Magma Pop – game guide

The game guide has three sections:

Accessing Magma Pop

Use this link to access Magma Pop.

Step-by-step game dialogue

This document includes the written dialogue/speech bubbles of Rua, the volcanologist, who explains the game. It is a step-by-step guide on how to play the game along with helpful background information. The document has screenshots from the game to aid understanding. The dialogue within each level can only be replayed after completing the level, so students may want to keep the document handy as they learn to play the game.

Introduction

Kia ora tamariki and welcome to Magma Pop!

I am Rua, the volcanologist.

You can learn to be a pro volcanologist like me by checking out the tutorial at the Magma Academy.

But before you start, I just want to tell you what you will be learning with me.

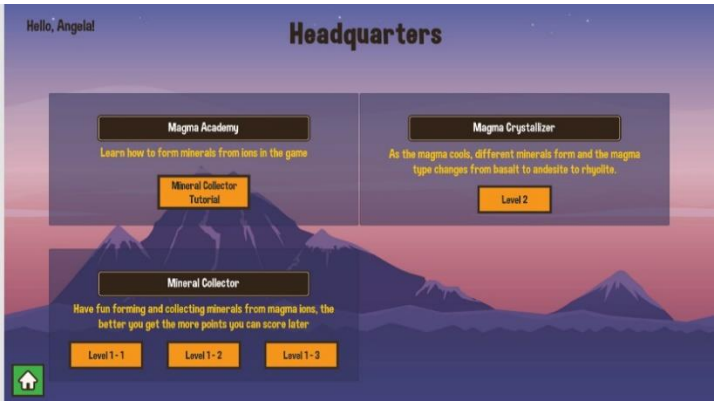
First, you will learn what magma is made of and what elements you have in common with magma. We all whakapapa to volcanoes.

Second, elements exist as ions in the magma and combine to form minerals with crazy names.

Third, magma can crystallise to form different volcanic rocks depending on the elements.

Last but not least, volcanoes can erupt at any time but are usually not dangerous (especially if we take precautions).

Headquarters

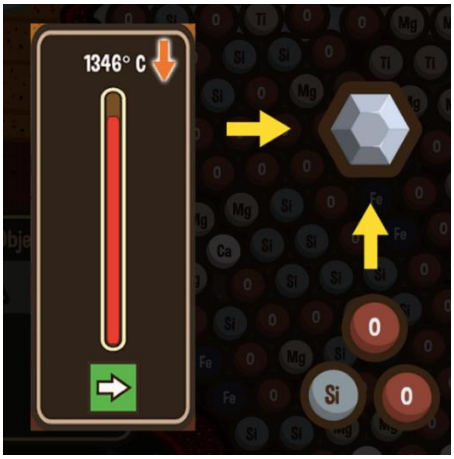


Mineral Academy

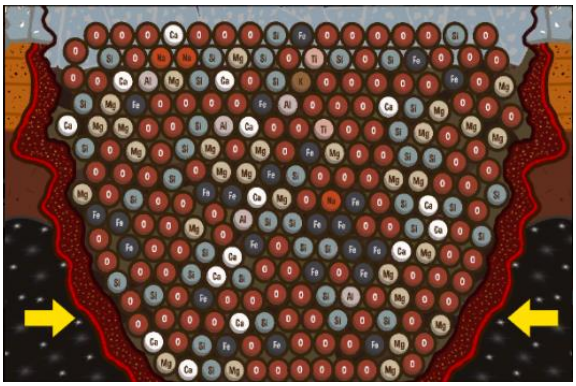
Kia ora tamariki and welcome to the Magma Academy!

Let us first learn about minerals and magma.

As magma cools, it starts to crystallize different minerals that are made of different elements.

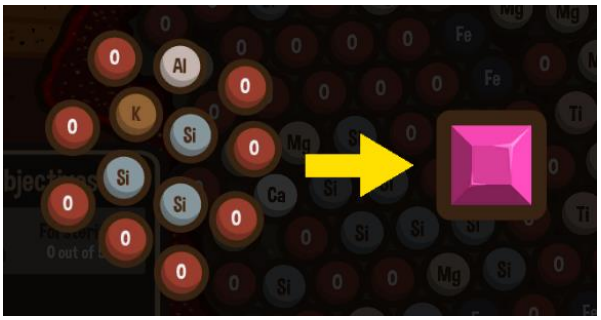


These minerals come from a reservoir of liquid magma beneath the volcano that contains these elements.

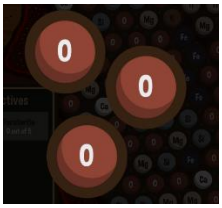


These elements exist as ions and combine to form different minerals as the reservoir cools.

For example, this pretty feldspar mineral known as “Orthoclase” is made up of many different elements like one potassium ion, one aluminum ion, three silicon ions and eight oxygen ions.

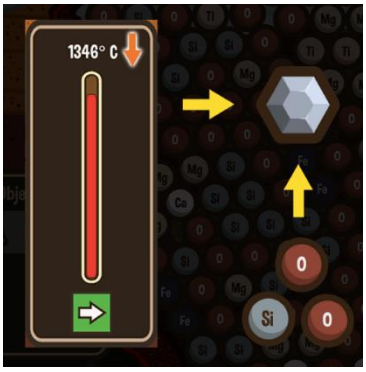


Oxygen is one of the important elements in rocks, just like it is for us.



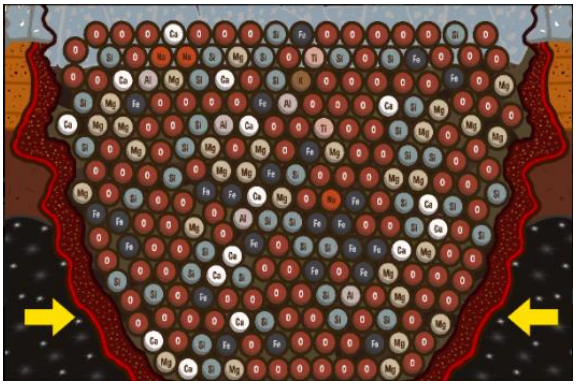
Rocks and humans both need oxygen – it is crazy we are made of the same stuff.

As the temperature changes within the reservoir, different minerals crystallize, and we will learn more about this in the later stages.



In the meantime, let me introduce you to our workplace.

Can you see this section in the middle of your screen?



This is a magma chamber.

This is where you'll see different cations that you can use to create crystals.

How do we create crystals, you say?

Well, you need to know their chemical composition.

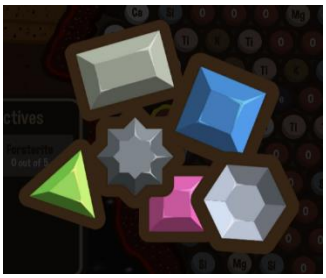
You can toggle the formula panel by clicking this button.

Memorizing formulas can take some time but you learn as you go.

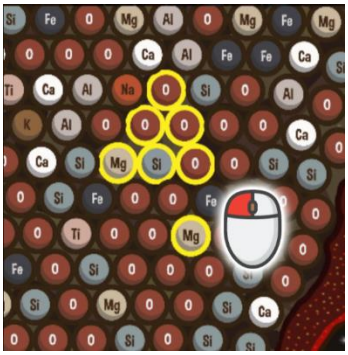
I will usually set objectives for you in each level.

You can toggle these objectives by clicking this button.

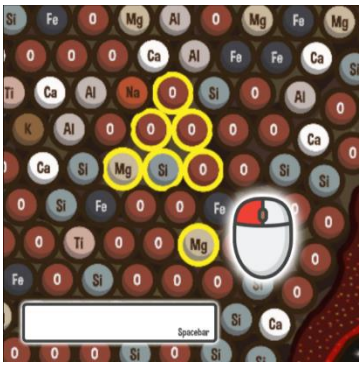
Now the fun part! Creating crystals!



Select cations in the magma chamber by using your left mouse button.

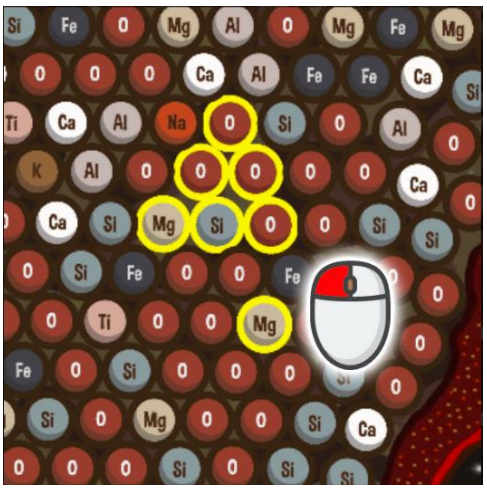


Once you've got all of the ion cations that make up a mineral, press the spacebar on your keyboard.



If you've got it correct, you'll create a crystal.

Remember, if you selected a cation and you change your mind, just left-click on it again to deselect it.



If you want to deselect every cation you selected, use your right mouse button.

Last but not least, when you feel like you've done enough for the day, you can always go back to headquarters by clicking this button.

Now, before you head back to the headquarters, create 5 forsterites.

After that, collect some minerals at the Mineral Collector level.

LEVEL COMPLETE (Click the arrow button to return to headquarters.)

Mineral Collector

Level 1-1

Welcome to the Mineral Collector level!

In this level, you will learn what minerals are present in magma.

Your task is to collect the minerals listed in the objective panel on the left.

You can form these minerals by clicking on the various elements needed to form these minerals.

These elements exist as ions within the magma reservoir; you will get points for each mineral collected.

When you select the right ions needed for a mineral, you can see its mineral formula.

A formula tells us what elements form each mineral.

Scroll through the formula panel on the right to see the mineral formulae instructions.

This will help you know what elements to select to form each mineral.

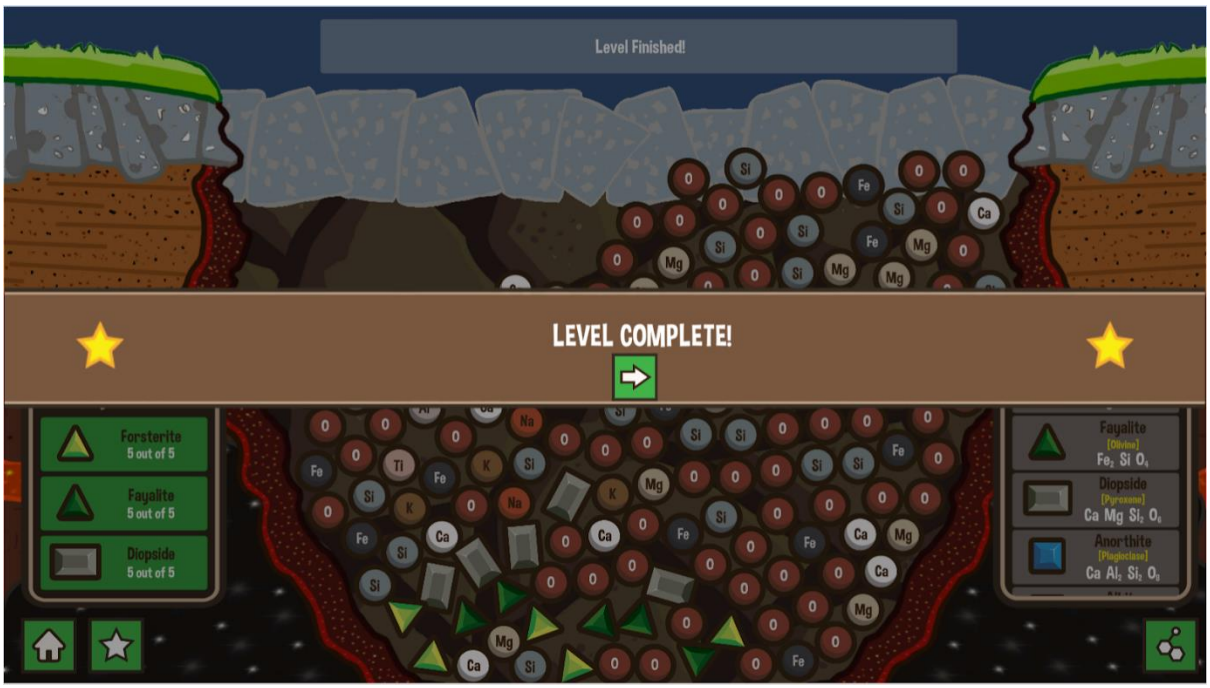
[Create the number of Olivines and Pyroxenes indicated in the Objectives window.]

5 forsterite

5 fayalite

5 diopside

LEVEL COMPLETE (Click the home button to return to headquarters.)



Level 1-2

Congratulations for collecting the two olivine minerals (forsterite, fayalite) and a pyroxene mineral (diopside) at Level 1-1.

Now we will collect some feldspars.

Do not forget to scroll through the formula panel if you need help with the mineral formula instructions.

[Create the number of Feldspars indicated in the Objectives window.]

5 anorthite

5 albite

5 orthoclase

LEVEL COMPLETE (Click the home button to return to headquarters.)

Level 1-3

Woah! You are almost an expert in the Magma Academy.

Now we will collect some quartz and two types of metal oxides (ilmenite and magnetite) by selecting the required number of ions to form these.

Pssst … In case you forget what to combine, scroll through the formula panel on the right.

Good luck, and see you on the other side.

[Create the number of Quartz, Ilmenite & Magnetite indicated in the Objectives window.]

5 quartz

5 ilmenite

5 magnetite

LEVEL COMPLETE (Click the arrow button to return to headquarters.)

Level complete. Ka pai e hoa!

You can now move onto racing the magma in the Magma Crystallizer.

But first check into the Mineral Academy to know the basics of this level.

You will now be redirected back to the HQ! Good Luck!

Magma Crystallizer Level 2

Ka rawe! Now you have the basic skills of mineral collection.

Practice, give it a go, before we do this under pressure for points and learn which minerals you find in which rock types.

In this level, you will crystallise minerals listed in the objective window by selecting the elements in the reservoir for particular magma types (basalt, andesite and rhyolite).

You do not have to worry about oxygen anymore, and now you just have to select the specific ions to make the minerals.

Note that silica now has a tetrahedral shape that looks like a 3-D triangle which includes all the oxygen.

Try to keep up with the cooling temperature and crystallize them all before the other minerals appear in the objective panel.

Let’s practice some mineral collection under pressure and see how you do.

You get points for every mineral that you crystallize.

Let’s go!

[Play Stages 1- 4 – Basalt]

Ka pai, the volcano is now ready to erupt more sticky magma andesite!

[Play Stages 5-6 – Andesite]

Ka pai, the volcano is now ready to erupt more sticky magma rhyolite!

[Play Stages 7-10 – Rhyolite]

→ Rumble and evacuated [Stage 9–10]

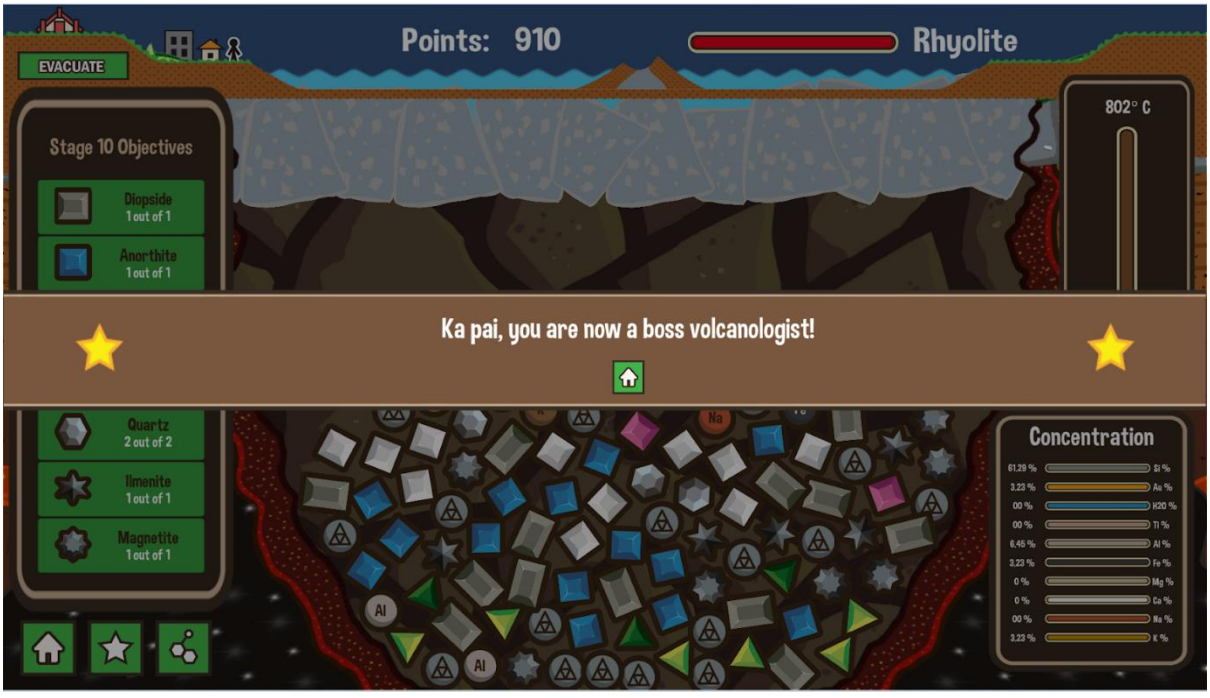
→ Rumble and didn’t evacuate

Aww, the volcano erupted which caused a tsunami. Your community has flooded. [-100 points]

[Click arrow to finish Stage 10]

Ka pai, you are now a boss volcanologist!

(Click the home button to return to headquarters.)

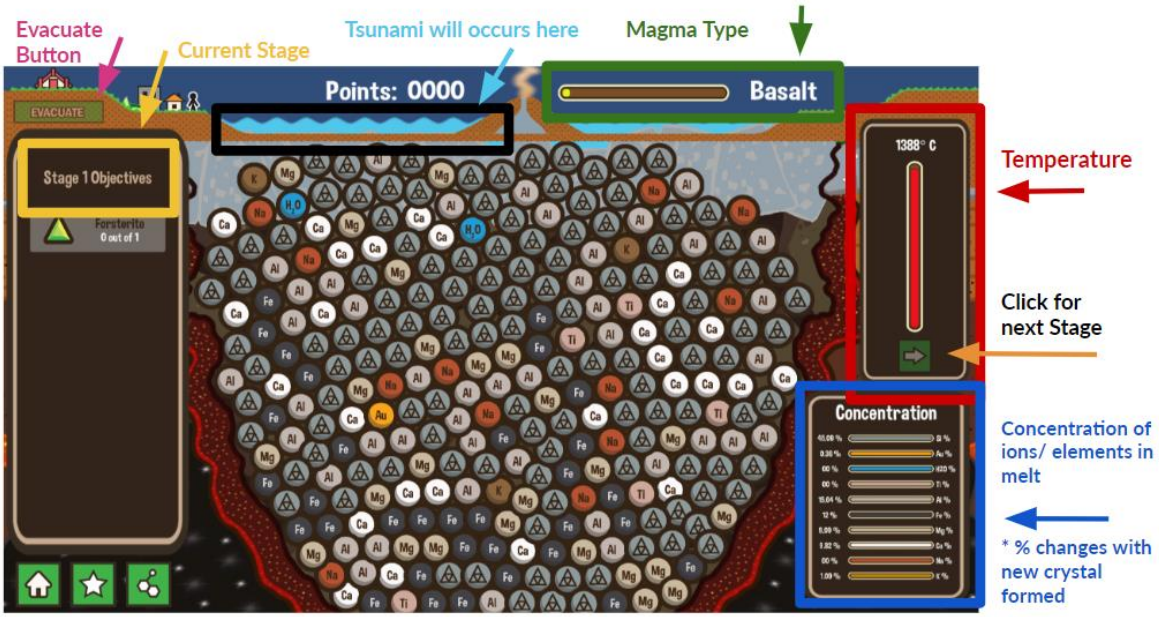


Mineral Crystallizer – advanced features

This level builds on the Mineral Collector level and should be played with the sound on. Below is an annotated screenshot that shows the new factors in the level. This level includes:

- Points – 10 or 20 points are gained for each mineral formed.
- Cooling magma relating to the stage (reducing temperatures).
- Changing concentrations of elements in the melt as elements are combined to form minerals.
- Change of magma chamber type.
- An unexpected eruption (indicated by sound) followed by an animated tsunami.
- An evacuate option to get to higher ground when the tsunami occurs.

This annotated screenshot of Level 2 shows the new factors in the game.



Mineral Crystallizer has 10 stages. Information about each stage is in the table below.

Stage	Stage Objectives Minerals (number to form)	Lowest Temperature*	Points*	Magma Type
1	Forsterite (1)	1346	10	**Basalt**
2	Forsterite (2), Diopside (1)	1286	40	
3	Forsterite (1) Diopside (1) Anorthite (1)	1226	80	
4	Forsterite (1) Fayalite (1) Diopside (1) Anorthite (1)	1164	130	
5	Forsterite (1) Fayalite (1) Diopside (1) Anorthite (2) Magnetite (1)	1104	210	**Andesite**
6	Fayalite (1) Diopside (3) Anorthite (3) Magnetite (2)	1042	330	
7	Diopside (2) Anorthite (2) Albite (2) Ilmenite (1) Magnetite (1)	982	450	**Rhyolite**
8	Diopside (2) Anorthite (2) Albite (3) Ilmenite (2) Magnetite (1)	922	600	
9	Diopside (1) Anorthite (2) Albite (3) Orthoclase (1) Quartz (1) Ilmenite (1) Magnetite (1)	862	760	
10	Diopside (1) Anorthite (1) Albite (3) Orthoclase (1) Quartz (2) Ilmenite (1) Magnetite (1)	802	910	

***Temperature and points are taken from the end of the stage

Points

Each mineral formed is 10 or 20 points. The only way to lose points if the player does not evacuate during the tsunami (-100 points).

Students do not have to finish the objectives list to move to the next stage.

Stages

There are 10 stages in this level. There is a specific amount of time allocated to each stage to complete the Stage Objectives. When time runs out, the next Stage Objective will appear, replacing the previous stage. Minerals that are not formed in time are potential points lost.

If students complete the stage early, they can click on the animated green arrow beneath the thermometer for the next stage.

In this game, the minerals selected to be formed in each stage are dependent on the temperature and concentration of the magma chamber.

Evacuation button 

The evacuation button on the top left corner of the screen should be clicked when there is a rumbling noise (sound on) and an animation at the top of the screen. The volcano erupts and a large wave moves left toward the person and the house. It all happens within a few seconds. When the evacuation button is clicked, the character heads inland and is safe from the tsunami.

- If the evacuation button is clicked – the student can continue playing.
- If the student missed the evacuation – they lose 100 points. They can continue playing.

The evacuation button will not be lit until there is a possibility of a tsunami occurring during a rhyolitic magma chamber stage to avoid unnecessary evacuation. The game is programmed to erupt in Stages 8 and 10 but may not erupt at all. Eruptions tend to occur in rhyolitic eruptions due to its high explosivity.

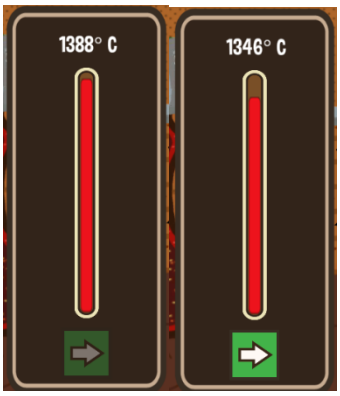
At no point in the dialogue does it indicate for the players to watch out or listen for a tsunami. This is to reflect the reality of unpredictable volcanic eruptions.

Temperature

Magma cools continuously and this is shown in the reducing thermometer. As it cools, crystals begin to form and grow. This is called crystallisation. There is an order that ions become stable to form minerals, which is associated with temperature and availability of free ions in the melt.

Olivine (forsterite) forms at higher temperatures associated with basaltic magma, and quartz is formed in lower temperature rhyolitic magma.

The order of crystallisation follows Bowen’s reaction series – a geological concept that explains the temperatures at which minerals crystallise from cooling magma.



The green arrow button will be lit up when the temperature has cooled to a certain temperature. A real magma chamber can only crystallise certain minerals at a range of temperatures.

Type of Magma Chamber

The magma type is determined by the chemical composition of the magma and changing temperatures.

As the magma cools, the magma type changes from basalt to andesite to rhyolite.

This is shown in the game at the top right corner. Basaltic magma is iron-rich and magnesium-rich. As these ions are used to form minerals, silica becomes more enriched in the melt as the magma cools.

Concentration

When minerals are formed, the concentration of the ions in the magma change. This is due to the ions being removed from the magma melt into the minerals.

Acknowledgement: All images from Magma Pop courtesy of Professor Ben Kennedy.