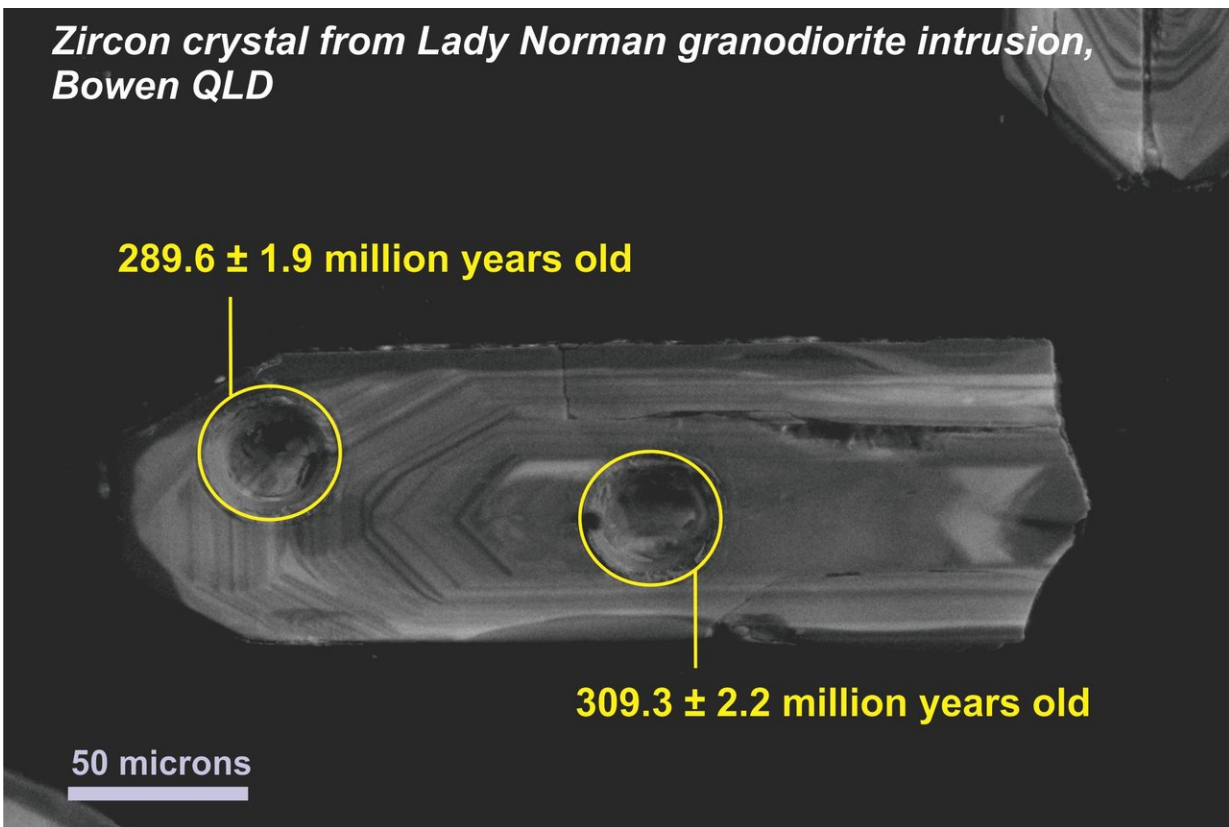


Zircon as Earth's timekeeper: Are we reading the clock right?

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Cathodoluminescence image from a scanning electron microscope of a typical igneous zircon crystal from samples studied by the QUT research team, revealing growth rings of the zircon. Yellow circles enclose ablation sites by a laser from which isotopic data is measured to determine the age of zircon growth. The analytical spots here show this zircon had two main growth periods approximately 20 million years apart in different magmas. Credit: QUT

Zircon crystals in igneous rocks must be carefully examined and not relied upon solely to predict future volcanic eruptions and other tectonic events, QUT researchers have shown.

- Zircon is a robust mineral and a timekeeper of Earth history
- Distinguishing the origins of zircon crystals, their individual chemistry and properties is not straightforward
- Misinterpreting data from zircon crystals could skew timescales for geological events such as [volcanic eruptions](#) by millions of years
- This has implications for understanding [volcanic hazards](#) and the future risks they pose

The researchers' findings have been published in *Earth-Science Reviews*. The paper, Use and abuse of zircon-based thermometers: A critical review and a recommended approach to identify antecrystic zircons, also proposes an efficient and integrated approach to assist in identifying zircons and evaluating zircon components sourced from older rocks.

Associate Professor Scott Bryan, from QUT's Science and Engineering Faculty, said the researchers had "gone back to basic science" and reassessed large data sets of analyses of igneous rocks in Queensland and from around the world, to show that wrong assumptions can be made about zircon crystals.

Igneous rocks are formed by the cooling of magma (molten rock) which makes its way to Earth's surface, often leading to volcanic eruptions.



The QUT research team examining and sampling igneous rocks in north Queensland. Credit: QUT

"One of the assumptions being made is that the composition of the zircons and the rocks in which they have formed give an accurate record of the magmas and conditions at which the zircons and magmas formed," Associate Professor Bryan said.

"From this, we then estimate the age of the event that caused them to form.

"But some [zircon crystals](#) may not be related to their [host rocks](#) at all. They may have come from the source of the magma deep in the Earth's crust or they may have been picked up by the magma on its way to the surface.

"If you don't distinguish between the types of crystals then you get a big variation in the age of the event which formed the rocks, potentially millions of years, as well as developing incorrect views on the conditions needed to make magmas.

"It is critical to get the timescales of magmatism correct, so we can understand how long it might take for reservoirs of magma to build up and erupt."



The QUT research team examining and sampling igneous rocks in north Queensland. Credit: QUT

This is particularly relevant to 'supervolcanoes' which do not always have pools of [magma](#) sitting beneath them, Associate Professor Bryan said.

There are more than 20 supervolcanoes on Earth, including Yellowstone in the US and Taupo in New Zealand.

"Determining accurately what [zircon](#) is telling us is fundamental to understanding Earth's history, defining major events such as mass extinctions, and how we understand global plate tectonics," he said.

"We need to understand the past, and read the geological clocks correctly, to accurately predict the future and to mitigate future

hazards."

More information: C. Siégel et al, Use and abuse of zircon-based thermometers: A critical review and a recommended approach to identify antecrystic zircons, *Earth-Science Reviews* (2017). [DOI: 10.1016/j.earscirev.2017.08.011](https://doi.org/10.1016/j.earscirev.2017.08.011)

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