Expedition to a Modern Pompeii

by American Museum of Natural History
This article is provided courtesy of the American Museum of Natural History.

Museum Geologist on the Scene of a 1902 Disaster

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The first came on the afternoon of May 7, when Mt. Soufrière, on the island of St. Vincent, erupted in a boiling mudflow of steam and ash, killing 1,565 people. The next morning, 75 miles to the north on Martinique, Mt. Pelée exploded in a cloud of hot gases, volcanic ash, and rocks. Traveling at a speed of 300 miles an hour, the searing mass rushed down the mountainside, incinerating everything in its path, including the picturesque seaside town of Saint-Pierre and nearly all the ships in the harbor. Within two minutes, some 27,000 people were dead. On May 20, the day before Hovey's arrival in Martinique, a second equally powerful eruption covered the now uninhabited town of Saint-Pierre again.

The scene he encountered defied words. "The devastation wrought by the eruption cannot be appreciated from a verbal description," Hovey wrote in *The American Museum Journal* of 1902, "and even photographs do not convey an adequate idea of what has happened" to a city that had enjoyed a reputation as the Paris of the Caribbean. Once a hub of trade in rum, sugar, cocoa, and coffee, its boulevards lined with handsome homes and showy shops, Saint-Pierre, as Hovey found it, was now a smoldering ruin with barely a brick left standing. Lying as the city did in a cul-de-sac in the path of incandescent volcanic discharge, Hovey wrote, Saint-Pierre and its residents had been "as helpless as an animal in a trap."

Left: Rubble covers a side street in northern Saint-Pierre in 1902. Right: Museum geologist Edmund Hovey, second from right, at Mt. Soufrière volcano in 1902.

The eruptions were of a type called *nuée ardente*, French for "glowing cloud." Magma or molten rock, supercharged with gases, is less dense than rock and so rises to the surface through cracks and crevices. If the gases can boil off gradually at the surface, the potential force is diffused, sometimes creating the effusive flow of lava we tend to associate with volcano eruptions. But in a *nuée ardente*, the gaseous magma is blocked and pressure builds until it is eventually released as a dense, swirling mass of hot gas, incandescent dust, and rock fragments known as a pyroclastic flow.

The explosive cloud can first rise high into the air and then collapse downward, as Pliny the Younger observed in what is thought to be the earliest recorded description of a volcanic eruption. In letters written years after the AD 79 eruption of Vesuvius, the Roman magistrate gave a remarkably detailed description of what he had seen as an 18-year-old across the bay. Vesuvius is sited east of what is now Naples, Italy, and the AD 79 *nuée ardente* killed some 20,000 people in the towns of Pompeii and Herculaneum.

Add water to the mix-as at Mt. Soufrière, which was known for its beautiful crater lake-and the result is the addition of a mudflow, or lahar. The mass of gaseous magma also can create chemical changes that eat away at rocks, weakening them, until the cloud of ash and gas blows out the mountainside before rushing fast and furiously downward. This was documented firsthand at Mount St. Helens in 1980 and is believed to have happened at Mt. Pelée in 1902.

"This type of volcano is the most explosive, literally analogous to twisting off the top of a soda bottle," explains geologist James Webster, curator in the Department of Earth and Planetary Sciences. "When the mountain is ripped open, the volcanic blast is faster and potentially more deadly because it has less distance to travel to reach the surface... What Hovey observed about trees at Mont Pelée is consistent with Mount St. Helens."

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During his Martinique expedition, Hovey also collected and sent back to the Museum invaluable specimens, molten household objects, pulverized street signs, and lumps of half-melted lava-called "bread-crust bombs" for their cracked tops- which had been thrown out of the volcano during the eruption. [A number of these artifacts will be on view in the Museum's special exhibition *Nature's Fury: The Science of Natural Disasters*.]

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how volcanoes erupt. "Since that time we have learned much more about gases, the relationship between seismic activity and magma movement, even about gas opening the rock and providing a pathway for magma to follow," says Dr. Webster.

Hovey's research was part of that long, steady progression toward a better understanding of volcanoes, of which better prediction is the goal and in which the Museum continues to play an important role. Webster, for example, has explored Vesuvius eight times and teaches a course in Naples every fall. The Museum's collection of samples from Vesuvius is among the best in the world, after the University of Naples Federico II and the University of Pisa.

With little knowledge of how volcanic eruptions occurred, the residents of Mt. Pelée woefully underestimated the risks of living in its vicinity and ignored signals that it was still active. Occasional spewings of steam and ash were taken less as a warning than an occasion for picnics near the mouth of the volcano. As J. Chatenay of Seaboard National Bank, who had lived in Saint-Pierre until shortly before the 1902 eruption, told *The World* newspaper on May 10, 1902: "No one ever thought of fearing the volcano, which all thought to be extinct...The people wandered about by thousands, never dreaming that there was any danger."

Even ominous signs in the months and weeks before the May 8 eruption failed to raise adequate alarm. On April 23, earthquakes dislodged dishes from shelves in Saint-Pierre. The next day, fine ash fell for two hours on a town nearby. On May 2, a lightning-lit column of ash and fumes rose nearly two miles high above the mountain, and an inch of ash covered Saint-Pierre. On May 5, a mudflow from the volcano killed 23 people north of the city, and a tsunami reached the harbor 15 minutes later. On May 6, the mountain flung huge molten rocks in the air.

Given the state of the science in the 1900s, the people of Saint-Pierre couldn't possibly have foreseen what was to befall them. But even today, with better science to back up predictions, an estimated half a billion people live within range of an active volcano, including more than 4,000 townspeople of the rebuilt Saint-Pierre and, perhaps more strikingly, roughly 4 million people who live in and around Naples. In fact, Naples recently built an emergency response hospital on the slopes of Vesuvius. "It's a strange concept," says Webster. "The first place you'd go is the first place that would be destroyed."

Bear in mind that as natural disasters go, the risks worldwide associated with earthquakes and hurricanes are orders of magnitude greater in loss of life and property damage than those associated with volcanic eruptions. Earthquakes alone affect the lives of some five million people a year. And where volcanoes are being monitored, scientists can generally predict eruptions in advance.

Still, the prospect of evacuating a population as dense as that around Vesuvius is daunting. In modern history, Vesuvius had relatively large eruptions in 1631 and 1944, with smaller ones in between-so it is by no means dead. But complicating the assessment of actual risk is the difficulty humans have appreciating geological timescales in which patterns are measured not in decades but in thousands and tens of thousands of years. In addition, even scientists disagree. Vesuvius operates on a very long cycle of major eruptions every 500 to 1,000 years, says Webster, and there is one camp that theorizes a large eruption is not imminent and another that believes Vesuvius could erupt catastrophically soon.

Asked which side he falls on, he says, "I don't know enough. But it definitely warrants heavy monitoring."

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monitor

mon · i · tor

Definition

noun

1. a device used to collect information about the operation or condition of someone or something.

    James was attached to a heart monitor while he was in the hospital.

2. a screen for a computer that shows information.

    Working in front of a computer monitor all day is tiring.

verb

1. to observe something in order to get information.

    The supervisor monitors our daily progress.

Advanced Definition

noun

1. a device for observing or recording continuous data about the function, operation, or condition of something, esp. a device that gives warning of an abnormal or potentially dangerous condition.

    The heart-lung monitor was showing a steady heart rate.

    The sound-system monitor lets us know if any instrument is too loud or soft.

2. a student appointed to assist in keeping order within a school.

    The hall monitor asked if we had a pass.

3. a radio or television receiving device that is used in a control room to check the quality of transmission.

4. a visual display screen for a computer terminal.

    My eyes get tired from looking at the computer monitor all day.

    There is space for only the monitor and the keyboard on the desk.

5. any of a variety of large carnivorous lizards of Southeast Asia and Australia; monitor lizard.

6. anything that serves to warn or remind.

transitive verb

1. to observe in order to check on.

    The prison censor monitors all correspondence.

    The progress of the space mission was monitored by scientists on earth.

    The supervisor monitors all our work procedures.

2. to detect, keep track of, or check the quality of (television or radio signals) with a receiver.
3. to observe and record information about, esp. using continuously recording instruments.

    This instrument monitors the movement of the stars.

4. to observe critically; supervise.

    A substitute teacher came in to monitor the exam.

intransitive verb

1. to serve as a recorder, detector, observer, or the like.

Spanish cognate

monitor: The Spanish word *monitor* means monitor.

These are some examples of how the word or forms of the word are used:

1. Bird-watchers and bridge workers **monitor** the falcons with Web cameras.
2. We will continue to **monitor** them to make sure they are healthy.
3. Chip readers will **monitor** all products and services in New Songdo City.
4. Scientists are using special sensors, known as digital skins, to **monitor** changes in this underwater treasure.
5. She hacked the television **monitor** so that instead of news programs it projected waves of multicolored static.

Name: ________________________________ **Date:** ______________

1. Why did geologist Edmund Hovey travel to the Caribbean in May 1902?

A. to investigate recent volcanic eruptions on the islands of St. Vincent and Martinique

B. to investigate the historic volcanic eruption of Mount Vesuvius

C. to try and predict when the next eruption of Mt. Pelée would occur

D. to try and help any survivors of the volcanic eruptions of Mt. Pelée and Mt. Soufrière

2. Towards the end of the article, the author draws comparisons between the risks of which two volcanoes?

A. Mount St. Helens and Mount Vesuvius

B. Mt. Pelée and Mt. Soufrière

C. Mt. Pelée and Mount Vesuvius

D. Mt. Soufrière and Mount St. Helens

3. Mt. Pelee and Vesuvius both had *nuée ardente* eruptions, the most explosive and deadly type of volcanic eruption. In this type of eruption, a cloud of hot ash and gas blows out of the volcano, then rushes very quickly down the volcano's side. What conclusion can be drawn from this evidence?

A. People living near Mt. Pelée and Vesuvius should have known that these volcanoes were active and likely to erupt.

B. The*nuée ardente* type of volcanic eruption is less dangerous to humans than other types of volcanic eruptions.

C. The*nuée ardente* type of volcanic eruption is incredibly dangerous to humans living near a volcano.

D. The areas surrounding Mt. Pelée and Vesuvius are unlikely to be damaged by future *nuée ardente* eruptions.

4. Based on the text, why might predicting volcanic eruptions be an important goal of scientists studying volcanoes?

A. because knowing when volcanoes might erupt will allow scientists to help warn people to leave the area in time to save their lives

B. because knowing when volcanoes might erupt will allow scientists to gain more information about how volcanoes work

C. because knowing when volcanoes might erupt will allow scientists to better understand past eruptions

D. because knowing when volcanoes might erupt will allow scientists to collect helpful samples for museums

5. What is a main idea of this article?

A. The eruption of Mt. Pelée in 1902 was similar to the eruption of Mount Vesuvius in AD 79, and should have been better predicted.

B. The eruption of Mt. Pelée in 1902 caused massive destruction and death, partly because people at the time did not know much about volcanoes.

C. It can be very exciting to live near an active volcano, which is why people currently live near volcanoes that may erupt in the near future.

D. A geologist went to study volcanic eruptions in the Caribbean in 1902 to see how they compared to the eruption of Mount Vesuvius.

6. Read the following sentence from the text.

"With little knowledge of how volcanic eruptions occurred, the residents of Mt. Pelée woefully **underestimated** the risks of living in its vicinity and ignored signals that it was still active."

Based on this sentence, what does the word **underestimate** mean?

A. to predict correctly

B. to analyze completely

C. to take something too seriously

D. to not take something seriously enough

7. Choose the answer that best completes the sentence below.

Thousands of people lived near Mt. Pelée in 1902 _______ the volcano's signals that it was still active.

A. in spite of
B. because of
C. as a result of
D. resulting in

8. Describe three warning signs of the 1902 eruption in Saint-Pierre that people ignored at the time. Use details from the text to support your description.

____

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9. Scientists today hope that their knowledge of volcanoes can help save human lives from future volcanic eruptions. What is one problem that might make it difficult to save lives from a future eruption?

____

____

____

10. Can scientists' current understanding of how volcanoes work prevent another terrible loss of human life like the ones in Pompeii and Saint-Pierre? Why or why not? Use evidence from the text to support your argument.

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Student answers should mention three of the following signs from the text:

-Earthquakes dislodged dishes from shelves

-Fine ash fell on a town nearby

-A lightning-lit column of ash and fumes rose from the mountain

-An inch of ash covered the town

-A mudflow from the volcano killed 23 people

-A tsunami reached the harbor

-The mountain flung huge molten rocks in the air

9. Scientists today hope that their knowledge of volcanoes can help save human lives from future volcanic eruptions. What is one problem that might make it difficult to save lives from a future eruption?

Student answers may vary, but should be based in the text. Possible problems could include:

> -Dense populations around the base of an active volcano could be difficult to evacuate; for example, the article says that "the prospect of evacuating a population as dense as that around Vesuvius is daunting."
>
> -Scientists cannot predict volcanic eruptions with certainty; for example, scientists disagree on when Vesuvius might erupt again.
>
> -Humans don't appreciate geological time scales, which makes it harder to figure out the risk of living near a volcano at any given time.

10. Can scientists' current understanding of how volcanoes work prevent another terrible loss of human life like the ones in Pompeii and Saint-Pierre? Why or why not? Use evidence from the text to support your argument.

Student answers may vary, as long as they use evidence from the text to support their argument.

> Those arguing that scientists' understanding of volcanoes CAN help prevent the loss of human life may mention that people can recognize warning signs, take warning signs into account, and leave the vicinity of a volcano when scientists suggest that it might erupt. People could also choose to live away from active volcanoes.

> Those arguing that scientists' understanding of volcanoes CANNOT prevent the loss of human life may mention that scientists cannot predict volcanic activity with certainty, and that it may be difficult to evacuate large populations from areas of volcanic activity. Students may cite the speed with which Mount Pelée erupted (a flow of 300 mph, which killed 27,000 people in two minutes) as evidence that evacuations would have to happen quickly before an eruption; quick evacuation, though, would be "daunting" in areas with high populations, like Naples.