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## Title

Volcanology and How Communities Are Affected By Volcanic Activity | Dr. Bradley Pitcher

## Image



Dr. Bradley Pitcher

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## Biography

In this episode of “What is Global Health,” Bowei Li (CC’26) spoke with Dr. Bradley Pitcher from Columbia University on the risks associated with volcanoes. Dr. Pitcher explains the health consequences that volcanoes induce and the tradeoffs that communities make in living near them. He also gives insight into future trends in volcanic activity in relation to climate change.

Dr. Bradley Pitcher is a professor at Columbia University. He is a faculty member of the Frontiers of Science program and a lecturer of Earth and Environmental Sciences at Columbia. His research specializes in igneous petrology, the study of magmatic rocks. Using imaging techniques, he determines the chemical composition of igneous rocks in order to examine past eruptions and predict future ones. Dr. Pitcher has conducted research in the Oregon Cascades, Mt. Etna, central Japan, and more.

## **Volcanology and How Communities Are Affected By Volcanic Activity | Dr. Bradley Pitcher | Transcript (via Sonix)**

**[00:00:08] Bowei Li**

Hello, everyone, and welcome to this week's episode of What is Global Health, a student run podcast series by the Journal of Global Health at Columbia University. In this series, we interview experts in the fields to learn more about topics ranging from COVID 19 to menstrual health and hygiene. We aim to factor all elements of identity: race, gender, sexuality, religion and more into discussions of global health. My name is Bobby Lee and I am a first year perspective public health student at Columbia College. This week, I got to speak with Dr. Bradley Pitcher about the health risks associated with volcanoes. So let's get started. Volcanoes might not be the first thing that comes to mind when you think of a public or global health risk, especially if you're a resident of the East Coast USA. However, volcanoes are health hazards to many communities around the world, and this has increasingly become a cause for concern as urbanization continues to expand and tight knit infrastructure systems are increasingly built on fertile volcanic soil. In light of these trends, Dr. Pitcher's work focuses on using past volcanic eruptions to inform and predict future ones. Dr. Pitcher has studied volcanoes everywhere from the US to Italy to Japan and is currently a lecturer of Earth and Environmental Sciences at Columbia University.

**[00:01:36] Dr. Bradley Pitcher**

The type of science that I do is actually called igneous petrology, but essentially I'm a volcano scientist. So what I do is I go and look at rocks from past volcanic eruptions and I shoot lasers at them and other things in order to figure out their chemistry. And by looking at the chemistry of these rocks, I can figure out what happened inside the volcano before it erupted. And so while although I study these past eruptions, there are other volcano scientists who look at current eruptions and and look specifically at how current eruptions or activity from active volcanoes could be affecting public health.

**[00:02:15] Bowei Li**

To start off the conversation, I wanted to get a wholesale sense of the health risks that volcanic eruptions pose. And as it turns out, the list is quite comprehensive. So what sort of health effects do erupting volcanoes or eruptive materials have on humans and like just generally health risks associated with that?

**[00:02:36] Dr. Bradley Pitcher**

Yes, that's that's a really great question. So in general, volcanoes have, you know, a handful of materials that can be erupted out of it. And so one of those is gases. So, for instance, the most common gas that gets erupted by volcanoes is actually water vapor. So that's not too big of a of a hazard. But then there's a bunch of other nasty gases that come directly from the magma and can be erupted during volcanic eruptions or even when the volcano is not erupting, it can be just slowly, passively degassing. And some of these more gnarly gases are, for instance, carbon

dioxide and then also sulfur dioxide, hydrogen sulfide, even gaseous forms of arsenic and various other things. And so these gases can really pose, you know, health problems for people that live nearby. And so, for example, there's an, in, I believe it was in 1985, there was a lake called Lake Kivu in Africa. And gases from a volcano nearby had been leaking into the lake and collecting at the bottom of the lake. And because there's no change in the season and therefore you don't have warm water at the top and cold water at the bottom and vice versa. And there's no there was no circulation of the lake. And so gases just built up, built up and eventually overcame that pressure. And then carbon dioxide was just thrown into the surrounding areas and it killed like 3000 people and all surrounding livelihood, livestock.

And so, you know, and so that, you know, is just carbon dioxide alone. And because it is denser than regular air it pools and in some cases near volcanoes, it actually poses more of a risk to children because they're breathing in a higher amount of carbon dioxide than taller people are. So so that's a big health effect. There's also, you know, sulfur dioxide can cause you to have serious health effects. It can degrade your lungs and then also can be bad for your teeth, you know, when there's acid rain and that kind of thing. So those are the gases. And I haven't even gotten to the fact that then when a volcano erupts, it can send ash up in the atmosphere, that if you were to breathe that in, it can actually cause I mean, because ash is actually just volcanic glass particles. And so if you breathe that in, it can just tear up the inside of your lungs and it can cause volcano silicosis and can cause, you know, you can have kind of a pneumonia from the ash particles breathing that in. And so those are kind of the health effects that don't involve immediately dying. But then there's also the fact that, you know, there are possibilities of volcanic eruptions just killing people right out.

**[00:05:36] Bowei Li**

Pretty significant, right? So what about the communities that live near volcanoes who are the most at risk? Do you find reason to be concerned about communities that are situated very close to volcanoes and like, if so, how can we better defend against these risks?

**[00:05:54] Dr. Bradley Pitcher**

Yeah, that's a really great question. And particularly, you know, these communities that are nearby, even when the volcano isn't erupting, you can have like for instance, that sulfur going up into clouds that are nearby and then raining down a sort of sulfuric rain. And so, for instance, on the big island of Hawaii, a lot of people collect rainwater and that's their drinking water. And we've actually yeah, we've actually seen serious problems with tooth decay because the water itself is sort of acidic and it's been eroding away at people's teeth. And that is partially that's both the sulfur, the hydrogen sulfide that gets in the water, but also fluorine as well.

**[00:06:36] Bowei Li**

The idea that volcanoes can pose a risk to communities even while dormant turns out to be a big risk factor. For one thing, it's perpetual, which builds chronic conditions such as the tooth decay that Dr. Pitcher mentioned. And for another, it's what he calls the quote unquote, silent killer,

because these risks are not taking place during an eruption and they can be hard to come across before it's too late.

**[00:07:04] Dr. Bradley Pitcher**

So a lot of times people do focus on the, you know, during an eruption, how could this go and devastate communities and maybe hit them with ash or lava and kill people that way? But I think that a lot of times people don't consider the fact that even without an eruption, you can have these dangers posing to people and their health. And, you know, and I think that particularly this is one of those instances, as we talked about, where different communities can be affected by these volcanic hazards to health in different ways. One example is Mammoth Mountain, which is part of the Long Valley Caldera, which is in California. Mammoth Mountain is a famous ski resort in California, and that volcano erupted 760,000 years ago. And while we while there's definitely still magma down there, it's probably not going to erupt in our lifetime or in many generations. It might erupt again in the future. But what we really do have to worry about is the fact that it's pumping out a lot of these gases. And in fact, in the in the late eighties, there was a skier who fell into a tree well, and then because carbon dioxide is heavier than air, it pooled in the tree well, and unfortunately, that skier died of asphyxiation. His friend tried to help him and also died. And then two ski patrol people came and they died. And so there are parts in the ski resort where skiers can't go because there's this pooling of carbon dioxide. So and that volcano is not likely to erupt. So these are pure health effects from a volcano that's not you know, that doesn't pose a direct threat of eruption. And these kind of gas type hazards are definitely ones that can happen, you know, all over the world. There's gases coming out of volcanoes all the time. And I think that that's probably the you know, it's the silent killer, I suppose, or even without killing, can have serious effects on people as we discuss with degrading teeth, lung health. Yeah. So definitely even even dormant volcanoes can pose a serious health threat.

**[00:09:17] Bowei Li**

Despite these risks, however, communities nevertheless exist on or close to volcanic sites. Dr. Pitcher stresses the fact that the reality is more complicated than simply being able to choose to avoid the risk of having a volcano close by.

**[00:09:37] Dr. Bradley Pitcher**

You know, there's definitely health effects, certainly for these people that are living near volcanoes. But it's hard because it just so happens the volcanic soil is really fertile. And so more and more and more each year, people are moving into these areas surrounding volcanoes, especially when they're in highly populated areas. And for many people, the the risk is greatly outweighed by the benefit of being in this fertile soil, being, you know, like in a place where they can afford to live. And so it definitely is this balance where, you know, there are people who that's where they live. But unfortunately, there's a constant threat of, you know, health problems.

**[00:10:17] Bowei Li**

That's interesting. And do you think that like this risk of volcanic eruption, does that make it like the cost of living kind of lower in those spaces or is like the fertility of the soil sort of outweighing that and these are becoming more populated touristy areas?

**[00:10:36] Dr. Bradley Pitcher**

Yeah, that's a really great question. So for example, just three years ago there was an eruption in Hawaii on the Lower East Rift flank zone and there was this whole neighborhood that was actually a relatively low income neighborhood. It was the only place that was livable on the big island. It's very expensive to live in Hawaii. And so there was this one community where it was actually, you know, middle class people could live there. And part of it was that it was a place that had been destroyed by a lava flow back in the early sixties. And so people moved back in knowing that there is a risk that there could be another lava flow. And sure enough, lava flows came through and destroyed about half of that, that town and village. And so there definitely is that problem where, you know, sometimes even marginalized communities can be pushed further towards danger. Another example is there's in the Democratic Republic of Congo, there is horrific violence occurring in some of the towns of Goma and some of these other places. And so but but and in surrounding countries, too, there's horrific violence. And so for some people, their refuge was this area near the volcano just outside of Goma. But this volcano, Nyiragongo, has several times had these large lava flows that can actually travel at 60 miles per hour and have caused quite a bit of damage and a lot of death in the past. And so I think for some it's just it's worth the risk and it's the kind of thing where it just doesn't those eruptions don't happen very often. And so it's easy to kind of forget that it's a persistent danger.

**[00:12:20] Bowei Li**

Definitely some big questions to be considering and not very many easy answers either. So where is this all going? To close the conversation, I wanted to get a better sense of the future of volcanic risks. In particular as climate change continues to shape our world, would it have any effect on volcanic activity? To shift gears a little bit. Is there research to suggest that volcanic activity is being affected by climate change, maybe getting more or less active or something?

**[00:12:53] Dr. Bradley Pitcher**

Ooh, that's a really good question. I love it. Nice. So let me before I answer that, I will say that there's abundant evidence that volcanic activity can cause changes in the climate. Now, that being said, usually the way it works is it actually causes global cooling. So it's the fact that these large explosive eruptions, including the one that just happened last year, Hunga Tonga-Hunga Ha'apai volcano, it's a mouthful for sure, but that one pumped enough sulfur dioxide in the atmosphere that it caused a teeny bit of global cooling. And we are winter this year is going to be very strange. It's going to be a strange La Nina year because of that volcano. And also, you know, there are volcanoes in the past. Tambora on 1815 caused the Year Without a Summer. It caused global cooling of two degrees. So that's how volcanoes can affect climate. A better question is the one that you asked me, and that is, has there been researched whether climate change could be causing volcanoes to erupt more? And that's a super active, very exciting part of research in our field. And I would lean toward saying yes, and here's why. Volcanoes, they have magma sitting underneath the volcano and they sit the magma sits there pretty happily until the pressure on the inside of the magma is more than the overlying pressure of the rock above it.

Well, now let's say you have volcanoes, especially up in the Arctic Circle or up in Alaska or something like that, where in addition to the volcano above the magma, you also have a mile of

ice or, you know, you have thousands of feet of ice above it. Well, all that ice contributes lots of weight and pressure, and that can keep that magma happily sitting there. But if you remove that ice, suddenly you've removed a lot of that pressure. And so now that same magmatic pressure suddenly becomes a lot more than just the rock above it, because now you've removed all that additional weight from the ice. So I would expect that there is an effect in in that respect. But no scientific study has been able to directly prove that. I'm hoping to do some research in Alaska in the future to kind of see that. There's also the possibility that if you cause a lot of glaciers to melt, that that can then cause meltwater to seep down into cracks. And then if water touches magma, then it flashes to steam and can cause a huge explosion. So it definitely is possible that, you know, in addition to more hurricanes, more hurricanes, stronger hurricanes, all these other things, that we might also have to contend with more volcanic eruptions.

**[00:15:33] Bowei Li**

Wow. Okay. But going with that train of logic, though, so you were talking about how the pressure is just less for the magma to be able to erupt. Would that mean that with more ice, maybe it would be like a more intense eruption versus more frequent, less intense eruptions or is that not a trade-off?

**[00:15:57] Dr. Bradley Pitcher**

Ah, that's a really great point. Yeah. So that would make sense that if you could pump more magma into a volcano without it erupting, then you could expect, you know, because maybe it had more of that weight from ice or something like that, then perhaps, yeah, you could expect to have, you know, large eruptions rather than, you know, more frequent, smaller ones. That's actually a really great idea. You should maybe you should consider being a volcanologist.

**[00:16:23] Bowei Li**

And that wraps up my conversation with Dr. Bradley Pitcher. In addition to all the incredible work he does in geology and igneous petrology, Dr. Picher aims to make his work as accessible as possible. You can find him on Twitter and Tik Tok @tiedyesciguy, where he posts a myriad of volcano-related content, including footage of volcano formation, videos on the effect of volcanic eruptions on its surrounding environment, and the interesting ways in which even you may have been affected by volcanic activity. Thanks for tuning into this installment of "What is Global Health?" We hope you enjoyed and as always, be on the lookout for new episodes every other week. Also, be sure to check out our online blog posts on our Columbia Journal of Global Health website, and we'll see you soon!