SUPPLEMENTARY MATERIAL Detailed description of our themes

These three themes are moving in order of 'predictive' power for recognizing cause and effect, or power of realization – so can be written in this way.

'Turning points' In narratology a 'turning point' is an event or circumstance that has a decisive role in the plot (Prince, 2003). Unsurprisingly in this context it is a synonym for 'crisis' which is also the word commonly applied to the entire sequence of events during volcanic eruptions. It also has parallels with the 'moment of change' seen as integral to generating interest in stories by Storr (2019) and is an essential element of all autobiography. So they are important in making the story interesting or memorable. In the context of our storytellers there are three ways in which turning points have value in sharing or generating new knowledge: (A) volcanic turning points – by definition these defined the choices of the stories told (Figure 1). In our dataset these are often specific or memorable types of eruptive behavior (see Table 1 and Appendix 3).
(B) individual turning points – there are moments of personal realization, and analysis of consequences. Includes Limitations (often risk-taking), recognition of intuitive approach, importance of other dimensions of knowledge in crisis situations.
(C) group turning points. A realization that has generalizable consequences for volcanological knowledge or disaster risk reduction (DRR) , or a realization or change made across a group of scientists or different actors in that moment. (coproductive knowledge, knowledge limitations and power dynamics).

'*Counterfactual analyses'* A powerful value of storytelling is its capacity to describe cause and effect in a given situation and over a defined timescale. The greatest inherent value in our stories would come in being able to provide this explanation in a way that is generalizable, so that it can be recognized in other situations (predictive). In chaotic multivariate natural systems this is notoriously hard to do but a first step on this pathway can be considered a counterfactual analysis of events that transpired. A causal relationship would be able to state that A will be true if we do B. A counterfactual analysis recognizes that A would have been different were it not for B. With a limited and often poorly repeatable series of well described events to draw on volcanologists are increasingly recognizing the power of counterfactual analysis in searching for the underlying causes of disaster (Woo, 2018, 2019), even when it has not necessarily occurred. Seeking causal inference in 'near misses' was a common feature of our storylines too.
In this dataset volcanologists tended to reflect on 'what could have gone wrong' or near misses. This and the related theme of recognizing 'what went right' are gaining prominence as an important feature of improving future response to eruptions (Aspinall and Woo, 2019) . These usually centred around reflections unnecessary personal risk-taking, shifting perception of what the experience of 'maximum expected behaviour' might be, and imagining standing up more strongly to the politicization of decision-making, or reinforcing ideas of how to this reflection to be better prepared (for example for equipment to fail).

'*Improvements in knowledge'* these often emerged as storytellers were either prompted to or spontaneously reflected on the value of that story to them. Many focused on offering causal insights into the key drivers of volcanic risk during the crisis situation described. We took an

inductive approach to the development of the subthemes used here but drew on other synoptic analyses of the drivers of risk and death in volcanic eruptions (Brown et al., 2015; Barclay et al;, 2019 and insights into political influences on decision-making in crises (Donovan et al., .

These themes are illustrated in Table 2. This centres on role of science in decision-making (as a knowledge base and as a trusted entity). Variance in behaviours. Interdependence of the hazards context and the socio-cultural landscape – what is most important about that. Sometimes these improvement are evolutionary in this respect, rather than revolutionary.

Finally, '*knowledge shaping and propagation'* – Here we used the aspirations of the UNDRR Sendai Framework for Disaster Risk Reduction, and descriptions of the circulation of knowledge in practice as a starting point with which to create the categories. Answers within this theme typically arose from the questions we asked during interview about how, where and why stories were told. These were usually straightforward description of who the stories were consciously being told to in what context, and with what lesson in mind. Our analysis also included implicit lessons in the stories – intuition value, coproduction of social and natural knowledge, value of listening and lessons about democratization of scientific knowledge with other things that are important in this context. Here the focus group conversation demonstrated that comparison and questioning of one another's stories makes the value of these stories even stronger. This hints at a greater value to this process if we present it as a formalized way to capture these experiences and their rationalization.

Interview protocol

Scientists as Story-tellers: Interview Template

An overall aim of our UK Arts and Humanities Research Council project is to try to understand the various ways that the recounting and recalling of events during volcanic eruptions happen. We want to explore the value the information in these stories brings to volcanic risk reduction. We wish to understand how **scientists** transmit important knowledge about risk reduction through the stories they tell *one another* as part of this. This is not about the 'story' of research findings but the sharing of experience and important knowledge about how to manage and cope with volcanic crises.

We want to understand how, where, when and why these stories are told. By doing this we want to understand what scientists regard as valuable about these 'stories'; and the role they might play to help reduce volcanic risk.

A secondary purpose of these interviews is to gather some of the unwritten information about events during the Soufriere Hills Volcanic crisis. With your permission only, distilled or full versions of these stories will be contributed to the Montserrat Volcano Observatory archive.

We estimate the interview will take around 40 minutes to one hour of your time, and it will largely focus on stories you tell about the crisis so you might want to think about those in advance.

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Questions

About the Stories

1. During what time periods have you worked on SHV? What were your principle roles and how has this changed over time?
2. Can you share three of the favourites 'stories' you share with other scientists when you are re-collecting times when you were involved in the SHV crisis? *Make sure you ask them to tell it as much as they can in the way they would share them with another scientist?* [*If you don't tell stories can you tell me a little bit about why not – and then finish*].
3. Can you explain why you chose these stories?
4. Is there any element of these stories that relates to materials either you have published or that have been published elsewhere? (*is your experience wholly consistent with the published accounts – if they say yes*)
5. Has your 'story' changed in anyway over the years (*or changes with the audience*). Do you have any idea why?
6. Does the content of the story vary according to whom you are telling it? What do you change about the wording?
7. Does it strike you there are phrases or words you tend to use to begin and end your story i.e. what sort of words or phrases do you use to being and end the story.

The when, where, and what of the stories

1. When and where do these stories get told? (*if stuck examples might be: in the field, while working on other volcanic systems, while teaching students – graduate or undergraduate*). Is this different between the exemplars you have given us?
2. What sort of people are in these stories? (*not necessary to ask if apparent from the story itself*)
3. Who do you tell these stories to? (*again not necessary if apparent from 1*).
4. Do you think there is anything important in these stories and why (*or why not*)?
5. Is there a particular lesson you want to convey when you recollect and tell any of these stories?
6. Are there reasons other than 'lessons' for you to tell these stories?

'Volcanic Turning Point's as Story Exemplars

Story 1

I often tell people when I'm talking about volcanoes and volcano hazards was actually how Soufrière Hills helped me grow up…

when the cold density surge came over Montserrat, over the Plymouth area, over the rim. The observatory had been in Plymouth and we moved the observatory to the Vuepoint. And I'm of course just like, wow, something's happening, this is cool and kind of in this very jazzed, totally scientific thinking of the volcano. And there was a woman who was basically a

cleaner there who was… vacuum cleaning the room and I went over to her and I said, 'Wow, isn't this really cool, isn't this interesting and exciting?' And she burst into tears and said, 'What will become of my home?' And that was, to me, probably one of the most profound actually interactions, even though short, that I've ever had in really putting the human face on what a crisis is all about

Story 3

So the Boeing 747 coming into Redoubt on December 14th or 15th I guess, of 1989 is another big one that we use. We all, I think, use 'cause many of us were involved in that eruption. But we talk about that one a lot because we talk about the difficulty of being in aircraft and clouds and not being able to distinguish in a low light, typical Alaska day, kind of what the difference between an ash cloud would look and a weather cloud

Story 5

[activity] leading up to the pyroclastic flow which happened on the 25th of June 1997, which caused 19 deaths. So this is very much an iconic moment, really, a sort of benchmark moment in the history of the eruption, really, because it was the first time there'd been fatalities, or the first time… I think, certain fatalities had occurred

let's be honest, it was an absolutely iconic moment. And I actually struggled, and I think a lot of other people who worked in Montserrat in those early days did struggle.

Story 8

And when the explosion happened they had to respond, and they did. Fortunately people got out quickly, no pyroclastic flows came out of the northern flank. Everything went down towards the Eastern side out of its way and nobody got hurt, but it really was a significant event.

I think, yeah … I'd say it taught you a lot about how you have to operate. I think for me it personally gave me a lot of confidence in my being –

. I think it's something important to me. I mean when this eruption started I think I was fairly inexperienced and young. I think having survived September 17th I had a lot of confidence in terms of what I could do and what I could do and what … there's a lot more belief in yourself because in the end, despite the fact that lots of things happen, it was probably managed …reasonably well,

Story 9

Now at the time we had never had, I mean I personally had never seen a pyroclastic flow. I'm a volcanologist but I've never seen anything like this. So you began to see this event, this cloud coming towards you. So I'm chatting to the guys and the guys … in those days, as it is now, most people felt that once a scientist it was there it was safe. So the guys are chatting to me, 'Oh yeah man …' So I then told them, 'I'm not sure what this is, you know.'

'But if it is what I think it might be …' because I didn't know there would be a surge, 'I think we'd basically …'

I: It's gonna be hot!

P: Gonna be hot, yeah. This is not a good position to be in.

Story 10

Right. It was those periods when you had those explosions, right? And the explosions got so regular that we figured out a pattern, it was really good. I mean it was wonderful being able to predict an eruption because we could predict when the eruption was going to be. In fact people used to set up right where the observatory is now – no Flemings, where the observatory is now. Because we told them exactly when the explosion was going to be, they would set up their cameras. And they would get a fantastic shot, right? So we had a protocol for when these explosions happened, so what happened during the time of just before the explosion … so we had developed a procedure where prior to an explosion we would reduce the staff at the MVO, at the observatory, because we wanted to expose less people to the danger, so we stripped it down to probably Chief Scientist and one or two other people.'

Story 12

Yeah, and not only that, these little things, 'cause I would have never known about the siren, it was the first time I heard that the helicopter had a siren. Yes, we did our intro and whatnot, we did it for helicopter safety, so the siren wasn't something I was familiar with until then. So learning about, so there are things I guess sometimes in the transferring of knowledge, or if you have to hand over to somebody, there are certain things that might take priority, and then there are certain little things that get left back, and these are things that become important!

Story 15

the volcanic unrest in 1992 and so this is interesting, initially you are thinking it's going to be like all the other periods of unrest, that the activity will start and subside within months and that will be it. But then you find it's not subsiding, and it is just going on and on

Story 17

And then you come to Holy Thursday, so the tradition at that time was that you have the holiday the next day, cricket the evening before, so we planned cricket and we started seeing the small earthquakes during the course of the day, so like in the afternoon you're seeing these small earthquakes

I: This is after lunch or

P: After lunch.

I: By then you had signals coming in directly?

P: Yeah, yeah.

I: By radio?

P: Yeah.

I: OK.

P: So the drums, three drums in technical office, so yes, so we are seeing these on Wallibou station. And as the time going by, so we are playing cricket and [Scientist X]and [Y] are coming in every time and they are looking at the drums and they're commenting that they're bigger. I was a student at the time, I was working on my bachelors, so I was normally here up until ten o'clock anyway, so –

I: Ten o'clock night?

P: In the night, . So I would go have supper and come back and work up until ten. So you are there and you're seeing this thing happening, the cricket is over and so I am there –

I: So when the cricket over, they didn't go, they were liming still?

P: limed a little, then they went but they kept coming back every half hour.

I: realised something was changing.

P: Yeah, something was building up. So by, well of course I stayed later than ten that night, so by 9:30 they are discussing it and saying we have to advise the Prime Minister this is looking, it is intensifying too rapidly to say wait until tomorrow. So by 10 o'clock they called the Prime Minister and advised him that we are seeing these unusual signals under the volcano and there is the potential for there to be an eruption. I don't think that they were thinking it would happen that night….

And because it was, the onset was rapid. Onset and culmination was so rapid. And that we were saying something happen beforehand and it did

Story 18

So I am heating up the lunch and Scientist is outside looking at the volcano, and Scientist said, '.. come! Come fast! See this!' So you're standing there and you're seeing the cloud going up and you're seeing the sun being blocked out and you're seeing the day going to dusk, going to night. So we come inside and then he said, 'Oh … ' he's anxious now to get back onto the Observatory, but his bald head, he has no hat <laughs>, so I gave him, I said, 'OK, take this umbrella, go with the umbrella.'

I: Was it ashing by then?

P: Mhm. Yes, it was ashing . So he went down and well, I finished have my lunch and then I went down and joined them. And when I went down now, so we go into the Observatory, I said, 'Is there anything we can get you, do you need anything, something to drink, whatever?' So then we had to go out and get drinks, so Scientist and I went out, so that was … oh, that was like winter. Everything was covered, blanketed in this grey ash, it was like winter. It was quite an experience just to see it. And then when we heard that the people had died, it was all very, very sobering.

Story 19

I think one of the bits I sort of concentrate on is the period after the September 21st collapse in '97, which was a big collapse which destroyed the airport, burnt it out and then there was a month of explosions after that. And from what I gather that's probably about the low point in the population on the island. It was a period that was, you know, it was immensely depressing on the island when everything was grey, covered in rocks. I mean I tell the students about it just trying to convey the reality of it.

… and it had been a big change in the monitoring when essentially everything was helicopter based, there was no more bombing round to Whites or round to O'Garra's or something in your car. Everything became helicopter based, so by definition it's a big deal doing any aspect of field work. You could have observations from JackBoy Hill and stuff like that but it was…

.. And it did feel remote, it felt very remote and quite unpleasant really and realistically if you're sensible about it and you've got your visuals and cameras and so on you can monitor perfectly well from that distance. But for us, and at the time, it did feel remote and a bit weird.

Story 23

I'm starting with the Boxing Day [event] because it's sort of somewhat easier to tell the story, but I think that's a very nice story in its own … some of the issues around managing volcanic crises, because in I think October 1996 we'd got what we call the Galway's Wall Crisis, the southwestern side of the volcano was becoming unstable, there was

faults and earthquakes going on and little avalanches down there, and I remember being on the island [Scientist], I think around October '96, and then there was some quite large earthquake swarms, and [scientist] and I went up to look at Galway's Wall with [scientist] I remember, one of the local staff. And I remember one particular visit because there was really intense earthquakes, felt earthquakes going on, swarms, and when you went up to the Wall, we knew from communication with the observatory that when there was an earthquake we could actually see the avalanches going down the wall. So that was both … and you could also see the dome growing and poking its head above the wall. And so we were at that stage very concerned about a Mount St Helens type collapse or flank failure, at the time, and that this would lead to something pretty devastating

Story 25

So, we went down the caldera and we waited carefully, so you know that this two hour period was over OK, so we had another puff, that was fine, we waited, another two hours and then… puff.. so right after this puff we we went up and it was easy to go up with the jeep there so we just climbed up the stairs, the concrete stairs to the crater rim and so we had a good hour and a half to map the crater rim, and so we did. We were just half way through when we heard this rumble, and we saw this cauliflower thing basically just coming out …. Completely out of the blue as it were, because it didn't .. it didn't [fit] fit to the timing that we had observed for at least two or three days

Story 26

Then Boxing Day Even happened and I saw the same ridge… and that was a few months later… and the same ridge was completely blown away… there was not a single bush standing where we had parked our helicopter….

Story 32

'And there was everyone there watching actually this amazing spectacle of lava flows knocking down buildings. The remarkable thing was that its very slow but steady and it just kind of pushes it over, it doesn't flow over, it just kind of knocks it over. And so there was maybe 150-200 people around. We parked our car about 500 m away. And we were watching it, pretty much like tourists, I mean it was an incredible thing. But, what we did not know was that within one of the buildings that had been knocked over there was a big metal tank, a water tank.

This was obviously, had been heating up. And, the water vapour was turning to steam, the water was turning to steam… and eventually, it exploded. So this lava flow, suddenly out of the blue when it had looked like it had been a peaceful situation..'