

Project background

In late January 2011, scientists from New Zealand and the United States will spend two weeks at Lake Rotomahana mapping the lakebed and looking for signs of geothermal activity at the bottom of the lake. The scientists will send two autonomous underwater vehicles (AUVs) into the lake to take measurements that will enable them to make a detailed map of the lakebed.

The AUVs are shaped like torpedoes and are packed with instruments that will take a number of other measurements in the lake while they are mapping. This includes temperature, acidity, water clarity, magnetism, and the electrical potential and conductivity of the water. The scientists will compile all the data into a three-dimensional map of the lake bed that will show features as small as 1m across.

What is the aim of the project?

The aim is to find out how a geothermal system that was once on land has adapted to being at the bottom of a lake. Prior to the eruption of Mt Tarawera on 10 June 1886, the Pink and White Terraces were the site of a very large on-land geothermal system. After the eruption, the Terraces and their geothermal system were drowned in at least 50m of water in the 'new' Lake Rotomahana, which enlarged after the eruption. There are very few examples in the world of large on-land geothermal systems that have been torn apart by an eruption and become inundated in this way. If the scientists find remnants of the geothermal system at the bottom of the lake, it will be internationally significant in scientific terms as it will show the geothermal system has carried on even after being significantly disturbed by an eruption. By surveying the lake in great detail, the scientists hope to show where the hot water is venting out of the lakebed and see if these areas correspond to the former location of the Pink and White Terraces.

Who is involved in the project?

The project is a collaboration involving GNS Science, the Woods Hole Oceanographic Institution in the United States, the University of Waikato, and the Te Arawa Lakes Trust Board. The project is being led by GNS Science, who also wish to acknowledge the support of Rotorua tourism operator, Waimangu Volcanic Valley.

Are there any risks in this project?

The project does not require humans to go under the water. Scientists will use a surface boat to support



the AUVs and to take associated measurements. The scientists will take standard boating safety precautions.

Is there evidence of geothermal/hydrothermal activity in Lake Rotomahana?

The present-day chemistry of the lake indicates that hydrothermal fluids are venting into the lake from beneath. The scientists are keen to locate the vents to determine the temperature and intensity of the venting, and analyse the chemistry of the vent fluids. Also, there are areas of the lake where gas bubbles rise to the surface from vents at the bottom of the lake.

What are the dimensions of Lake Rotomahana?

The lake is roughly 3km by 6km and 115m deep at its deepest point.

How do the AUVs work?

The torpedo-shaped AUVs are about 2m long. They are battery powered and have a propeller at the back. They will travel under the water on pre-programmed co-ordinates at about walking pace following the shape of the lake floor while taking measurements. They have about eight hours of on-board battery life. When their power is exhausted, they rise to the surface and scientists retrieve them

and re-charge them overnight so they are ready for the next day's surveying. The model of AUV being used is the REMUS 100, developed by the Woods Hole Oceanographic Institution (WHOI) in the United States. There is more information on the REMUS 100 here: <http://www.who.edu/page.do?pid=29858>

Is there a chance that any part of the Pink and White Terraces will be found?

Most geologists believe the Terraces were destroyed in the Tarawera eruption of 1886, which was so violent it was heard in Auckland and in the South Island. The remnants of the Terraces most probably lie under at least 50m of water plus an unknown thickness of mud and volcanic debris. Some historians believe there is a small chance the White Terraces may have partly survived the eruption as they were adjacent to a ridge which may have given some protection from the blast. Balanced against this is the fact that a deep fissure opened up through the lake during the eruption. This would have reduced chances of survival of the Terraces.

Are any future investigations planned?

If the mapping of the lake is successful, scientists plan to come back in the future (possibly in 2012) to do a seismic reflection survey over areas of the lake where they find the most active hydrothermal vents. This will show geological structures and the general architecture of the Rotomahana geothermal system beneath the lake floor. This will be the best opportunity to reveal any remnants of the Pink and White Terraces, should they still exist.

Lake Rotomahana and the Pink and White Terraces

Before the eruption in 1886, Lake Rotomahana was only about 20 percent of its present size. The eruption opened up a deep rift through the lake. The site where the Pink and White Terraces had stood

became a deep crater. The previous outflow of the lake became dammed, and over time it filled with water and formed a new Lake Rotomahana, much larger than the original. The eruption also produced numerous new geothermal features, including Waimangu Geyser, the largest in the world.

The Pink and White Terraces were two separate and enormous fan-like silica terraces on the shores of Lake Rotomahana. They were the largest silica terraces the world has seen and their tiers of cascading hot pools attracted visitors from all points on the globe. Writers, artists and photographers of the day struggled for superlatives to describe their beauty. The White were larger and more spectacular than the Pink, although the latter were particularly admired for their remarkable colour and marble-like surfaces. They formed because of the outflow of a huge volume of geothermal fluid rich in dissolved silica. As the fluid cooled, the silica precipitated out and was deposited in the form of the terraces. Smaller modern-day examples of these terraces can be seen at the Wai-o-tapu geothermal system.

The Tarawera eruption

Soon after midnight on 10 June 1886, a series of increasingly large earthquakes shook the Rotorua area. Within a couple of hours, a huge eruption started along the crest of Mount Tarawera. The violent explosions ripped along a 17km line of vents. Surges of hot ash and mud destroyed villages within a 6km radius of the mountain, with the loss of 108 lives. The eruption plume rose about 10km above the mountain. By 6am the eruption had ended. Maori and European settlers of the day did not realise that Mount Tarawera was an active volcano.

When the project starts, there will be regular updates on this blog site: www.gns.cri.nz/blog



Pink Terraces, pre-1886

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