New trigger found for volcanic eruptions

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New insights into what might trigger the eruption of Mount St Helens and other potentially explosive volcanoes are reported today in *Nature* by scientists working at the University of Bristol, UK.

Professor Jon Blundy and colleagues show that as magmas crystallise they heat up rather than cool down, as previously thought. And the more a magma crystallises the hotter it gets – by up to 100 °C. This ability to self-heat may provide a trigger for eruptions.

In addition, they show that crystallisation of underground magmas is a short-lived phenomenon – taking years rather than centuries – which is precisely the timescale over which volcanoes can be monitored.

Professor Blundy said: “This work is now being used to gauge the direction of the volcanic activity currently happening at Mount St Helens

and could be applied to any active volcano for which monitoring and petrological records are available."

Dr Madeleine Humphreys added: "Explosive volcanic eruptions are fuelled by the escape of volcanic gases from magma stored in underground reservoirs and pipes several kilometres below the surface. Predicting such eruptions requires a real-time knowledge of just where the magma is at any one time and what it is doing."

Blundy and colleagues analysed tiny droplets of volcanic liquids that become trapped inside crystals as the magma crystallises on its way to the surface. This enabled them to reconstruct the changes in pressure, temperature and crystallinity that occur within a body of magma prior to eruption. The researchers demonstrate that as pressure decreases, crystallinity increases, and the more a magma crystallises the hotter it gets – by up to 100 °C.

This surprising result indicates that the driving force behind crystallisation of these magmas was a drop in pressure, rather than loss of heat to the surrounding rocks, as previously thought. This raises a number of interesting possibilities for eruption dynamics.

If ascending magma is able to heat itself up, simply by crystallising, this may provide an important trigger for eruption without the need to invoke an extraneous heat source, such as a shot of hotter magma from below.

And because decompression can be effected much more quickly than cooling, which requires slow heat loss through the walls of the magma chamber, the new results raise the possibility that volcanic crystals grow in response to decompression on the unexpectedly short timescale of several years, which is the timescale over which volcanoes are monitored.

This work opens up the possibility of directly linking the monitoring record of active volcanoes to magma crystallisation underground in a fashion not previously possible.

Source: University of Bristol