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Melting ice caps may trigger more volcanic eruptions

10:38 03 April 2008 by Catherine Brahic

A warmer world could be a more explosive one. Global warming is having a much more profound effect than just melting ice caps - it is melting magma too.

Vatnajökull is the largest ice cap in Iceland, and is disappearing at a rate of 5 cubic kilometres per year.

Carolina Pagli of the University of Leeds, UK, and Freysteinn Sigmundsson of the University of Iceland have calculated the effects of the melting on the crust and magma underneath.

They say that, as the ice disappears, it relieves the pressure exerted on the rocks deep under the ice sheet, increasing the rate at which it melts into magma. An average of 1.4 cubic kilometres has been produced every century since 1890, a 10% increase on the background rate.

Frequent eruptions

In Iceland there are several active volcanoes under the ice. The last big eruption was in 1996 at Gjalp, and before then in 1938 - a gap of 58 years. But Pagli and Sigmundsson say that the extra magma produced as the ice cap melts could supply enough magma for similar eruptions to take place every 30 years on average.

Predicting the eruptions precisely will be tricky, though, as the rate of magma migration to the surface is unknown.

The situation in Iceland does not necessarily mean magma will be melting faster around the world. Vatnajökull sits atop a boundary between plates in the Earth's crust, and it is this configuration that is allowing the release in pressure to have such a great effect deep in the mantle.

But the thinning ice has another effect on volcanoes which will be more widespread.

As the amount of weight on the crust changes, geological stresses inside the crust will also change, increasing the likelihood of eruptions. "Under the ice's weight, the crust bends and as you melt the ice the crust will bounce up again," explains Bill McGuire of University College London in the UK, who was not involved in the study.

Unexpected activity

Pagli say places likely to be at increased risk of eruption due to ice-melt include Antarctica's Mount Erebus, the Aleutian Islands and other Alaskan volcanoes.

The shifting stress might even cause eruptions in unexpected places.

"We think that during the Gjalp eruption, magma reached the surface at an unusual location, mid-way between two volcanoes, because of these stress changes," says Pagli.

McGuire thinks the Vatnajökull study is based on "perfectly reasonable" physics. However, he says that climate change presents an even more explosive threat. "It's not just unloading the crust that triggers volcanic activity but loading as well."

He and his team are looking into the effects that rising sea-levels - also a consequence of melting ice caps - will have on volcanoes. "We are going to see a massive increase in volcanic activity globally," he told **New Scientist**. "If we look back at previous warm periods, that is what happened."

Journal reference: *Geophysical Research Letters* (in press)

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Vatnajökull in the south-east is the largest ice cap in Iceland and conceals several volcanoes (Image: NASA)

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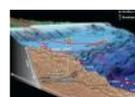


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Negative Feedback

Thu Apr 03 12:05:20 BST 2008 by **Tobs**

Would this be a last desperate effort by the planet to fight global warming? more volcanic activity = more sunlight reflected...

Hope springs eternal.

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Negative Feedback

Thu Apr 03 12:42:47 BST 2008 by **Anonymous**

What if more volcanic activity = more green house gases emitted = more heat = chain reaction?

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Negative Feedback

Thu Apr 03 13:18:27 BST 2008 by **Joe**

From Wikipedia on the Year without a Summer.

http://en.wikipedia.org/wiki/Year_Without_a_Summer

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More Volcano's, More Cooling?

Thu Apr 03 13:23:00 BST 2008 by **Sally**

That was my reaction! Sure volcano's spew forth greenhouse gases, but they also spew forth dust which cools the world. The world hasn't seen any serious volcanism for over 100 years now and the little it has seen has resulted only in a year or two of haze due to the small volume of ash produced. I haven't read anything yet that associates volcanism with

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excessive warming and global extinctions but...

Probably more worrying is WHERE are these volcano's going to erupt - are they going to result in acid rain which will have a devastating impact on the world's crops?! Aren't the dinosaurs supposed to have been brought to the edge of extinction but excessive sulphuric emissions from the Deacon Traps in India?!

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More Volcano's, More Cooling?

Thu Apr 03 18:32:20 BST 2008 by **Malcolm Hunter**

My understanding is that you should get short-term negative feedback, as a result of the injection of sulphate aerosoles into the atmosphere, but longer term positive feedback, as the CO2 that is also released will stay in the atmosphere for a lot longer than the sulphur.

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More Volcano's, More Cooling?

Tue Apr 15 11:16:49 BST 2008 by **Ian Orchard**

If you check <http://tinyurl.com/4fyng6> for the NS report of the flood basalt eruptions about where Iceland is now, that have been implicated in the Paleocene-Eocene Thermal Maximum (PETM) 55M ya. That event lasted about 20k yrs and includes extensive extinctions particularly of marine life. Huge volumes of CO2 and methane were released causing a global temperature rise of 6-8C. The worry is that the amount released was less than the fossil carbon humanity is dumping into the biosphere currently

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Rheology!

Thu Apr 03 16:26:35 BST 2008 by **Prasad Rao**

Rapid changes in the mass of ice overlying volcanoes could cause exfoliation of basement rocks and even minor earthquakes and faults resulting from redistribution of stresses in the rock mass, but changes in magma production and volcanic activity seems rather farfetched? But then, I am no geophysicist or a rheologist.

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Rheology!

Thu Apr 03 22:03:53 BST 2008 by **Dave**

Varying pressure changes the melting point of materials, not just temp. I guess that's why losing the ice could mean more magma.

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