Scientists move closer to predicting volcano hazard

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The crater of Mt St Helens showing the active dome belching steam and volcanic gases.

UK and Russian scientists say they are a step closer to predicting how dangerous a volcano is after developing a method that lets them figure out how individual volcanoes are 'plumbed'.

The new approach means researchers need only analyse a single chunk of rock from a volcano to work out how big and deep its magma chamber is.

The same method also lets them calculate the length and width of the vent that brings the magma from the chamber to the surface.

Having both measurements is vital for predicting how hazardous a volcano will be.

'Generally speaking if a volcano has a big magma chamber and a narrow, short vent, the volcano tends to be more explosive than a volcano with a small chamber and wide vent,' says Professor Jon Blundy from the University of Bristol, a member of the research team.

'So, if we know the details of the plumbing system underneath a volcano, we're in a better position to say how dangerous it is likely to be,' he adds.

Being able to predict how hazardous a volcano is has long been the Holy Grail for volcanologists. But the size and depth of magma chambers underneath volcanoes varies hugely, and finding out the inner dimensions of individual volcanoes' plumbing systems has until now proved time-consuming, challenging and expensive.

Now researchers at the University of Bristol and Moscow State University have developed a mathematical model that is cheap, safe and easy to apply.

It relies on a fact volcanologists have known about for some time: as magma moves from the magma chamber towards the surface, both crystals and gas bubbles form inside the magma. The rate at which crystals and bubbles grow depends on just how quickly the magma rises to the surface, which in turn depends on the diameter of the vent through which it travels.

'Magma from explosive volcanoes produces rocks with lots of bubbles in it, whereas rocks from volcanoes that ooze magma more slowly contain crystals of different sizes,' explains Blundy.

The researchers have taken this further: using their mathematical model they show that the range of sizes and types of crystal in volcanic rock also tells them about the plumbing for different volcanoes.

'Counting the size of the crystals gives us a window into the subterranean plumbing of a volcano,' says Blundy.

To test their model, the researchers applied it to a rock sample from Mount St Helens volcano in the US, which erupted in the 1980s.

Their model predicted a vent diameter of around 30 metres, connecting the volcanic crater to a magma chamber at a depth of around 14 kilometres. These predictions fit with other estimates using more traditional techniques like satellites or seismometers.

'The idea is to use this surprisingly simple and low cost technique in conjunction with some of the other methods to tell us about individual volcanoes' plumbing systems, that then inform our models of how volcanoes operate during eruptions,' Blundy says.

The study is published in the April 2011 edition of the journal *Geology*.

More information: Oleg E. Melnik, Jonathan D. Blundy, Alison C. Rust and Duncan D. Muir, Subvolcanic plumbing systems imaged through crystal size distributions, *Geology* v. 39 no. 4 p. 403-406, First published online March 8, 2011, doi: 10.1130/G31691.1

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