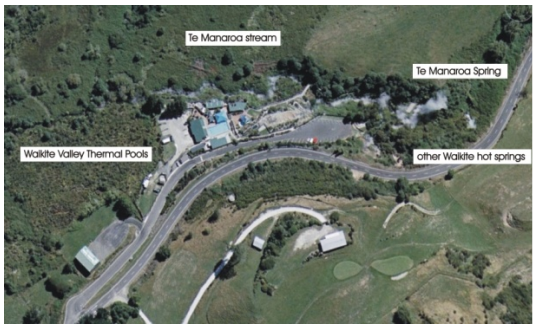
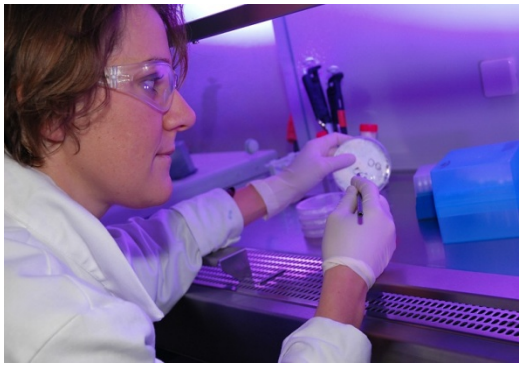
Microbiology and Geochemistry of Waikite Thermal Valley





The Waikite geothermal system contains over 35 springs spanning a distance of 1.5 km. The temperatures of these springs range from 30°C to 99.5°C.While these conditions appear uninhabitable to life, a group of microscopic organisms known collectively as extremophiles not only survive here, but actively grow!

Extremophiles include organisms from all three domains of life, *Bacteria*, *Archaea* and *Eukarya*, and are thought to be modern versions of the first forms of life more than 3.5 million years ago.

Extremophiles live in conditions unsuitable for human habitation, such as high temperatures, elevated acidity or alkalinity, and high levels of radiation or pressure.

The hot springs and soils at Waikite are inhabited by high temperature-loving microorganisms known as thermophiles.

These microorganisms are very small; it is estimated that approximately one billion ($1x10^9$ or 1,000,000,000) microbial cells can inhabit a single gram of soil.

This means that there are up to $1x10^{30}$ microorganisms (one with 30 zeros) on Earth - making up approximately half of the total weight of all living organisms. Microorganisms truly rule the world!

Microorganisms can't be seen by the naked eye, so researchers study microbes using a microscope or by analysing the entire microbial DNA in an environmental sample. While scientists attempt to grow microorganisms in the laboratory, it is not always possible to grow all or even the dominant microbial species from an ecosystem. In fact, it is estimated that only 1-5% of all microbial species have ever been grown in the laboratory. By employing both DNA and microscopy methods, researchers can develop a more thorough understanding of the ecology of microbial communities.

Researchers from GNS Science have investigated the indigenous microbial populations here at Waikite. It is important to investigate these and other extremophile populations to increase understanding of the biological diversity of the Earth, provide insights into the origin-of-life, and create opportunities for new pharmaceuticals, environmental rehabilitation and biotechnological processes.

WAIKITE VALLEY THERMAL POOLS

If you are interested in reading more about this work visit GNS Science website or email us

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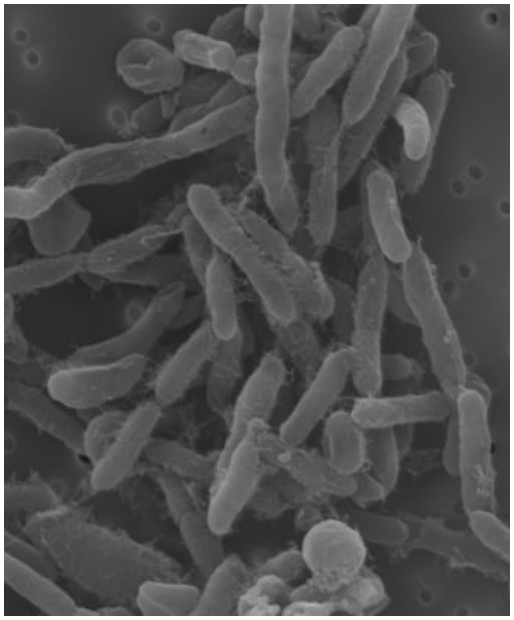
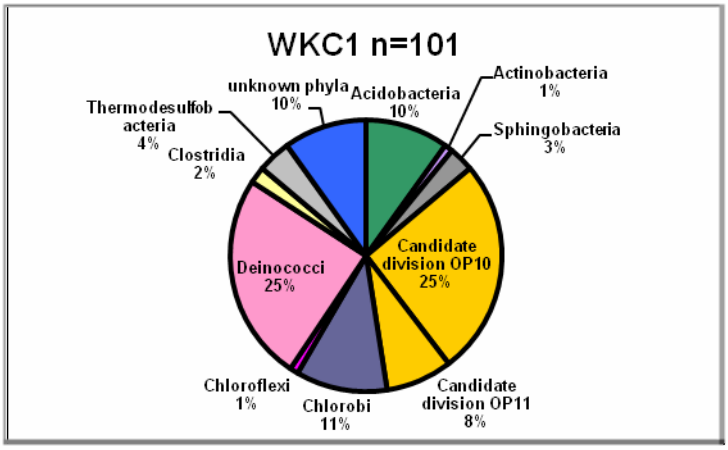


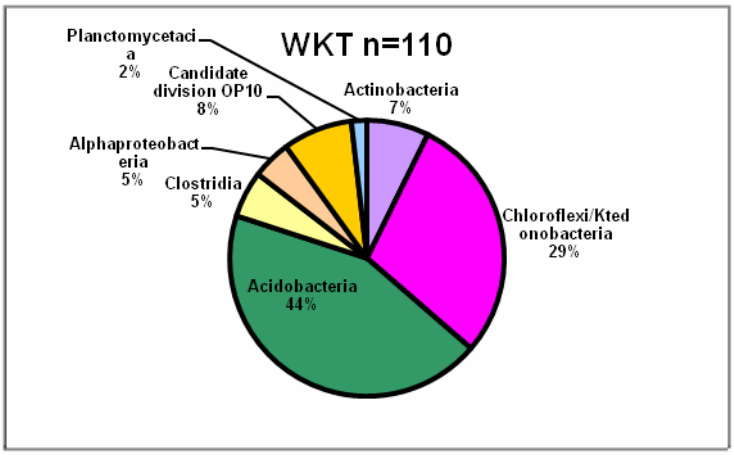
Above: Electron microscope image of a bacterial species isolated from Waikite. Each cell is approximately 3/1000 mm long.

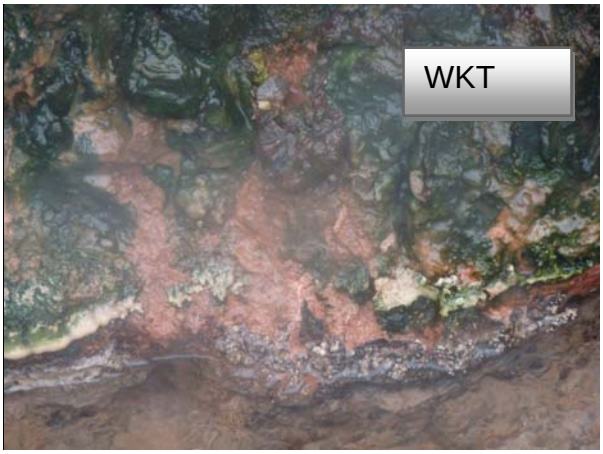
The geothermal springs here at Waikite are home to a broad range of extremophiles with a wide range of metabolic and physiological capabilities.

For example, bacteria from the *Ktedonobacteria* phylum and the candidate division OP10 use the cellulose fibres from dead and decaying plant matter for growth. These microorganisms may be useful in the manufacture of biofuels from cellulose material, such as waste timber from forestry.Other microbial species found at Waikite may be useful for remediating toxic waste. For example, bacterial species from the phylum *Deinococcus* are extremely resistant to radiation and are being investigated for the use in the decontamination of radioactive materials.

Reference:
Stott, M.B., Crowe, M.A., Mountain, B.W., Smirnova, A.V., Hou, S., Alam, M. and Dunfield, P.F. 2008. Isolation of novel bacteria, including a candidate division, from geothermal soils in New Zealand. Environmental Microbiology, 10(8), 2030-2041.







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