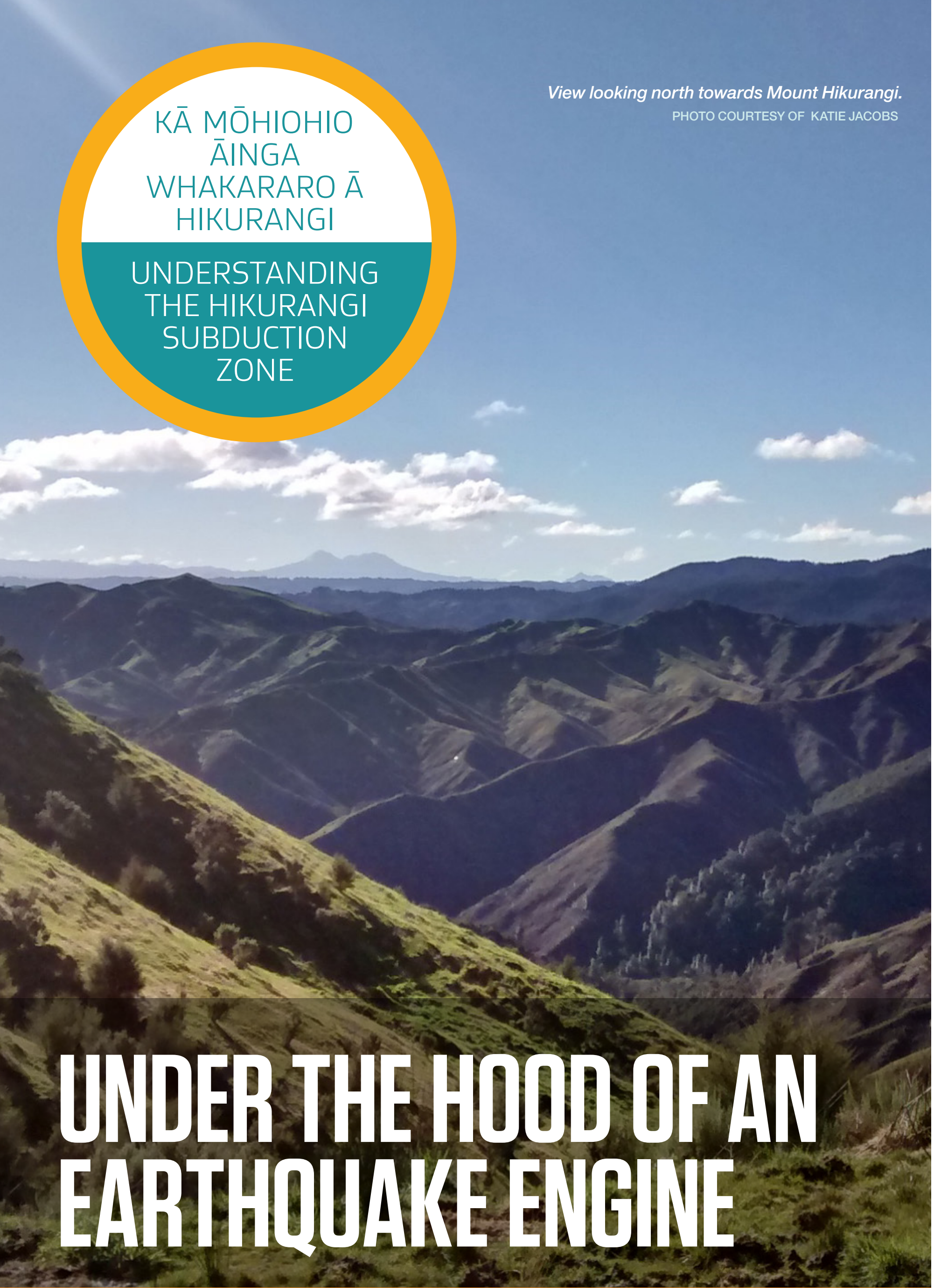
KĀ MŌHIOHIO ĀINGA WHAKARARO Ā HIKURANGI

UNDERSTANDING THE HIKURANGI SUBDUCTION ZONE



View looking north towards Mount Hikurangi.
PHOTO COURTESY OF KATIE JACOBS

UNDER THE HOOD OF AN EARTHQUAKE ENGINE

SHIRE: SEISMOGENESIS AT HIKURANGI INTEGRATED RESEARCH EXPERIMENT

PHASE 1: COMPLETE

The seismometers deployed during phase one recorded local, regional, and global earthquakes in addition to sound energy from a ship offshore. This allowed scientists to image the deeper structures associated with the subduction zone in this region of New Zealand.

PHASE 2: PLANNED

A line of seismometers will record signals from controlled underground explosions. This additional data will allow scientists to produce a high-resolution image of the shallow structures, zones of weakness (such as faults), and material properties within the region.

WHAT IS A SUBDUCTION ZONE?

Off the East Coast of New Zealand's North Island the Pacific tectonic plate dives beneath the Australian plate forming the Hikurangi Subduction Zone. Subudction zones are regions where one tectonic plate is forced beneath another. Subduction zones develop a type of fault that is responsible for the world's largest and most powerful earthquakes and tsunamis. The SHIRE project and other scientific projects focused on the Hikurangi Subduction Zone are using multiple techniques to understand this large fault, so local communities can be better prepared.

WHY STUDY THE HIKURANGI SUBDUCTION ZONE?

We know that the Hikurangi subduction zone can produce large earthquakes and tsunamis, and that these events have occurred in the past. We want to discover how often these earthquakes happen and how large they can be.

The Hikurangi Subduction Zone is also home to the shallowest slow slip events in the world (also referred to as "slow earthquakes" or "silent earthquakes"). This makes the East Coast one of the best places in the world to learn more about why slow slip events occur. Studying this region will help us continue to refine our understanding of earthquake and tsunami hazards and the risks they pose to coastal communities.

HOW WILL THE EXPERIMENT WORK?

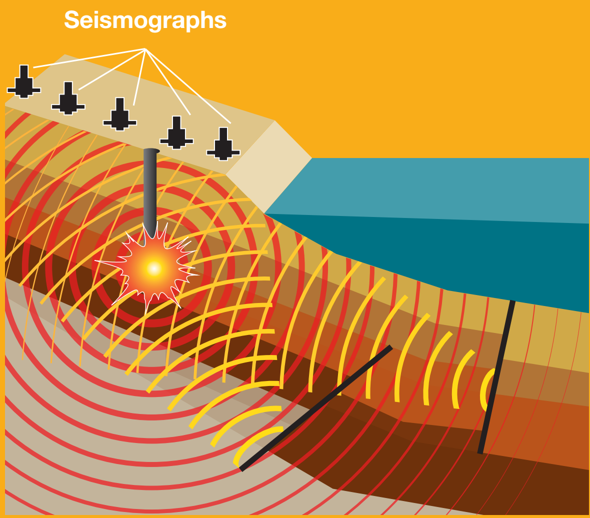
In February 2019, it is planned that scientists will set off explosives that act like a small earthquake, creating waves of radiating energy while the temporary sensors record the Earth's response. Recording the variation in when the energy arrives at each sensor will provide scientists with information about the rock types and structures between the blast and the sensor.

WILL THE EXPLOSIVES CAUSE ANY DAMAGE?

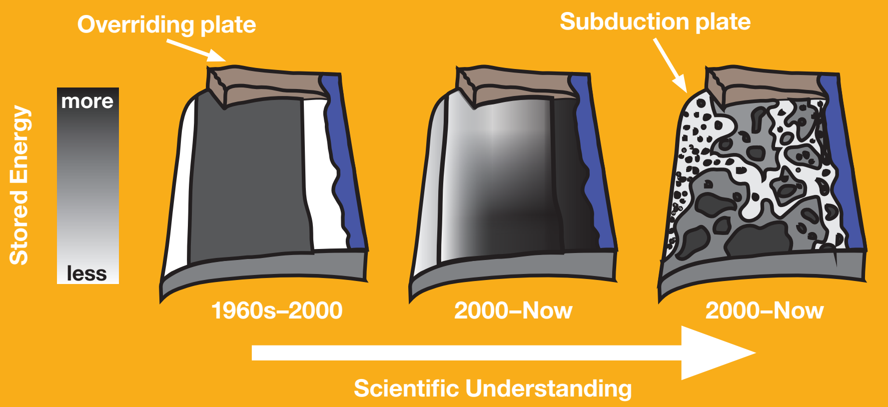
Any damage done by the blast is minor and very localized to the site. For example in previous experiments, the gravel used to backfill the boreholes has been ejected during the blast. At the bottom of the borehole, the explosion may create a small hole a few meters wide. There is not expected to be any damage from the explosion at the surface. In the unlikely even that damage does occur, each site will be remediated and returned to its original condition.

WHY DO WE NEED THIS DATA?

Scientists already know a lot about earthquakes, and the potential effects of tsunami events along the East Coast. The data collected for the SHIRE project will be used to build on our current understanding and improve our knowledge of the environments in which earthquakes occur. For example, the picture over the page shows how our understanding of the subduction zone earthquake potential is evolving with time. To understand earthquake behaviour we need much more detailed pictures of where energy is stored, and how stored energy is used up during earthquakes. The data from this project will give us a more focused picture of earthquake habitats within the Hikurangi Subduction Zone.



The energy from explosions travels out evenly in all directions. The time the energy arrives at each station should mostly depend on the distance from the explosion. Differences in the expected arrival time of the energy at each station are caused by structures, like faults, and changes in rock type that act as boundaries that change the direction and total travel time of the energy waves.



As we uncover more details of the Hikurangi Subduction Zone we can learn more about where energy is stored, and how the location of stored energy relates to where earthquakes start and how they develop.

Examples of previous boreholes.

WHY USE EXPLOSIVES?

Controlled explosions have two main advantages over earthquakes for these studies:

1. CONTROL - We can control and know the exact time and place of the energy source. Choosing the location allows us to study a particular region of interest rather than relying on where earthquakes happen to occur.
2. DENSITY – The density of recording seismographs is essential for identifying and mapping smaller structures and variations. The national network of seismic stations is focused on earthquake location and has a limited density with 20-40 km between stations in the region (**www.geonet.org.nz/data/network/sensor/map**). To record the explosions we will deploy a temporary network of up to 1000 stations which is ~100 times more dense than the permanent network.

WILL WE HEAR OR FEEL THE EXPLOSIONS?

The controlled source explosions, planned for February 2019, direct energy downwards so that the energy ends up in the ground. The further away you are to the explosion the less likely you are to feel it. For example, if you were standing within a 100 meters you would feel the vibration of the explosion and hear a booming sound but if you were standing 2 km away the experience might be similar to that of a truck driving past nearby. Atmospheric and weather conditions also contribute to how far sound from the explosion will travel. The sound might be heard 10-20 km away but at a very low noise level. Each explosion will take place on private land with owner's cooperation.

MORE INFORMATION

For more information on SHIRE and the other

Hikurangi focused projects visit:
www.gns.cri.nz/hikurangi

EAST COAST LAB (Life At the Boundary):
www.eastcoastlab.org.nz

Be Prepared. Its your Best Defence:
www.happens.nzContact

If you have questions please email:
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