Lesson: “Why do some volcanoes explode?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Doug! I want to tell you a true story, an event that took place on May 18, 1980, in the state of Washington, the northwest corner of the United States. People were going about their morning as usual, when suddenly, the ground shook. There had been a huge explosion. When people looked up, they saw a cloud of smoke, steam, and ash rising up into the sky. It was Mount St. Helens. Mount St. Helens, the local volcano, had erupted its first eruption in over 100 years. When all the dust finally settled, people realized just what an enormous eruption this had been. This is what Mount St. Helens looked like before it erupted. And this is what it looked like afterward. This volcano had exploded. It blew off its entire top. It exploded with so much force that it knocked down entire forests that had been growing on the mountainside. Cars parked nearby were buried in bits of rock or ash. In fact, ash from the explosion burst outward so far that some of it came down over 1,000 miles away in Oklahoma, halfway across the United States. Other volcanoes have erupted like this, too. Here's a video from space by astronauts as they passed over Mount Sarychev in Russia, which you can see is exploding just like Mount St. Helens did. Maybe the most famous exploding volcano of all time was Mount Vesuvius, which, when it exploded 2000 years ago, buried the ancient Roman city of Pompeii. This is just a painting since they didn't have cameras back then. Now, definitely not all volcanoes explode like this when they erupt. There's another second kind of volcano, which is much gentler. Here you're seeing one. This is in Hawaii, where people are actually walking around on it. You can go right up to the lava flows in these places. Watch as this man plays with the lava on this volcano. Isn't that wild? Now, obviously, you don't want to get any of this stuff on you. It's really hot, and you don't want to stand too close to the center of the volcano. That would be bad. But even if this kind of volcano were spurting out its lava like you see here, as long as you stay out of the way of the lava, you could stand there and watch this. What's going on here? Why are some volcanoes more gentle, where people can get close to them while they erupt, but other volcanoes are explosive, blowing bits of rock high up into the sky? That's weird. Why do some volcanoes explode? To find out, we need to spend a little time looking more closely at these two kinds of volcanoes. See what you notice about them.

EXPLORATION VIDEO 2

So, did you spot any differences in how the two volcanoes look? Hopefully, you were able to notice that the exploding kind of volcano—well, at least before it explodes—it's shaped like this, like a tall cone. So let's call these the cone volcanoes. But what about the shape of the other kind of volcano, the kind that doesn't explode, the more gentle erupting kind? Notice how these volcanoes tend to be wide but not as tall. Scientists call these shield volcanoes because one of the first ones ever discovered was noticed by the Vikings in Iceland who thought that it looked like the shape of one of their battle shields when set down on the ground. Personally, they remind me more of the top of an umbrella, but we'll go with the word shield because that's the word that scientists use. There was a second difference you noticed between these two volcanoes, and that's how their rocks look. The rocks of the cone volcano, the kind that explodes, are all pale or light colored, like pale pink or pale tan. Scientists call these pale-colored rocks felsite. But the rocks that come from the shield volcano, the kind that doesn't explode, are all dark colored, dark gray or black. Scientists call these dark-colored rocks basalt. So we still don't know why one kind of volcano explodes and the other one erupts gently. But we do know that the two volcanoes each have their own shape and each have their own kind of rock. That brings us to a really big clue. It turns out that the reason for the two different rocks is because these volcanoes actually are erupting two different kinds of lava. One of the lavas looks like this. It moves pretty quickly because it's thin and runny. It's kind of like syrup or honey in how it flows. A couple of scientists in New York recently made a device where they can take some of the rocks from the thin, runny kind of lava and melt them, turning the rocks back to lava again. This is what it looks like. They pour it out, and they observe it up close, and they can do all this without having to travel to a volcano. You see how thin and runny this stuff is? But now the other kind of lava is like this. It's thick and pasty. It might shoot out steam and fire. You can see this is a video taken at nighttime, but you notice how the lava itself just sort of sits there. It has the thickness of a material like toothpaste or peanut butter. It doesn't flow or move much at all. So which lava belongs to which type of volcano? Does the cone volcano erupt thin, runny lava or thick, pasty lava? And could the differences between these two kinds of lavas explain the differences we've been seeing between the two kinds of volcanoes? Today, you're going to do an experiment to figure out the answer to that question yourself.

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to experiment with two different liquids. One that's thin and runny, and one that's thick and pasty. Just like the two different kinds of lava, one that's thin and one that's thick. In today's experiments, you're going to figure out: do the two kinds of lava explain why there are two kinds of volcano? OK, it's time to get started. I'll walk you through the activity, step by step.

ACTIVITY STEP 1

Find a partner to work with. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Cover your workspace with newspaper or plastic.

ACTIVITY STEP 3

Get your supplies. The two of you need these.

ACTIVITY STEP 4

Tilt each cup to see which lava is thin and which is thick. Put them on the placemat to remember which is which.

ACTIVITY STEP 5

Time to experiment. Do your lava worksheets. When the class is done, clean up, and then discuss the question on the next slide.

ACTIVITY STEP 6

Discuss this question.

WRAP-UP VIDEO

So, were you able to figure out anything about what kind of lava comes from each volcano? Which kind of volcano has the thin, runny kind of lava, the lava on the left there? Well, let's imagine a crack in the ground, and let's imagine that lava is shooting out of it. If that lava is thin and runny, it will flow nice and smoothly, and it will spread out into a big pile. Just like in your experiment when you spooned your thin lava onto the plate. Doesn't this shape look familiar? Thin lava forms shield volcanoes. But imagine that the lava shooting out of the crack was thick and pasty instead. Because it's thick and pasty, it can't flow as easily when it comes out. So instead of spreading out, it will just kind of fall down into a pile. Splat! It piles up into a tall mountain shape, a cone. Look familiar? Thick lava forms cone volcanoes, just like it did in your experiment. So, now you understand the differences between these two volcanoes. Shield volcanoes have a thin, runny lava that cools into a dark-colored basalt rock. And cone volcanoes have the thick, pasty lava that cools into the pale felsite rock. But this only explains the shapes of the volcanoes. What we still don't know is why do cone volcanoes sometimes explode, the way this one is doing here? The answer to this question is in the bubbles. Let me explain why we had you blow bubbles in your experiment. Inside a volcano is mostly melted liquid rock, but it sometimes also has gases in it, which make bubbles in the lava. So imagine you could look inside of a shield volcano, like this, which has thin lava. When bubbles form in thin lava, they travel up to the top pretty quickly, and they pop. You saw the same thing when you blew bubbles in thin lava in your experiment. Lots of bubbles reached the top really quickly. Plus, it was really easy to blow the bubbles. That's important to notice. The bubbles didn't have any trouble at all escaping the thin liquid and then popping at the top. But in thick lava, something different happens. Imagine we could look inside of a cone volcano now, which has thick lava. This is the kind of volcano that explodes, remember? This type of lava doesn't flow very well, and the thick and pasty lava tends to plug up the top of the volcano. It forms kind of a hard crust at the top. When bubbles form in this lava, watch what happens. They can't escape, and more and more bubbles will come, but they'll all get trapped at the top. The bubbles try to escape, but they can't, so pressure builds up and builds up, and this can go on for months, years, sometimes even hundreds of years, until one day the pressure is too great and…boom! The volcano explodes. You saw the same thing in your experiment. It was hard to blow bubbles in the thick lava. You couldn't even see the bubbles for a while. All of the bubbles were trapped under the surface until…boom! All the bubbles exploded out all at once. Bubbles in thick lava are the reason why the cone volcanoes explode. So, we've solved the mystery. Let's look at that picture of Mount St. Helens again. Before it exploded, remember? And then after. So now we can understand. The thick lava inside the volcano trapped so many bubbles that the top and sides of the volcano eventually blew out, sending bits of hot rock everywhere. Now you may think that once a volcano like this has exploded, that's the end of its story, but it's not. In the time since 1980, since the eruption, Mount St. Helens has been slowly building itself back up again. Look at this. Do you see that? There is a little baby cone volcano forming right in the middle of the old explosion spot. It'll surely be a long time before the pressure inside this gets too great, but one day, Mount St. Helens will explode again.