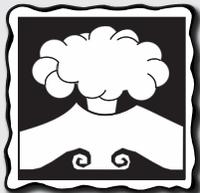


Eruption!

Living with a **VOLCANO** in Your Backyard
MOUNT RAINIER



Grade Level: 6+

Learner Objectives:

Students will:

- Identify existing knowledge of volcanoes and volcano-related myths
- Visualize and describe a volcanic eruption through creative story writing
- Gain insight on volcanic processes, hazards, and community risk

Setting: Classroom

Timeframe: 30 minutes; 20 minutes

Writing A Journal Entry

Reading A Real Volcano Eruption Story

Materials:

Writing A Journal Entry

- Copies of “Eruption!” student page
- Pen or pencil

Reading A Real Volcano Eruption Story

- Copies of “Letters from Pliny, 79 A.D.” student page
- Graphic for “Map of Vesuvius Area”



**Living with a Volcano in Your Backyard-
An Educator's Guide with Emphasis on
Mount Rainier**

Prepared in collaboration with the National Park Service

U.S. Department of the Interior
U.S. Geological Survey

General Information Product 19

Overview

In this pre-assessment activity, students describe their perceptions of a volcanic eruption in a personal journal entry. They then read an incredible eyewitness account from the 79 A.D. eruption of Mount Vesuvius in Italy and compare this account to the eruption events depicted in journal entries.

Teacher Background

Testing student perceptions about volcanoes

Movie portrayals of volcanic eruptions such as “Volcano” or “Dante’s Peak” and television footage of Hawaiian *lava flows* often shape student perceptions of volcanoes. Although these types of media can sometimes be educational, they can also be deceptive and advance commonly held misperceptions and myths. This activity is best used as a pre-assessment tool to evaluate students’ understanding and perceptions of a volcanic *eruption*.

Pliny the Elder as model volcano observer

Pliny the Younger wrote letters to a friend, the Roman historian Tacitus, describing observations of the Mount Vesuvius eruption of 79 AD that were made by Pliny the Younger and his uncle, Pliny the Elder. This eruption devastated nearby cities and killed 3,360 people. Numerous researchers have studied Pliny’s account and have found archeological and geological evidence to support his version of events. His account depicts what can happen in other volcanic eruptions.

Some volcanic processes described from Mount Vesuvius are similar to processes that might occur during eruptions at Cascade Range volcanoes. Pliny the Younger portrays the *ash cloud* from the eruption, “likening it to a pine tree.” Italian pine trees are shaped differently from those in

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Eruption!



Chapter 1

Vocabulary: Ash cloud, eruption, hot ash flow, lava flows, pyroclastic flow, tsunami, volcanic ash

Skills: Communicating, creative writing

Benchmarks:

Please see the Mount Rainier National Park Education Program website for the most recent alignment of these activities with Washington State and nationally approved education standards.

<http://www.nps.gov/mora/forteachers/curriculummaterials.htm>

the Pacific Northwest. They have a trunk with branches concentrated at the top to form a broad canopy. Hence, the volcanic cloud described by Pliny is similar in shape to the mushroom-shaped cloud commonly observed in a volcanic ash eruption. Later on, Pliny talked about the darkness being “darker and thicker than any night.” Similar darkness also occurred during the May 18, 1980 eruption of Mount St. Helens, when **volcanic ash** darkened skies over eastern Washington.

Pliny observes volcanic processes that are common at many volcanoes

At one point, Pliny wrote that a cloud “stretched down to the ground and covered the sea” and “looms behind us following us like a flood poured across the land.” Pliny probably observed a **pyroclastic flow** or **hot ash flow**. These deadly clouds of hot gas and ash and larger particles are so dense they flow close to the ground and move rapidly down the sides of volcanoes. Most of the victims in the Vesuvius eruption were killed from asphyxiation in these pyroclastic flows. Casts of victims who were buried by ash and debris in Pompeii and Herculaneum can be seen in museums today. The sulfur smell noted by Pliny was from volcanic gases.

Pliny also described the earthquakes that occurred before, during, and after the eruption. Similar seismic activity would be expected prior to an eruption of Cascade Range volcanoes, a good warning of an impending eruption. When Pliny mentioned that the “sea was being sucked backwards,” he described what happens just before a **tsunami**. Water typically recedes from shore before rushing quickly back and washing inland. Strong earthquakes associated with the eruption of Mount Vesuvius caused tsunamis to flood coastal areas near the volcano.



Eruption! continued...

Pliny wrote about lightning in the Vesuvius eruption cloud; many people have observed this phenomenon in other volcanic eruptions. The bright sheets of flame observed by Pliny could have been incandescent pyroclastic flows, or fires started by volcanic ash.

With Pliny the Elder's interest in the natural world and his ability to make careful observations, he would have made an excellent geologist. Pliny's natural curiosity and careful note-taking are important traits for all scientists to develop.



In order to help students develop good observation and note-taking skills, ask students to place all materials from this guide into a portfolio or field journal. This activity can be used as an introduction to their portfolio or field journal.

Procedure

Writing a Journal Entry

Write a journal entry about a volcanic eruption to assess knowledge of volcanic processes and terms.

1. Instruct students to read the account of a hypothetical eruption on the **Eruption!** student page. Students should then finish the story by writing their own hypothetical account of the remainder of the eruption based on their existing knowledge of volcanoes. This exercise is useful as a pre-assessment tool.
2. Discuss some of the volcanic events portrayed in the students' stories. Write a list of volcano-related terms on a whiteboard or overhead.

Reading a Real Volcano Eruption Story

Read accounts about the 79 A.D. eruption of Mount Vesuvius and compare with the students' journal entries.

1. Briefly describe Pliny the Younger, the 79 A.D. Mount Vesuvius eruption, and the location of the eruption. Use the graphic "*Map of Vesuvius Area*" to show the major cities mentioned by Pliny in his letters. Continue to display the graphic when reading the letters so that students may refer to it.
2. As a class or smaller group, read the eruption accounts on the "*Letters from Pliny, 79 A.D.*" student page as a group. Add to your whiteboard or overhead list of volcano-related terms.
3. Use this list of volcano-related terms and processes to discuss the similarities and differences between Pliny's account of a real volcanic eruption and the students' journal entries.

Adaptations

- ◆ Instead of reading Pliny's letters, read survivor accounts from the Mount St. Helens eruptions.
- ◆ Direct younger students to draw a picture of a volcanic eruption and label the drawing.

Extensions

- ◆ Instruct students to highlight any words they do not understand in Pliny's letters and students should research the definitions.
- ◆ At the end of your volcano teaching unit, tell students to reread Pliny's letters and identify the volcanic processes that Pliny describes. How are they similar to processes at Mount St. Helens? At Mount Rainier?
- ◆ Use Internet and library research to find drawings or photographs of Pompeii, during the 79 A.D. eruptions and Pompeii today.
- ◆ Use Internet or library research to find similarities between the volcanic processes described by Pliny and those predicted by geologists during an eruption of a Cascade volcano.
- ◆ Invite an eyewitness of a Mount St. Helens eruption to talk to the class about what they observed when the volcano erupted.
- ◆ Watch any video that provides eyewitness accounts of volcanic eruptions and compare the observations made by survivors of any volcanic eruption to Pliny's observations.

Assessment

Use **Eruption!** as a pre-assessment activity, and to engage students in the study of volcanoes. Repeat writing of "Journal Entry" after completion of activities in chapters 2 and 3 about volcanic processes and hazards. Compare and assess how the student's ideas have grown to an understanding of eruptions at Mount Rainier and other Cascade volcanoes. Responses should indicate recognition of eruption processes at Cascade volcanoes, including ashfall, lava flows, pyroclastic flows and lahars. Refer to a scoring rubric to assess journal entry writing skills.



References

- Gilman, Benedicte, 2007, Ashen sky, the letters of Pliny the Younger on the eruption of Vesuvius, illustrated by Barry Moser: Getty Publications, Los Angeles, 39 p.
- Harris, S. L., 2005, Fire mountains of the west—the Cascade and Mono Lake volcanoes: Mountain Press Publishing Company, 3rd edition, 454 p.
- Lipman, P. W. and Mullineaux, D.R. (Eds.), 1981, The 1980 eruptions of Mount St. Helens, Washington: U.S. Geological Survey Professional Paper 1250, 3rd edition, 844 p.
- Radice, Betty 1968: “Pliny and the Panegyricus”, Greece and Rome, no.15, p.166-172.
- Tilling, R. I., Topinka, Lyn, and Swanson, D.A., 1990, Eruptions of Mount St. Helens: past, present, and future: U.S. Geological Survey series of General Interest Publications (Revised edition), 57 p.

Resources

A variety of videos about Mount St. Helens and other Cascade volcanoes are available through:

Discover Your Northwest

164 S. Jackson St.

Seattle, WA 98104

Customer Service: (877) 874-6775

<http://www.discovernw.org/>



Refer to **Internet Resources Page** for a list of resources available as a supplement to this activity.



Letters from Pliny the Younger

Instructions: Read the eyewitness accounts of a real volcanic eruption. Pliny, the Younger wrote these letters about his own and his uncle's experiences during the 79 A.D eruption of Mount Vesuvius in Italy.

LETTER ONE



MY DEAR TACITUS,

You ask me to write you something about the death of my uncle so that the account you transmit to posterity is as reliable as possible. I am grateful to you, for I see that his death will be remembered forever if you treat it [sc. in your Histories]. He perished in a devastation of the loveliest of lands, in a memorable disaster shared by peoples and cities, but this will be a kind of eternal life for him. Although he wrote a great number of enduring works himself, the imperishable nature of your writings will add a great deal to his survival. Happy are they, in my opinion, to whom it is given either to do something worth writing about, or to write something worth reading; most happy, of course, those who do both. With his own books and yours, my uncle will be counted among the latter. It is therefore with great pleasure that I take up, or rather take upon myself the task you have set me.

He was at Misenum in his capacity as commander of the fleet on the 24th of August [sc. in 79 AD], when between 2 and 3 in the afternoon my mother drew his attention to a cloud of unusual size and appearance. He had had a sunbath, then a cold bath, and was reclining after dinner with his books. He called for his shoes and climbed up to where he could get the best view of the phenomenon. The cloud was rising from a mountain-at such a distance we couldn't tell which, but afterwards learned that it was Vesuvius. I can best describe its shape by likening it to a pine tree. It rose into the sky on a very long "trunk" from which spread some "branches." I imagine it had been raised by a sudden blast, which then weakened, leaving the cloud unsupported so that its own weight caused it to spread sideways. Some of the cloud was white, in other parts there were dark patches of dirt and ash. The sight of it made the scientist in my uncle determined to see it from closer at hand.

He ordered a boat made ready. He offered me the opportunity of going along, but I preferred to study-he himself happened to have set me a writing exercise. As he was leaving the house he was brought a letter from Tacitus' wife Rectina, who was terrified by the looming danger. Her villa lay at the foot of Vesuvius, and there was no way out except by boat. She begged him to get her away. He changed his plans. The expedition that started out as a quest for knowledge now called for courage. He launched the quadriremes and embarked himself, a source of aid for more people than just Rectina, for that delightful shore was a populous one. He hurried to a place from which others were fleeing, and held his course directly into danger. Was he afraid? It seems not, as he kept up a continuous observation of the various movements and shapes of that evil cloud, dictating what he saw.

Ash was falling onto the ships now, darker and denser the closer they went. Now it was bits of pumice, and rocks that were blackened and burned and shattered by the fire. Now the sea is shoal; debris from the mountain blocks the shore. He paused for a moment wondering whether to turn back as the helmsman urged him. "Fortune helps the brave," he said, "Head for Pomponianus."





LETTER ONE CONTINUED

At Stabiae, on the other side of the bay formed by the gradually curving shore, Pomponianus had loaded up his ships even before the danger arrived, though it was visible and indeed extremely close, once it intensified. He planned to put out as soon as the contrary wind let up. That very wind carried my uncle right in, and he embraced the frightened man and gave him comfort and courage. In order to lessen the other's fear by showing his own unconcern he asked to be taken to the baths. He bathed and dined, carefree or at least appearing so (which is equally impressive). Meanwhile, broad sheets of flame were lighting up many parts of Vesuvius; their light and brightness were the more vivid for the darkness of the night. To alleviate people's fears my uncle claimed that the flames came from the deserted homes of farmers who had left in a panic with the hearth fires still alight. Then he rested, and gave every indication of actually sleeping; people who passed by his door heard his snores, which were rather resonant since he was a heavy man. The ground outside his room rose so high with the mixture of ash and stones that if he had spent any more time there escape would have been impossible. He got up and came out, restoring himself to Pomponianus and the others who had been unable to sleep. They discussed what to do, whether to remain under cover or to try the open air. The buildings were being rocked by a series of strong tremors, and appeared to have come loose from their foundations and to be sliding this way and that. Outside, however, there was danger from the rocks that were coming down, light and fire-consumed as these bits of pumice were. Weighing the relative dangers they chose the outdoors; in my uncle's case it was a rational decision, others just chose the alternative that frightened them the least.

They tied pillows on top of their heads as protection against the shower of rock. It was daylight now elsewhere in the world, but there the darkness was darker and thicker than any night. But they had torches and other lights. They decided to go down to the shore, to see from close up if anything was possible by sea. But it remained as rough and uncooperative as before. Resting in the shade of a sail he drank once or twice from the cold water he had asked for. Then came a smell of sulfur, announcing the flames, and the flames themselves, sending others into flight but reviving him. Supported by two small slaves he stood up, and immediately collapsed. As I understand it, his breathing was obstructed by the dust-laden air, and his innards, which were never strong and often blocked or upset, simply shut down. When daylight came again 2 days after he died, his body was found untouched, unharmed, in the clothing that he had had on. He looked more asleep than dead.

Meanwhile at Misenum, my mother and I—but this has nothing to do with history, and you only asked for information about his death. I'll stop here then. But I will say one more thing, namely, that I have written out everything that I did at the time and heard while memories were still fresh. You will use the important bits, for it is one thing to write a letter, another to write history, one thing to write to a friend, another to write for the public.

FAREWELL,

PLINY THE YOUNGER





LETTER TWO



MY DEAR TACITUS,

You say that the letter I wrote for you about my uncle's death made you want to know about my fearful ordeal at Misenum (this was where I broke off). "The mind shudders to remember ... but here is the tale."

After my uncle's departure I finished up my studies, as I had planned. Then I had a bath, then dinner and a short and unsatisfactory night. There had been tremors for many days previously, a common occurrence in Campania and no cause for panic. But that night the shaking grew much stronger; people thought it was an upheaval, not just a tremor. My mother burst into my room and I got up. I said she should rest, and I would rouse her (sc. if need be). We sat out on a small terrace between the house and the sea. I sent for a volume of Livy; I read and even took notes from where I had left off, as if it were a moment of free time; I hardly know whether to call it bravery, or foolhardiness (I was seventeen at the time). Up comes a friend of my uncle's, recently arrived from Spain. When he sees my mother and me sitting there, and me even reading a book, he scolds her for her calm and me for my lack of concern. But I kept on with my book.

Now the day begins, with a still hesitant and almost lazy dawn. All around us buildings are shaken. We are in the open, but it is only a small area and we are afraid, nay certain, that there will be a collapse. We decided to leave the town finally; a dazed crowd follows us, preferring our plan to their own (this is what passes for wisdom in a panic). Their numbers are so large that they slow our departure, and then sweep us along. We stopped once we had left the buildings behind us. Many strange things happened to us there, and we had much to fear.

The carts that we had ordered brought were moving in opposite directions, though the ground was perfectly flat, and they wouldn't stay in place even with their wheels blocked by stones. In addition, it seemed as though the sea was being sucked backwards, as if it were being pushed back by the shaking of the land. Certainly the shoreline moved outwards, and many sea creatures were left on dry sand. Behind us were frightening dark clouds, rent by lightning twisted and hurled, opening to reveal huge figures of flame. These were like lightning, but bigger. At that point the Spanish friend urged us strongly: "If your brother and uncle is alive, he wants you to be safe. If he has perished, he wanted you to survive him. So why are you reluctant to escape?" We responded that we would not look to our own safety as long as we were uncertain about his. Waiting no longer, he took himself off from the danger at a mad pace. It wasn't long thereafter that the cloud stretched down to the ground and covered the sea. It girdled Capri and made it vanish, it hid Misenum's promontory.



LETTER TWO CONTINUED

Then my mother began to beg and order me to flee however I might, saying that a young man could make it, that she weighed down in years and body, would die happy if she escaped being the cause of my death. I replied that I wouldn't save myself without her and then I took her hand and made her walk a little faster. She obeyed with difficulty, and blamed herself for delaying me.

Now came the dust, though still thinly. I look back: a dense cloud looms behind us, following us like a flood poured across the land. "Let us turn aside while we can still see, lest we be knocked over in the street and crushed by the crowd of our companions." We had scarcely sat down when a darkness came that was not like a moonless or cloudy night, but more like the black of closed and unlighted rooms. You could hear women lamenting, children crying, men shouting. Some were calling for parents, others for children or spouses; they could only recognize them by their voices. Some bemoaned their own lot, other than that of their near and dear. There were some so afraid of death that they prayed for death. Many raised their hands to the gods, and even more believed that there were no gods any longer and that this was one last unending night for the world. Nor were we without people who magnified real dangers with fictitious horrors. Some announced that one or another part of Misenum had collapsed or burned; lies, but they found believers. It grew lighter, though that seemed not a return of day, but a sign that the fire was approaching. The fire itself actually stopped some distance away, but darkness and ashes came again, a great weight of them. We stood up and shook the ash off again and again, otherwise we would have been covered with it and crushed by the weight. I might boast that no groan escaped me in such perils, no cowardly word, but that I believed that I was perishing with the world, and the world with me, which was a great consolation for death.

At last the cloud thinned out and dwindled to no more than smoke or fog. Soon there was real daylight. The sun was even shining, though with the lurid glow it has after an eclipse. The sight that met our still terrified eyes was a changed world, buried in ash like snow. We returned to Misenum and took care of our bodily needs, but spent the night dangling between hope and fear. Fear was the stronger, for the earth was still quaking and a number of people who had gone mad were mocking the evils that had happened to them and others with terrifying prognostications. We still refused to go until we heard news of my uncle, although we had felt danger and expected more.

You will read what I have written, but will not take up your pen, as the material is not the stuff of history. You have only yourself to blame if it seems not even proper stuff for a letter.

FAREWELL,

PLINY THE YOUNGER

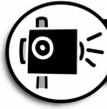




Eruption!

Geologists told us that the volcano in our community's backyard was becoming restless. They were right. The volcano erupted! You won't believe all the things that happened?

(Finish the journal entry, explaining the events before, during, and after the eruption.)



Map of the Mount Vesuvius Area

