows. The ash deposits are very weak. So the key shape of Mount Taranaki is a step sided volcano.

Lahars as an erosional force that helps shape Mount Taranaki.

Mount Taranaki is famous for its lahars. Much of the landscape around the volcano is the result of lahars. Lahars are where ice and snow are melted during an eruption and lubricate the unstable rocks which slip down the steep sided volcano and rush out over the landscape.

Lahars move at fast speeds due to the water content and because they carry lots of rocks and boulders they are strong erosive agents. On Mount Taranaki they have over-steepened the upper slopes of the volcano making them unstable for when the next eruption occurs.

Lahars are a real concern for future eruptions and since Mount Taranaki could erupt at any time in the future damage from lahars is a major concern. Lahars are extremely dangerous in New Zealand. They can travel up to 40km from the vent area. (2)

	Grade Boundary: High Merit
2.	For Merit, the student needs to investigate in depth geological processes in a New Zealand locality. This involves explaining the plate tectonics and rock cycle processes that have formed the types of rocks in a named locality, and explaining the erosional processes that have shaped the current landforms in the named locality. The locality investigated is Mount Taranaki. This student has identified the key rock in the area, andesite, as an igneous rock, and explained how this rock was formed during plate tectonics (1). There is also an explanation as to how the lahars are an erosional agent on Mount Taranaki (2). To reach Excellence, the student could describe the link between the erosional force of lahars and plate tectonic forces in the formation of the volcano. These forces have combined to create the landscape features we see today at Mount Taranaki.

The geology of Mount Taranaki/Egmont

The igneous rocks of Mount Taranaki and their origin.

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Andesite is a mixture rock made where a subducting plate dips under a continental plate. For Mount Taranaki the subducting plate is the Pacific oceanic plate moving in a westerly direction and it dips under the Australian continental plate. As the Pacific plate moves westward it sinks under the Australian plate and as it sinks the rock melts as the temperature rises. The rock type on the subducting plate is basalt. As the basalt melts it rises as the density is reduced. As it rises to the surface it meets the solid continental rock and is trapped there. The heat from the molten basalt is transferred to the continental rock and helps to melt it. Molten continental rock melts to rhyolite. The molten rocks of basalt and rhyolite mix together and end up making andesite. This andesite migrates along the Egmont Fault and erupts to the surface at Mount Taranaki. (1)

Andesitic volcanoes produce lava that is fairly viscous and does not travel far. The maximum lava flow on Mount Taranaki is about 15 km long. Andesitic volcanoes are quite high and have steep sides because of the thick lava. When the volcano is not erupting lava it erupts ash deposits so the mountain is layered with ash layers and lava flows. The ash deposits are very weak. So the key shape of Mount Taranaki is a step sided volcano.

Lahars as an erosional force that helps shape Mount Taranaki.

Mount Taranaki is famous for its lahars. Much of the landscape around the volcano is the result of lahars. Lahars are where ice and snow are melted during an eruption and lubricate the unstable ash deposits and weathered rocks which slip down the steep sided volcano and rush out over the landscape. This erosive force is caused when ice melts on the crater and water lubricates the unstable rocks. These lahars move fast and form deep gullies over the mountain. (2)

Lahars are a real concern for future eruptions and since Mount Taranaki could erupt at any time in the future damage from lahars is a major concern. They can travel up to 40km from the vent area.

	Grade Boundary: Low Merit
3.	For Merit, the student needs to investigate in depth geological processes in a New Zealand locality. This involves explaining the plate tectonics and rock cycle processes that have formed the types of rocks in a named locality, and explaining the erosional processes that have shaped the current landforms in the named locality. The locality investigated is Mount Taranaki. This student has identified the key rock in the area, andesite, as an igneous rock, and explained how this rock was formed during plate tectonics. (1) There is also a simple explanation as to how past lahars acted as an erosional force on Mount Taranaki (2). For a more secure Merit, the student could explain in depth how lahars are formed and have contributed to the shape of Mount Taranaki that we see today.

The geology of Mount Taranaki/Egmont

The igneous rocks of Mount Taranaki and their origin.

Mount Taranaki is made up of an igneous rock called andesite. Andesite is a fine-grained volcanic rock that is found in stratovolcanic form volcanoes. These volcanoes have steep sides and look like how volcanoes are drawn.

Andesite is a mixture rock made where a subducting plate dips under a continental plate. For Mount Taranaki the subducting plate is the Pacific oceanic plate moving in a westerly direction and it dips under the Australian continental plate. As the Pacific plate moves westward it sinks under the Australian plate and as it sinks the rock melts as the temperature rises. The rock type forming on the subducting plate is andesite. This andesite migrates along the Egmont Fault and erupts to the surface at Mount Taranaki. Many of the volcanoes in the North Island erupt andesite that has been formed by the subducting plate.

Andesitic volcanoes produce lava that is fairly viscous and does not travel far. The maximum lava flow on Mount Taranaki is about 15 km long. Andesitic volcanoes are quite high and have steep sides because of the thick lava. When the volcano is not erupting lava it erupts ash deposits so the mountain is layered with ash layers and lava flows. The ash deposits are very weak. So the key shape of Mount Taranaki is a step sided volcano. (1)

Lahars as an erosional force that helps shape Mount Taranaki.

Mount Taranaki is famous for its lahars. Much of the landscape around the volcano is the result of lahars. Lahars are where the glacier on the mountain top is melted and the water rushes down the mountain slope It forms steep gullies on its way to the sea. Lahars form during an eruption and are a mixture of ash, water and rocks. They move at high speeds and will affect transport. (2) Lahars are a real concern for future eruptions and since Mount

Taranaki could erupt at any time in the future. Damage from lahars is a major concern. They can travel up to 40 km from the vent area and end up in the sea.

	Grade Boundary: High Achieved
4.	For Achieved, the student needs to investigate geological processes in a New Zealand locality. This involves: • identifying the types of rock(s) found in a named locality • describing how plate tectonics and rock cycle processes have formed the rocks found in the locality • describing the erosional processes that have shaped the current landforms in the locality. The locality investigated is Mount Taranaki. This student has identified the key rock in the area, andesite, as an igneous rock, and explained how this rock was formed during plate tectonics (1). There is also description of how lahars are an erosional force on Mount Taranaki (2). To reach Merit, the student could explain how a lahar is a major erosive force that has contributed to the shape of Mount Taranaki as we see it today.

The geology of Mount Taranaki/Egmont

The igneous rocks of Mount Taranaki and their origin.

Mount Taranaki is made up of an igneous rock called andesite. Andesite is a fine-grained volcanic rock that is found in stratovolcanic form volcanoes. These volcanoes have steep sides and look like how volcanoes are drawn.

Andesite is a mixture rock made where a subducting plate dips under a continental plate. For Mount Taranaki the subducting plate is the Pacific oceanic plate moving in a westerly direction and it dips under the Australian continental plate. As the Pacific plate moves westward it sinks under the Australian plate and as it sinks the rock melts as the temperature rises. The rock type forming on the subducting plate is andesite.

Andesitic volcanoes produce lava that is fairly viscous and does not travel far. The maximum lava flow on Mount Taranaki is about 15 km long. Andesitic volcanoes are quite high and have steep sides because of the thick lava. When the volcano is not erupting lava it erupts ash deposits so the mountain is layered with ash layers and lava flows. The ash deposits are very weak. (1)

Lahars as an erosional force that helps shape Mount Taranaki.

Mount Taranaki is famous for its lahars. Much of the landscape around the volcano is the result of lahars. Lahars are where the snow on the mountain top is melted and the water rushes down the mountain slope. It forms steep gullies on its way to the sea. Lahars form a humpy land. (1, 2)

Lahars are a real concern for future eruptions and since Mount Taranaki could erupt at any time in the future damage from lahars is a major concern. They can travel up to 40 km from the vent area and end up in the sea.

	Grade Boundary: Low Achieved
5.	For Achieved, the student needs to investigate geological processes in a New Zealand locality. This involves: • identifying the types of rock(s) found in a named locality • describing how plate tectonics and rock cycle processes have formed the rocks found in the locality • describing the erosional processes that have shaped the current landforms in the locality. The locality investigated is Mount Taranaki. This student has identified the key rock in the area, andesite, as an igneous rock, and described how this rock was formed during plate tectonics (1). Lahars have also been identified as an important feature in Taranaki (2). For a more secure Achieved, the student could describe how lahars act as important erosive agent contributing to the shape of Mount Taranaki.

The geology of Mount Taranaki/Egmont

The igneous rocks of Mount Taranaki and their origin.

Mount Taranaki is made up of an igneous rock called andesite. Andesite is a fine-grained volcanic rock that is found in stratovolcanic form volcanoes. These volcanoes have steep sides and look like how volcanoes are drawn.

Andesite is a mixture rock made where the Pacific plate dips under the North Island. Andesite flows slowly. The rock type forming on the subducting plate is andesite and occurs due to melting of the Pacific plate. Andesite is erupted in a volcanic eruption.

Andesitic volcanoes produce lava that is fairly viscous and does not travel far. The maximum lava flow on Mount Taranaki is about 15 km long. Andesitic volcanoes are quite high and have steep sides because of the thick lava. When the volcano is not erupting lava it erupts ash deposits so the mountain is layered with ash layers and lava flows. The ash deposits are very weak. (1)

Lahars as an erosional force that helps shape Mount Taranaki.

Mount Taranaki is famous for its lahars. Much of the landscape around the volcano is the result of lahars. Lahars are where the snow on the mountain top is melted and the water rushes down the mountain slope causing erosion. It forms steep gullies on its way to the sea. Lahars form a humpy land. (2)

Lahars are a real concern for future eruptions and since Mount Taranaki could erupt at any time in the future damage from lahars is a major concern. They can travel up to 40 km from the vent area and end up in the sea.

	Grade Boundary: High Not Achieved
6.	For Achieved, the student needs to investigate geological processes in a New Zealand locality. This involves: • identifying the types of rock(s) found in a named locality • describing how plate tectonics and rock cycle processes have formed the rocks found in the locality • describing the erosional processes that have shaped the current landforms in the locality. The locality investigated is Mount Taranaki. This student has identified the key rock in the area, andesite, as an igneous rock, and described how this rock was formed during plate tectonics (1). To reach Achieved, the student could describe any erosive agent that operates on Mount Taranaki. Stream erosion, freeze-thaw and lahars are possible examples.

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