**ACTIVITY: Tsunamis in the sandpit**

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| **Activity idea**In this activity, students use a balloon in a container of sand and water to model how volcanic eruptions can generate a tsunami.  By the end of this activity, students should be able to:* demonstrate how magma chambers expand and the effects this expansion may cause
* demonstrate how a horseshoe-shaped crater is formed by a lateral eruption
* demonstrate how tsunami waves are generated by a landslide
* identify Te Puia Whakaari/White Island and Anak Krakatoa volcanoes and tsunamis and discuss their formation.
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**For teachers**

[Stratovolcanoes](https://www.sciencelearn.org.nz/resources/648-types-of-volcanoes) are steep-sided, cone-shaped volcanoes. If the magma chamber within the volcano grows, the expansion can break the flanks of the volcano and cause it to collapse – creating a landslide.

Volcanoes in the ocean can be submarine or rise above sea level to form islands. Stratovolcanoes throw magma, ash and rock across large areas. Material (pyroclastic flows, debris flows) from the volcano displaces large amounts of water – [producing sufficient energy to form tsunami waves](https://www.sciencelearn.org.nz/resources/125-comparing-tsunamis-and-surf). Tsunami waves travel through the water column and surge onto surrounding coastlines.

Te Puia Whakaari/White Island and Indonesia’s Anak Krakatau are examples of volcanoes that have collapsed to form tsunamis. Both volcanoes display the horseshoe-shaped crater that formed after the eruptions.

***Teaching suggestions***

Watch the video [Modelling a tsunami](https://www.sciencelearn.org.nz/videos/2197-modelling-a-tsunami) as an example of how to set up and run the activity. Decide how you might use the video with students – it may be preferable to watch the video after you’ve completed the activity. The video transcript includes discussion questions.

If your local area is known to be at risk from tsunamis, discuss the civil defence procedures the school and community have put in place to keep people safe.

***What you need***

* Sand container – plastic storage box or similar
* Sand – the amount will vary depending on the size of the container
* Small balloons – water balloons are ideal
* Small sticks, toothpicks, pencils or houses made of LEGO
* Balloon pump
* Device to video the activity (optional)

***What to do***

1. Explain that this activity is a model designed to demonstrate how a magma chamber expanding in a stratovolcano can collapse the flank of the volcano and generate a tsunami.

1. Half fill the container with wet sand – wet sand is easier to work with. Form a sloping sand hill on one side of the container. Place a few sticks or LEGO houses at varying elevations to represent communities situated along the coast.
2. Build a circular island of sand of a similar height at the opposite end of the container.

1. Pour water into the container until just the coastline and the island of sand are exposed at the surface.
2. Discuss how the sand represents the land, the water represents the sea and the island represents a volcano.

1. Attach the balloon to a pump. Hold it in place in the centre of the island. The balloon represents a magma chamber. Clarify that magma chambers are filled with magma, not air. (Discuss the benefits and drawbacks regarding the use of models in science.)

1. Ask a volunteer to cover the balloon with 10–15 cm of damp sand. Build upwards to make it pointy like a stratovolcano. Ask if this reminds anyone of islands they know. Prompt to see if anyone recognises the shape as like a volcano.
2. Slowly fill the balloon with air. Stop once the island has grown by a few centimetres.
3. Observe and discuss what is happening to the magma chamber and to the sides of the volcano. Discuss what might happen to the volcano if we keep pumping in air/the magma chamber keeps expanding.
4. Assign roles to observe and record what happens next with some students observing the volcano while others observe the coastline. (If you plan to video the activity, assign someone to fill this role.)
5. Continue to fill the balloon with air. After part of the volcano collapses and falls in the water, let the rest of the air out of the balloon.
6. Discuss the observations regarding the volcano and those monitoring the coastline.
7. Discuss whether the water/waves reached the houses and what may have caused this to happen.
8. Remove the balloon and discuss the shape of the remaining island and how it was formed.
9. Compare the shape of the model’s crater to those of [Te Puia Whakaari/White Island](https://en.wikipedia.org/wiki/Whakaari_/_White_Island#/media/File:White_Island_2013.jpg) and Anak Krakatau ([shown before and after](http://itic.ioc-unesco.org/index.php?option=com_content&view=category&layout=blog&id=2699&Itemid=3314)).

***Extension idea***

This activity features a lateral eruption. Model the Hunga Tonga–Hunga Ha’apai volcanic eruption and tsunami by creating an underwater caldera – similar to the [Calderas in the sandpit](https://www.sciencelearn.org.nz/resources/935-calderas-in-the-sandpit) activity.