GEOTHERMAL DRILLERS SAVE PLANET EARTH

Drilling for Geothermal Energy!

WELCOME MAGMA DRILLERS!

Welcome to the magma drillers game! During this game you will learn to interpret scientific data to make a decision about where and how you should drill in magmatically active areas.

You will also learn what behaviour is expected of scientists, and you will be asked to sign a code of conduct.

SCIENTIST CODE OF CONDUCT

Based on the NASA Astronaut Code of Professional Responsibility

COMPETENCE | NGANA "MĀ TE HINGA, KA TUTUKI"

There is uncertainty involved with new scientific endeavours, so try your best to be prepared for your role. Failure is part of the design cycle on the pathway to success.

TEAMWORK | MANI TAHI "MAHIA TE MAHI KO HOROTAI TE WHIWHI"

Scientific endeavours are the result of collaboration and the end result reflects the strength of the team.

INTEGRITY | NGĀKAU PONO

As responsible scientists, it is important that you seek to support your ideas with evidence and look for evidence supporting others' explanations. Be open to critique of your ideas.

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RELATIONSHIPS | WHAKAWHANAUNGATANGA

Science is hard work, so be open to new learning, trust each other. Be aware of how your words and actions affect other people.

PERSONAL BEHAVIOUR | TINO RANGATIRATANGA

Accept personal responsibility for your behaviour. Be respectful and supportive of your team members and others during this mission.

STEWARDSHIP | KAITIAKITANGA

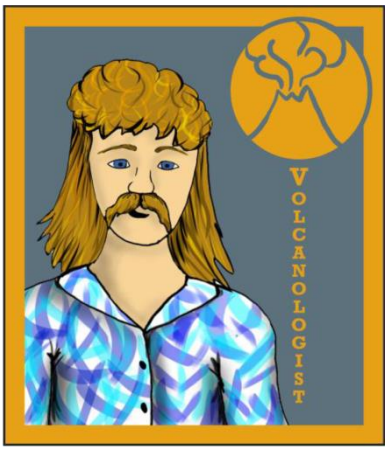
Resources are precious –as a responsible citizen it is important that you use resources wisely and take steps to reduce your impact on local communities, and protect the important natural features of our planet.

Name: _____ **Signature**: _____

Date: _____

Drilling for Geothermal Energy!

Your role: Volcanologist



The volcanologist is a person that researches what eruptions have happened in the past and assesses the potential of future eruptions and the hazard these eruptions pose to society. The volcanologist achieves this by examining and describing rocks exposed at the surface and in drill holes.

In the context of location of geothermal energy, volcanologists can provide insightful information on the location, size and shape of magma chambers and help identify and describe suitable reservoir rocks where hot water may be stored. This can be done by studying surface features of recent eruptions- such as the source of recent lava flows or volcanic explosions. Other useful information would be describing the crystallised magma chambers that have been uncovered by erosional processes or seen in other drill holes.

Mission 1: Renewable Energy

It is the year 1974, the Beatles have broken up, the world is running out of energy resources and excuses to party and, new innovative groups of people were developing amazing ideas like Rap music, Star wars and geothermal power.

You are part of a hand-picked team of heroes with puffy hair, moustaches and glitter where it doesn't belong put together to try to save the world's energy problems through guardianship of our resources. In remote Northern Iceland, an area where water heated deep in the earth reaches the surface, Icelanders are trying to follow in the footsteps of the brave New Zealand and Italian pioneers to harness Earths natural heat to make energy.

In order to complete this mission, you will have to watch both the introduction video and the volcanologist video.

In this mission, you will be asked to collaborate with other scientists in order to extract renewable energy

out of the ground. Your job, as a volcanologist, will be to use the knowledge you have gained to help locate the heat source and pathways to surface.

The map on the following page will help you answer the questions below. Once you are confident about your answers to those questions, you will be able to report back to your team and help make a decision.

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Question 1

List, in order of importance, which feature is most closely related to heat at depth:

- Fumaroles
- Old Explosive craters
- Recent Explosive craters
- Lava flow

1. _____

2. _____

3. _____

4. _____

Question 2

How does heat from magma get to the surface? Mark on the following four features on the diagram below:

- Magma
- Cracks
- Borehole
- Hot Volcanic Water

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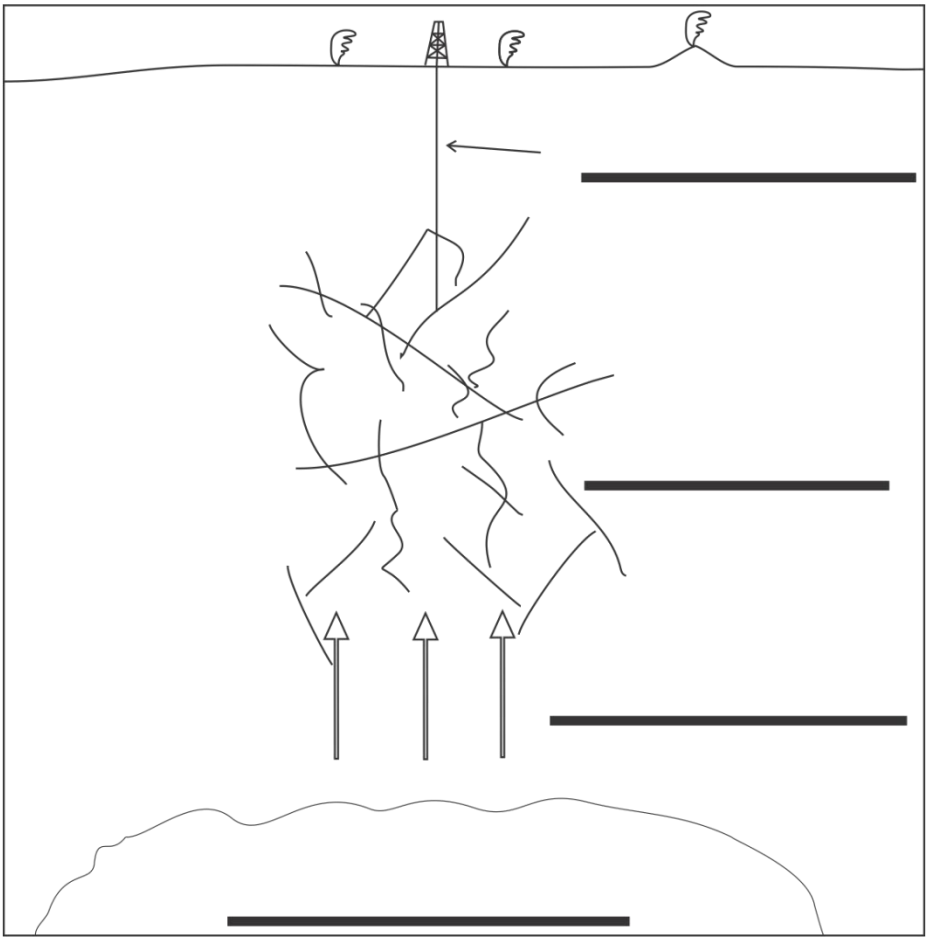

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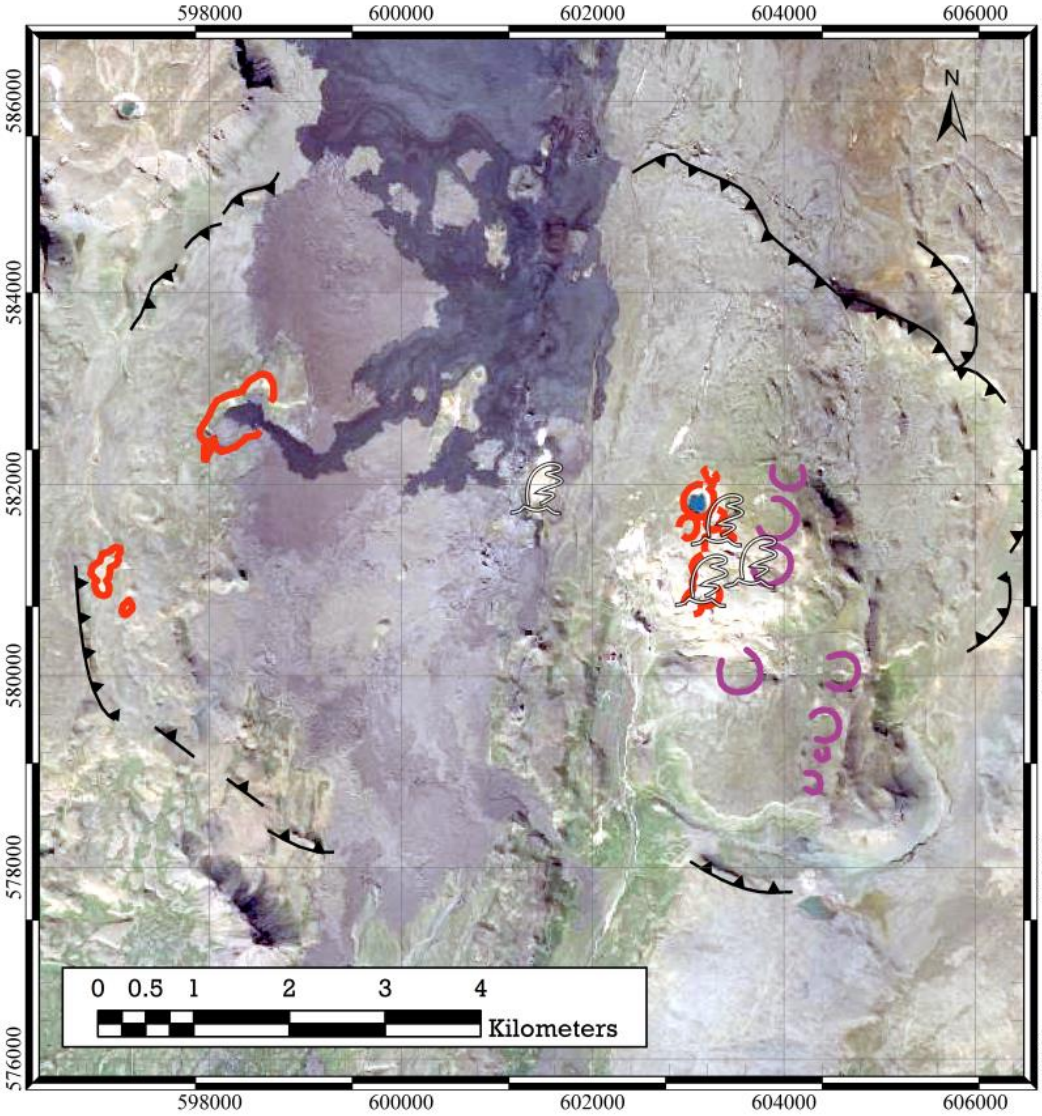
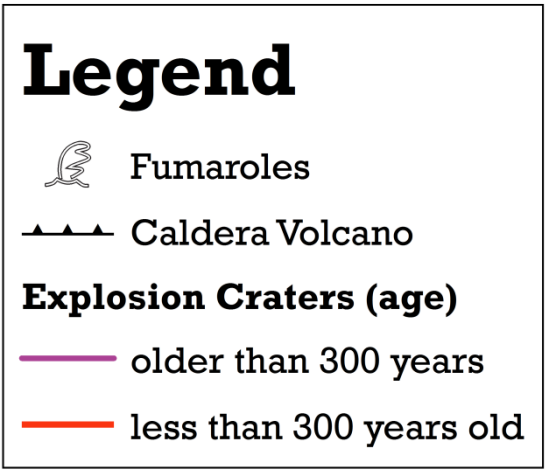


Question 3

Volcanic Features of the Krafla Caldera



Highlight or circle areas on the map that show evidence of a heat source at depth.

Question 4

Choose your preferred location to drill, based on your understanding of where there is likely to be a high amount of geothermal activity. Mark it on the map.

Well done. Stop here and consult with your team before moving on!

Drilling Plan Evaluation

Take a moment to think about how your first mission went.What did your team do well when making your drilling plan?

What is one thing your team could do better when planning together for the next mission?

Did everyone feel that they contributed to the final plan?

1 2 3 4 5

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CURIOUS MINDS
HE HIHIRI I TE MAHARA

UC
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND