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Level 2 Earth and Space Science, 2018

91191 Demonstrate understanding of the causes of extreme Earth events in New Zealand

9.30 a.m. Thursday 8 November 2018
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of the causes of extreme Earth events in New Zealand.	Demonstrate in-depth understanding of the causes of extreme Earth events in New Zealand.	Demonstrate comprehensive understanding of the causes of extreme Earth events in New Zealand.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

A regional map showing locations referred to in the questions is on Page 16 of this booklet.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

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A regional map showing locations referred to in this paper is on page 16.

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QUESTION ONE: HAVRE SEAMOUNT ERUPTION 2012

In 2012 scientists identified a 400 square kilometre floating pumice raft, which came from the Havre Seamount, close to the Kermadec Trench. This group of 14 underwater volcanic vents erupted to form a caldera that is 4.5 kilometres in diameter.

Scientists found that the eruption of the silica-rich magma produced ash, lava domes, and seafloor lava flows underwater, in addition to the floating pumice raft on the surface.

https://eleanormvelasquez.files.wordpress.com/2015/02/kermadecarcimage.png

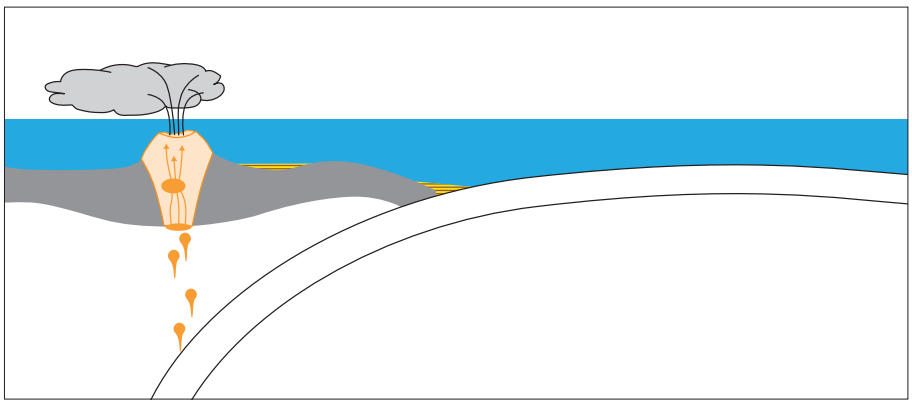
https://cdn.zmescience.com/wp-content/uploads/2018/01/4f2d246b51cee816f4176fb57ce2904d.jpg

Explain in detail why eruptions from underwater volcanoes close to the Kermadec Trench produce calderas and silica-rich volcanic products, such as pumice and rhyolitic lava domes and flows.

In your answer, you should:

- annotate the diagram below to describe how plate tectonics lead to underwater volcanoes
- describe how magma is formed in these underwater volcanoes
- explain how plate tectonics in this area can lead to the formation of underwater calderas
- explain the link between magma composition and the eruption products in this event.

Annotations added to the provided diagram below will assist your answer. You may also draw and annotate additional diagrams.



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More space for this answer is available on the following pages.

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QUESTION TWO: FIORDLAND – DUSKY SOUND EARTHQUAKE

On Wednesday 15 July 2009, a severe shallow earthquake struck along the edge of the Pacific and Australian plate boundaries. This quake was felt throughout the South Island and bottom of the North Island.

The earthquake's epicentre was in the transition zone, where the plate boundary changes **from a transform boundary (Alpine Fault) to a subduction zone (Puysegur Trench)**. Scientists accept that this earthquake was caused by the Australian Plate thrusting forward by up to 5 metres.

www.odt.co.nz/sites/default/files/styles/odt_portrait_medium_3_4/public/story/2016/04/_the_whole_house_was_moving__9753256994.jpg?itok=mvjlzoFH

Explain in detail how a rupture and its release of energy along the edges of this plate boundary could lead to a magnitude 7.8 earthquake.

In your answer, you should:

- annotate the diagram, including arrows, on the opposite page to describe ALL the plate tectonic movements associated with this earthquake
- explain how plate tectonics in this area cause earthquakes
- explain ALL of the plate movements associated with this earthquake.

Annotations added to the provided diagram showing ALL directions of movement will assist your answer. You may also draw and annotate additional diagrams.

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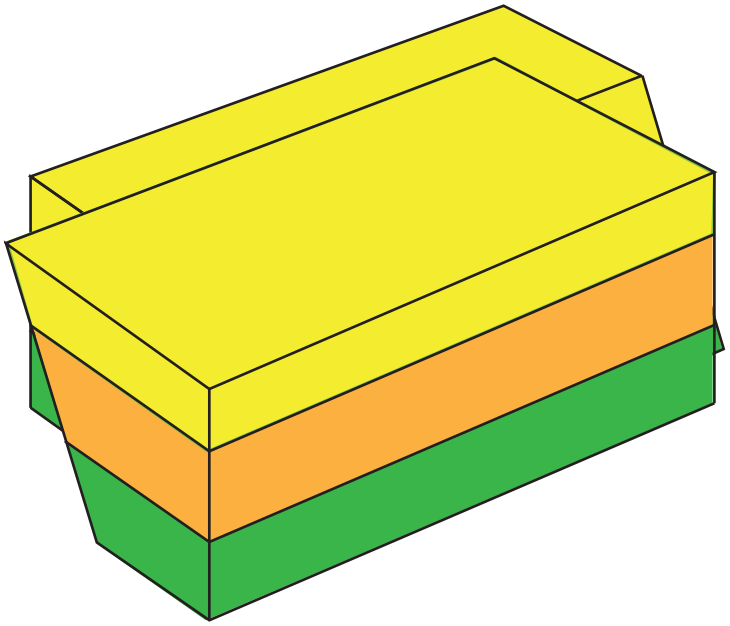

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QUESTION THREE: DOUBTFUL SOUND, FIORDLAND – LANDSLIDES AND TSUNAMIS

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A severe 7.2 magnitude earthquake occurred on 22 August 2003 at a depth of 24 kilometres. This generated over 200 landslides in the area covered by the map below. At least seven were major summit-to-valley floor landslides covering heights of up to 1500 metres.

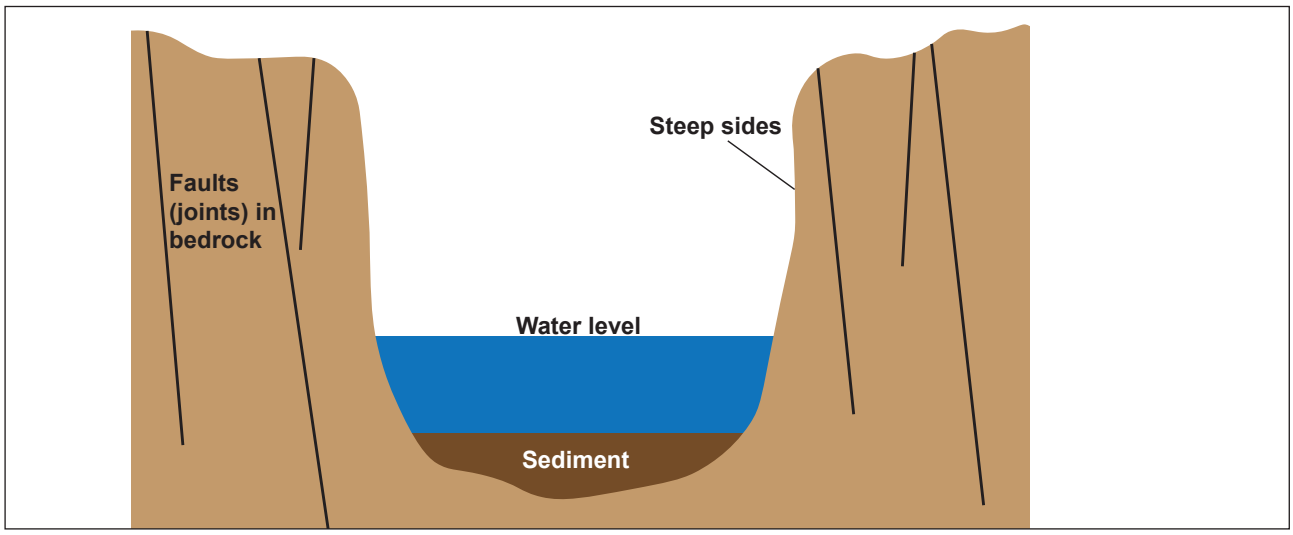
www.google.com/maps/ https://teara.govt.nz/en/photograph/6209/landslide-fiordland

Explain in detail how large summit-to-valley-floor landslides in this area produced localised tsunami waves, sometimes of large amplitude of up to 5 metres.

In your answer, you should:

- annotate the diagram below to describe how large landslides into a fiord can produce large-amplitude tsunamis
- explain how the amount of material displaced by the landslide affects the amount of water displaced
- explain how the height and width of the fiord affects the amplitude of the tsunami.

Annotations added to the provided diagram will assist your answer. You may also draw and annotate additional diagrams.



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Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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Write the question number(s) if applicable.

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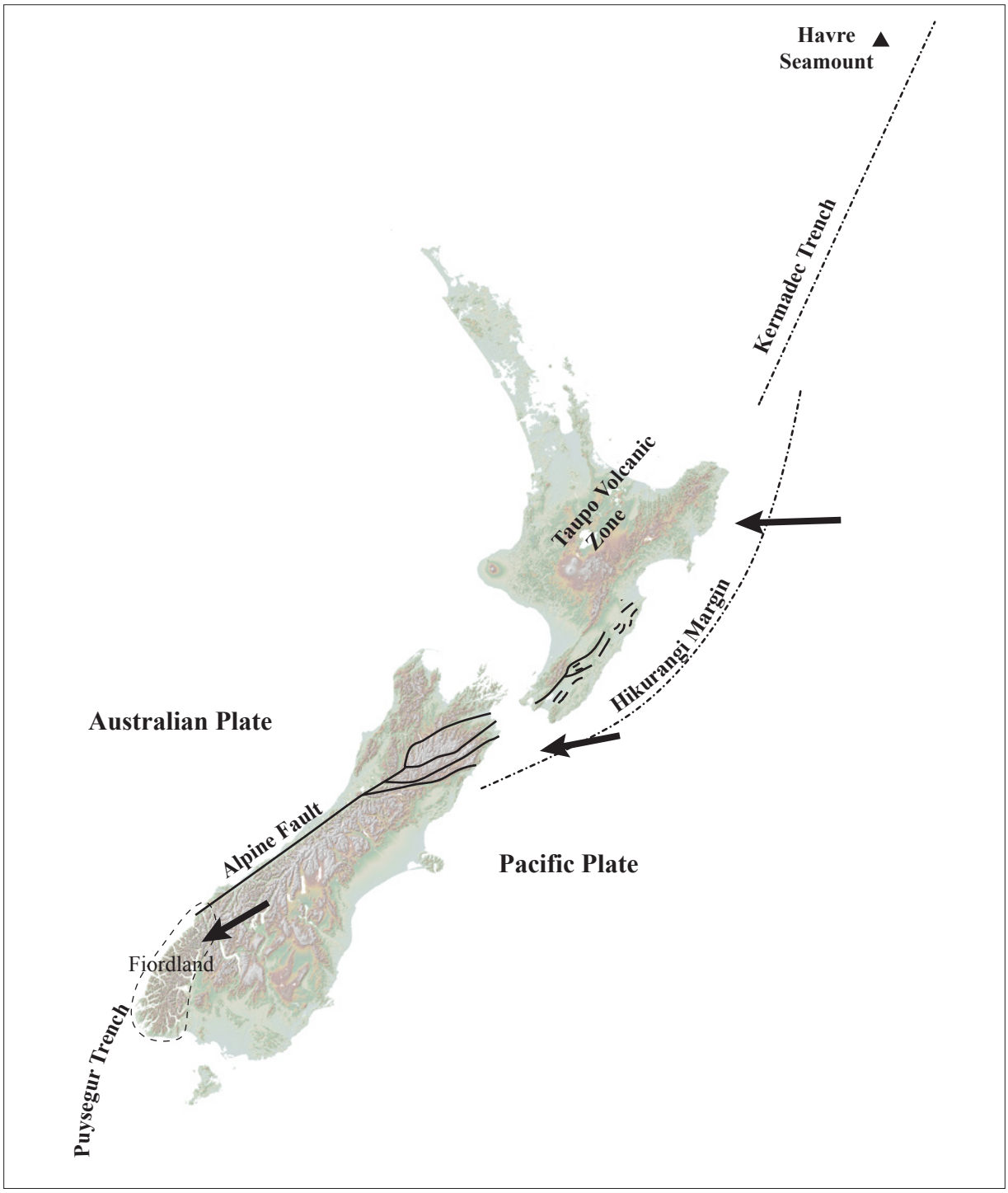
Regional Map Showing Locations Referred to in this Paper



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