VOLCANOLOGIST KATE MAURIOHOOHO

(Top) Lake Taupō |Photo by Dougal Townsend, GNS
(Centre) Kate in her lab with rock samples collected for further analysis

BORN
Te Awamutu. Grew up in Kihikihi in late 80s-90s

AFFILIATIONS
In Kate's words, "He uri ahau nō Raukawa ki Wharepuhunga, Tūwharetoa ki Taupō, Ngāti Maniapoto, Ngaati Maahanga".

SCHOOLS AND SUBJECTS
Hamilton Girls High School. Kate took Science, Physical Geography, Biology, Maths, Japanese; but surprisingly not Chemistry!

HOW SHE GOT INTO SCIENCE
As a kid, Kate's favourite movie was Jurassic Park which got her interested in palaeontology and geology. A school trip to Rangitoto got her fascinated with volcanoes.

TRAINING AND JOBS
"After high school I worked for a few years to save for university. Once I decided on geology as my course of study, I went to Waikato University, originally intending to do a BSc, but that morphed into an MSc and then shockingly a PhD at Victoria University finishing last year."

She worked as an Engineering Draughtsperson (before University); Laboratory Tutor, Waikato University (2013-2015); Contract Researcher, GNS (2016); Field Geology Tutor at Victoria University (2017-23); Postdoc Research Fellow Auckland University (started in 2023).

FIELDS OF SCIENCE
Geology (Volcanology, Geochemistry, Geothermal); Whakaaro Māori/Mātauranga Māori; Ecology; Engineering Geology

RESEARCH EXAMPLES
Supereruptions and large silicic caldera systems

A supervolcano is a volcano that has had an eruption with a magnitude 8 on the 'Volcano Explosivity Index' (VEI). A supereruption is defined as an eruption that erupted >450 cubic kms magma or >1000 cubic kms of pyroclastic material. Such supereruptions lead to the formation of a 'caldera' (e.g. Lake Taupō), which look like large cauldrons as opposed to conical ones with narrow peak. "These have geothermal systems attached to them, which is why my interest covers that as well," says Kate. Taupō Volcanic Zone (TVZ) is distinguished as the source of Earth's youngest supereruption (Ōruanui, 25,500 years ago). Four of the ten supereruptions worldwide in the last 2.5 millions years originate from the Taupō Volcanic Zone (TVZ). However, how magma systems evolve and behave in between supereruptions are not well constrained in volcanology. Kate's research attempts to understand how magma systems in the north Taupō area were organised in time and space between two supereruptions - the Whakamaru and Ōruanui.

Kate studying a rock up close during her fieldwork

Lava domes and magma systems
"In my PhD, I focussed on lava domes in and around Taupō and just to the north," she says. "I date rocks from these domes using argon isotopes, which can tell you how old a rock is, and therefore when it erupted." Kate also uses Strontium isotopes, and major and trace element chemistry to identify if the rocks from an eruption are chemically related to another eruption. "But for me to understand how those techniques work, I had to translate it in my head into a way that I would understand easier," she says. Her cultural roots brought a different perspective to her way of thinking. "I could use the technique to understand if these eruptions have a common ancestor. Are they from the same or different magma body? Are they from a different hapū? This enabled me to understand the techniques from a chemistry perspective."

"In the field, it's a little bit like a treasure hunt... you are searching for something that looks out of the ordinary or shouldn't be there, but equally what you expect to be there."

HOW SHE FINDS THINGS OUT

Kate starts her research by **mapping** to target sites, using Google Earth and ArcGIS.

The second leg of her work is to do the actual **fieldwork** - to ground truth what you are targeting and acquire samples, to record contacts between different rock types by geological mapping to record eruption layers (stratigraphy). "It is key to walk the whenua to get a feel for the land/whenua, orientate yourself in the landscape," she says. "In the field – it's a little bit like a treasure hunt, you are searching for either the contact between two rock types, something that looks out of the ordinary or shouldn't be there, but equally what you expect to be there. Sometimes it's even just a gut feeling and the only way to know for sure is to ground truth." The **lab preparation** of samples collected from the fieldwork forms her next step. "Sometimes I cut them into thin sections so that I can look at the different minerals in it, and there are other times where I have to mill it, which is where you grind the rocks down to a really fine powder so that you can dissolve them in acids."

For **analysis**, she uses the 40Ar/39Ar dating technique which enables her to determine the geochronology (when multiple eruptions occured). Other methods of analysis include x-ray fluorescence (major element chemistry), inductively coupled plasma mass spectometry (trace/rare elements); thermal induced mass spectrometry to measure isotopes (Sr, Pb, Nd); electron probe micro analysis to identify mineral species by chemistry.

MOST VALUABLE RESULTS

Kate noted some of her most recent results are from her study of lava domes. Not all magma systems lead to a supereruption, she says. What they need is a thermal flux. “Imagine you have a pot of porridge. When you've got your pot of porridge on the stove, it bubbles away because it's got that thermal heat flux underneath coming from from the stove. But if you shift that pot a little, the bubbling stops. Magma systems and thermal flux work in somewhat a similar manner,” she explains.

However, a thermal flux can move in space and decrease or increase in intensity over time. “So in the TVZ for instance, when the thermal flux shifted to the northeast, that’s when we got the really explosive eruptions. The lava domes are still near the thermal flux, but not quite, so the eruptions are effusive and not explosive. The thermal flux is still shifting, but the big question that remains unanswered is what causes it to shift and how to forecast it.”

Past results include: the application of rapid geochemistry techniques in the field to assess which rock formations geothermal drillers are drilling into; and identifying the temperature of a wet pyroclastic surge (~54°C) from the Te Maari eruption of 2012.

MĀTAURANGA MĀORI

“Mātauranga Māori is our science, our way of interpreting the world. It is science, but seen through a different lens, worldview and codified differently. It is also used for applied purposes as a way of living with the environment. In the field that I am in, the only way I can make sense of it myself is through whakaaro Māori or mātauranga Māori using whakapapa principles. Geology is essentially atua and tūpuna.”

WHAT SHE LIKES ABOUT SCIENCE

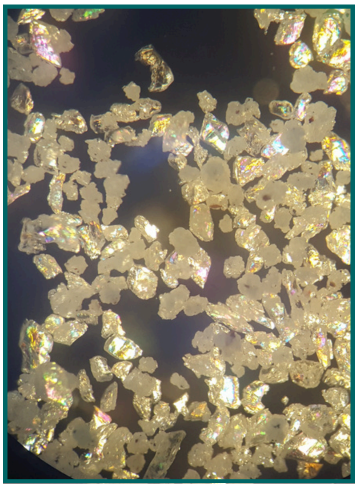
“What I like about science is the curiosity factor, it allows you to express your curiosity.”

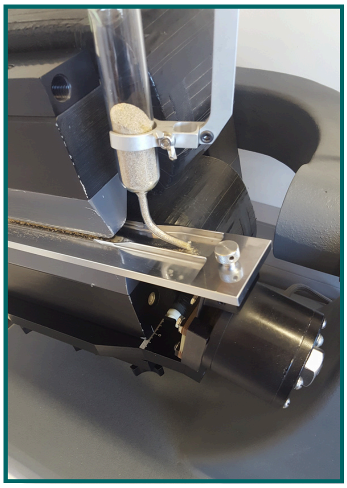
NGĀ KUPU

Tahepuia, rahoto, rangitoto - lava, scoria
Puia - geyser, hot spring, volcano
Pupuhatanga - erupt
Tawhā - caldera
Puia kōpuku - dome volcano
Puia koeko - cone shaped volcano

LINKS

Te Kōtuku, 2019. Kate Mauriohoohoo. Tūwharetoa Tribal newsletter. (p25)
Te Papa Tongarewa, 2021. Taupō supervolcano and caldera. YouTube.





(From left to right) Olympus microscope with polarising lens attachment to help identify minerals; what minerals look like under the microscope with a polarising lens attachment; Rock saw; Frantz LB1 Magnetic Barrier Laboratory Separator to separate minerals magnetically | Photos by Kate Mauriohooho