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: _____

Your role: Geophysicist

Sometimes referred to as geo-magicians, a geophysicist uses different forms of energy to sense the physical properties of rock at depth. The amazing thing about geophysical surveys is that they are able to gather a lot of information about the underworld without gathering samples or disturbing the ground.

Surveys run by geophysicist are crucial to help us locate and describe various properties of a geothermal and volcanic system. Locating the source of earthquakes might be a geophysicists job, or using how seismic waves travel through rock and fluids to help locate magma or fluid dominated areas underground. Some surveys are able to sense whether some rocks are more conductive to electrical currents than the surrounding rocks-

sometimes using solar flares to do so! All in in all, the ability to located features spatially without actually having to sample them provides the team with valuable insight into where resources might be located.

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 hot water 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 geophysicist 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 geophysicist, will

be to use the knowledge you have gained to help decide on the depth of the acidic clay and the heat source.

The cross section and the map on the following pages 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 final decision on where and how to drill.

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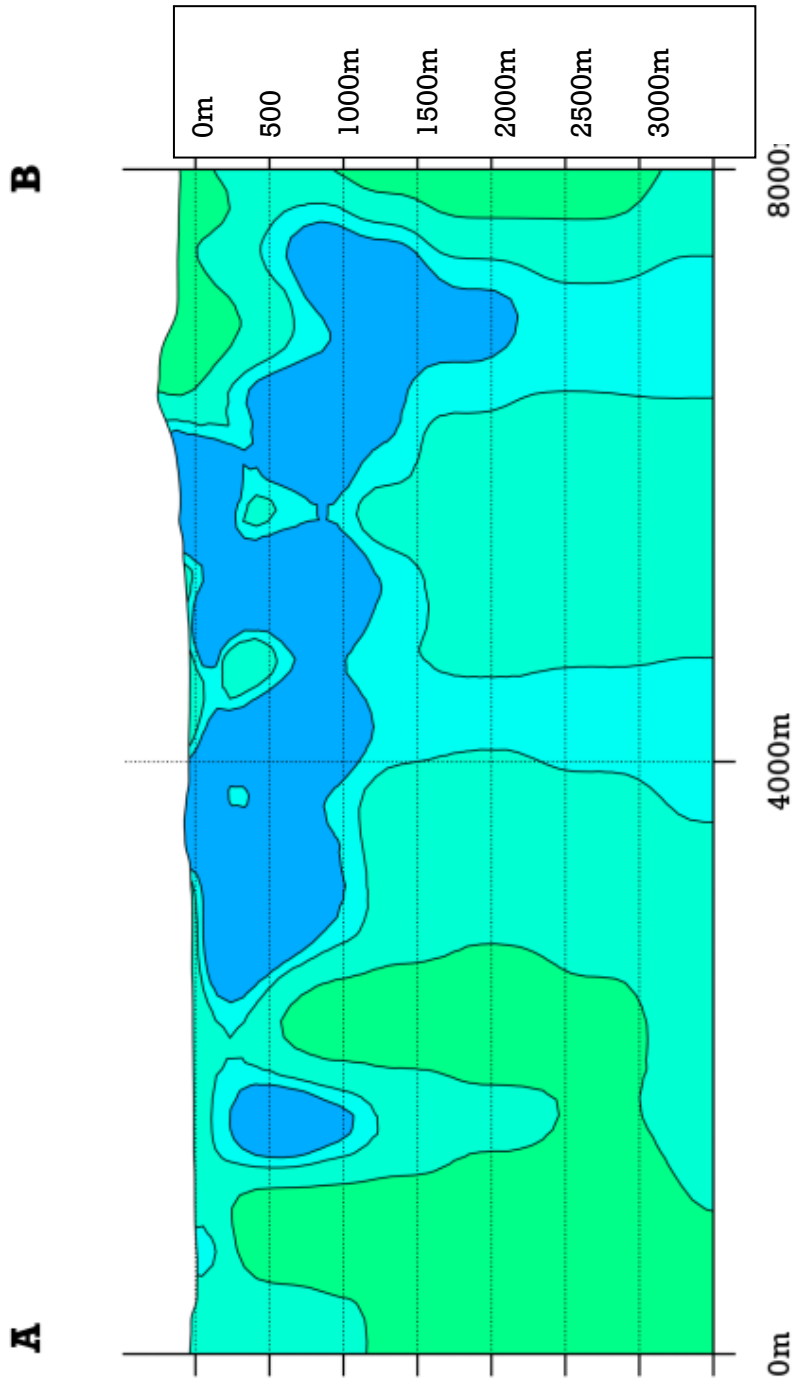

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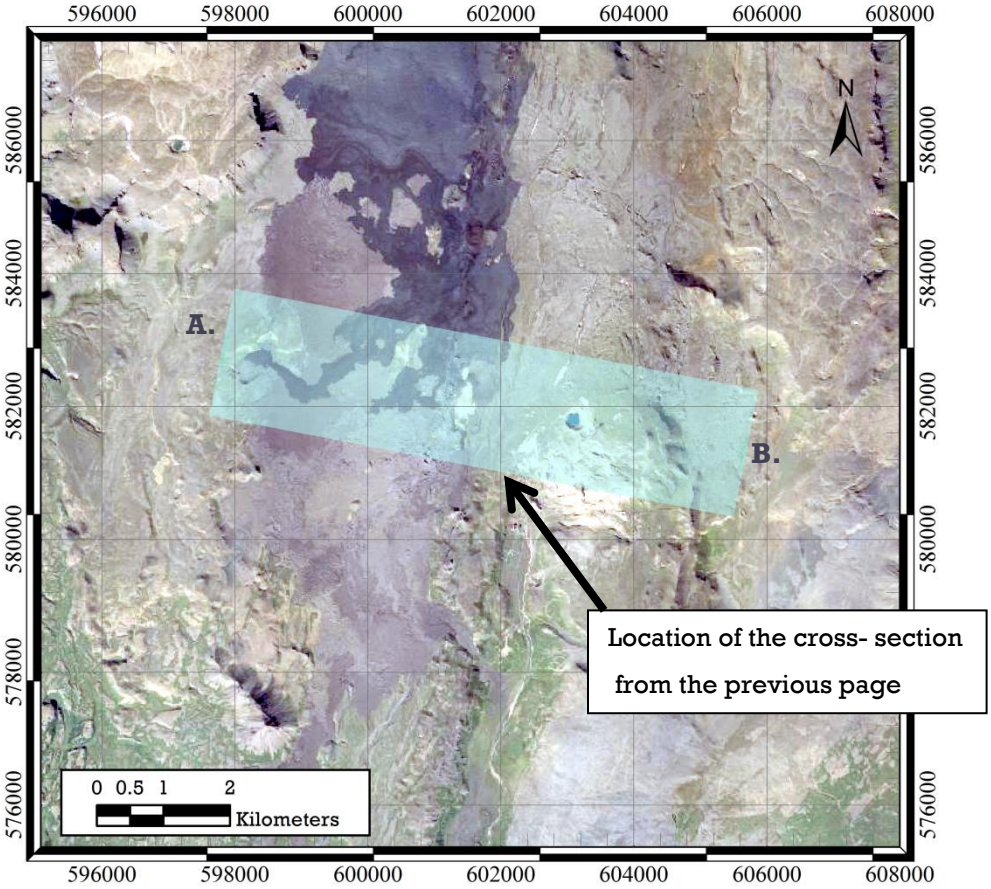
Resistivity Cross-section of Krafla



Legend

- <1.3 (high clay)
- 1.3-1.5 (medium clay)
- 1.5-2.1 (low clay)
- >2.1 (no clay)

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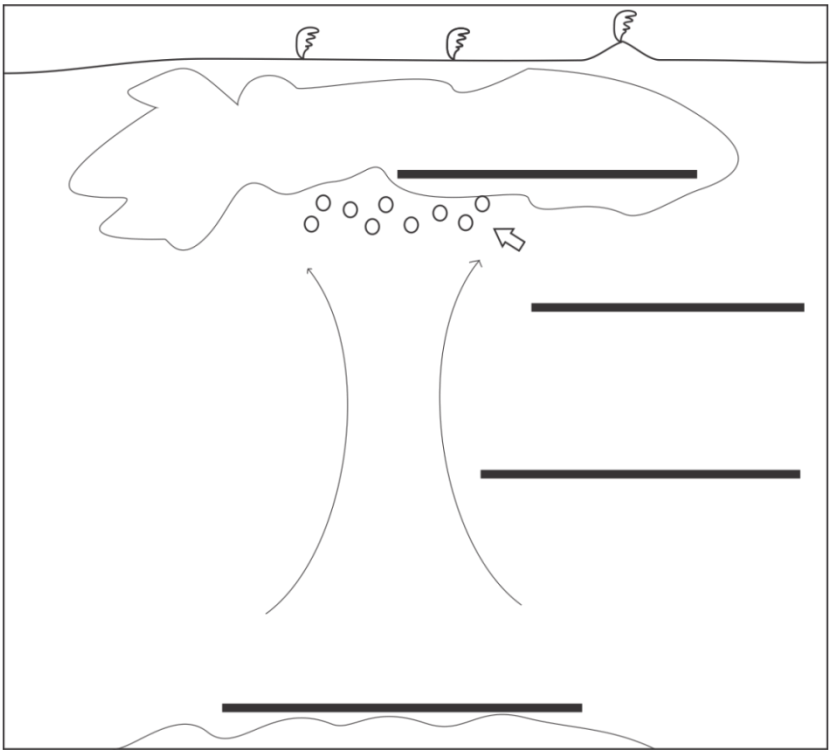
Question 1

What does a low resistivity feature represent?

A. Material that conducts electricity
B. Material that is resistant to erosion
C. Material that stops electricity flow
D. Material that is low in iron

Question 2

Label the model of a hydro-magmatic system, and label the resistive properties of each feature. Use the following terms: Acid boiling fluids, Hot neutral fluids, Clay, Heat source



Question 3

Describe, in your own words, how clay is formed in magmatic systems. Mark the area with high clay on the cross-section.

Question 4

Mark where you would recommend the drill hole on the cross section.

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

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UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND