MIDDLE SCHOOL

SOCIAL STUDIES, SCIENCE, MATHEMATICS

Geography, History, Earth Science, Expressions & Equations

Middle School Lesson Plan 1: Geography and Geology

Teacher Instructions

Geography and geology were both key to Pompeii's commercial success and cultural diversity in 79 A.D. With ports on the Bay of Naples and paved roads connecting nearby towns, this region benefitted from all the Roman Empire had to offer, including the rich agriculture in the area. Fertile lands surrounding Vesuvius provided enough crops to keep at home, sell in market, and trade abroad.

In sharp contrast with the limestone-based soil of most of southern Italy, Pompeii had some of the richest land on Earth because of volcanic deposits laid down after eruptions of Vesuvius thousands of years earlier. Along with a mild, sunny climate, the land provided three annual crops of all kinds of fruits and vegetables. Farmers in the countryside and gardeners in the city could grow almost any kind of food. Local wines, olive oils, and onions were produced here and shipped around the Mediterranean world.

Pompeii's location next to Vesuvius was also the key to its destruction. The collision of two tectonic plates created the mountain, which has erupted many times in its geological life. Some of these events built up the cone, making it taller, while others have blown off the top, forming craters. With its most recent eruption in 1944, Vesuvius is still considered to be an active volcano. Scientists know that there will be another catastrophic eruption someday, but they don't when it will happen.

One thing is certain. Mt. Vesuvius is part of a group of several volcanoes that form the Campanian volcanic arc. Some of these volcanos are considered active, like Vesuvius, while others are dormant or even extinct. All were formed by the collision of the African and Eurasian plates. When a heavier oceanic plate (the African) collides with a land plate (the Eurasian), it subducts, or sinks beneath, the land plate. This subduction zone between the tectonic plates stretches along the length of the Italian peninsula.

Pompeii: The Exhibition provides a glimpse of daily life in this geographic zone during the first century. In the activities below, your students will delve into the geography of Pompeii and the geology of Mt. Vesuvius. Students will need a blank map of Italy, enlarged to focus on the area centered on the Bay of Naples so they can accurately label the locations discussed in this assignment.

If your class Social Studies textbook does not already provide blackline master maps for you to copy, there are several collections available online:

- www.worldatlas.com/webimage/countrys/europe/outline/it.htm
- www.freeworldmaps.net/europe/italy/political.html
- www.d-maps.com/pays.php?num_pay=200

ANSWER KEY

3. (a.) Pompeii is about 150 miles south of Rome. (b.) Naples is 17 miles away from Pompeii; 15-20 miles is an acceptable answer.
4. (a.) 3 days by ox cart; (b.) 15 days by walking
5. (a.) Less than a day/between 8-9 hours by ox cart; (b.) 1 ½ - 2 days by walking
6. 19 miles/less than 20 miles
8. Southeast of the mountain
10. Answers can vary, but should mention population density in the area and the threat to human lives

Name Class Date

Geography and Geology

Student Activity

Geography and geology were both key to Pompeii's commercial success and cultural diversity in 79 A.D. With ports on the Bay of Naples and paved roads connecting nearby towns, this region benefitted from all the Roman Empire had to offer, including the rich agriculture in the area. Fertile lands surrounding Vesuvius provided enough crops to keep at home, sell in market, and trade abroad.

In sharp contrast with the limestone-based soil of the rest of southern Italy, Pompeii had some of the richest land on Earth because of volcanic deposits laid down after eruptions of Vesuvius thousands of years earlier. Along with a mild, sunny climate, the land provided three annual crops of all kinds of fruits and vegetables. Farmers in the countryside and gardeners in the city could grow almost any kind of food. Local wines, olive oils, and onions were produced here and shipped around the Mediterranean world.

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The village of Misenum was far enough from the volcano to avoid destruction, but close enough for Pliny the Younger to witness the eruption.

One thing is certain. Mt. Vesuvius is part of a group of several volcanoes that form the Campanian volcanic arc. Some of these volcanos are considered active, like Vesuvius, while others are dormant or even extinct. All were formed by the collision of the African and Eurasian plates. When a heavier oceanic plate (the African) collides with a land plate (the Eurasian), it subducts, or sinks beneath, the land plate. This subduction zone between the tectonic plates stretches along the length of the Italian peninsula.

Pompeii: The Exhibition provides a glimpse of daily life in the first century of the Roman Empire. In the activities below, you will map your discoveries as you delve deeper into the geography of Pompeii and the geology of Mt. Vesuvius.

In 79 A.D., Pompeii was a busting metropolis still recovering from an earthquake in 62 A.D.—a precursor for what was to come 17 years later.

Terms to Know: caldera, dormant, fertile, pyroclastic, subduct, tectonic

Name Class Date

You will need the blank map from your teacher, a modern atlas, and an historical atlas if these are not already included in your Social Studies textbook. For locations whose names have changed since the first century A.D., the modern name is in parentheses. Create a key to show what the symbols on your map will mean.

1. The ruins of Pompeii and Herculaneum provide archaeologists, historians, and scientists unique glimpses of life in ancient Rome. The discoveries made there are the sources of the amazing artifacts seen at *Pompeii: The Exhibition*.

(a.) Ancient Pompeii was near the modern town of "Pompei." Today it is in land, but at the time of the eruption it would have been nearer to the coast. Pompeii is five miles away from Mount Vesuvius. Identify and label both the ancient and modern locations.

(b.) Herculaneum (Ercolano) appears to have been a wealthier town than Pompeii, but more of it is unexcavated. It is nine miles northwest of Pompeii. Locate and label Herculaneum on the map.

2. Locate and label the following physical features on your map:

- Mount Vesuvius
- Water: Bay of Naples, Tyrrhenian Sea, Sarno River, Tiber River, Volturno River
- Islands: Capri, Sicily, Sardinia, Ischia

3. Add the cities of Rome and Naples to your map. Use the scale to estimate the distance between Pompeii and these two cities.

(a.) How many miles are between Pompeii and Rome? _____	(b.) How many miles are between Pompeii and Naples? _____

4. Today, the train ride between Pompeii and Rome is about two hours. How many days it would take to you travel from Pompeii to Rome in 79 A.D.…

(a.) …by ox cart, a popular mode of transportation at the time, if you traveled 50 miles per day? _____	(b.) …by walking, the way slaves, poor freedmen, and women traveled, at 10 miles per day? _____

Name Class Date

5. Today, the train ride between Pompeii and Naples is about 30-40 minutes. How many days would it take to you travel from Pompeii to Naples in 79 A.D.…

(a.) …by ox cart, a popular mode of transportation at the time, if you traveled 50 miles per day? _____	(b.) …by walking, the way slaves, poor freedmen, and women traveled, at 10 miles per day? _____

6. The only surviving primary source describing the eruption in 79 A.D. comes from Pliny the Younger. At the time, he was 18 years old and living with his uncle. Pliny the Younger witnessed the eruption from his home in Misenum (Miseno). Add Misenum to your map. Use the scale on your atlas to estimate the distance between Misenum and Mt. Vesuvius.

_____

7. Pliny the Younger's uncle, Pliny the Elder, was in charge of the Roman navy. He sailed across the Bay of Naples to rescue people. He left Misenum with a fleet of ships headed towards Oplontis (Torre Annunziata). He was unable to reach the coast. Oplontis was buried in the eruption. Instead, he landed at Stabiae (Castellammare di Stabia), where he died.

(a.) Add Oplontis and Stabiae to your map.

(b.) Draw a line to represent Pliny the Elder's route.

Before 79 A.D., Vesuvius had not had a major eruption for almost 700 years.

POMPEII
THE EXHIBITION

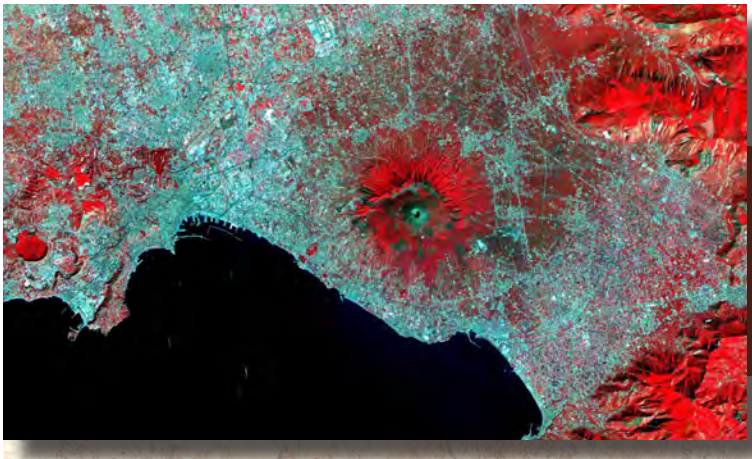
Name Class Date

8. Based on the locations of the towns that Vesuvius destroyed, in which direction do you think the lava, ash, and the pyroclastic surges flowed from the volcano?

9. Mt. Vesuvius is the only volcano in the Campanian volcanic arc to erupt in recent times. The arc, centered on the Bay of Naples, forms the southern end of a larger chain of volcanoes, all produced at the boundary between the African and Eurasian tectonic plates. Some are underwater while others are visible. Locate these visible volcanoes and add them to your map.

- Campi Flegrei, a large caldera to the northwest of Mt. Vesuvius
- Mt. Epomeo, on Ischia
- Stromboli, a volcanic island in the Tyrrhenian Sea
- Vulcano, a volcanic island in the Tyrrhenian Sea
- Mt. Etna, on Sicily
- Monte Cavo, southeast of Rome

10. Although it is not the largest, Vesuvius is sometimes called the most dangerous volcano in the world. For what reason do you think it might have been given this name?



This image from NASA shows the densely-populated areas around Mt. Vesuvius. It is closely monitored for potential signs of unrest that could signal the beginning of another eruption.

MIDDLE SCHOOL

SOCIAL STUDIES, LANGUAGE ARTS, FINE ARTS, SCIENCE

History, Primary Sources, Visual Art, Earth Science

Middle School Lesson Plan 2: Casting History

Teacher Instructions

In a matter of hours, Pompeii was transformed forever by the catastrophic eruption of Mount Vesuvius. Thousands lost their lives as hot air, mud, lava, ash, and toxic gases poured from the volcano, burying streets, homes, gardens, temples, and workplaces. But the sudden disaster that destroyed Pompeii in 79 A.D. also preserved it. In the 1740s, the city was rediscovered. Over time, archaeologists uncovered a unique record of an entire ancient civilization, sealed in a time capsule. Much of what we know and understand about life at the height of the Roman Empire comes from the ruins of Pompeii.

The final gallery of Pompeii: The Exhibition displays the most poignant finds among the ruins. These are the people who did not flee during the first phase of eruption, when dry ash and lapilli rained down upon the city. They hid in their shops and homes and decided, hours later, to make a desperate run across the deep layers of accumulating ash. Instead of finding safety, they were overwhelmed by the pyroclastic surges that swept the area during the night and early morning. The wet material encased their bodies where they fell and preserved, facial features, grim expressions, and even the folds of their clothing. Eventually the bodies decomposed leaving an empty cavity in the now hardened ash.

In 1863, Italian archaeologist Giuseppe Fiorelli poured liquid plaster into an empty hole found by his team of excavators. He knew that the hole had been created when the layers of molten ash from Vesuvius hardened around one of the victims. After the plaster dried, the ash and dirt surrounding it were chipped away. The results were astonishing. No one expected to see the men, women, and children killed by Vesuvius in such striking detail.

Students should work in groups to complete Part 1 of this lesson plan. Using dolls, they will make a mold that simulates the body cavities found in Pompeii and create their own plaster casts using Fiorelli's techniques. The materials needed for Part 1 are listed below. In Part 2, students will hear from Fiorelli himself when they compare two primary sources on the very first time this process was used in Pompeii. Both primary source excerpts come from the book Pompeii's Living Statues: Ancient Roman Lives Stolen from Death by Eugene J. Dwyer (University of Michigan Press, 2010).

• Old doll, dressed and accessorized • Petroleum jelly (Vaseline®) • Silicone rubber epoxy or other quick-set silicone rubber mix • Plastic food storage container, larger than the doll • Small wood dowel • Ruler • Scissors	• Funnel • Masking tape • Plaster of Paris • Mixing bowl • Spoon • Water • Paper towels • Sand paper

ANSWER KEY
Part 2

1. Location: "in a small street near the baths, and right in the middle of the street"
2. Artifacts found: "about a hundred silver coins, four earrings, and a small finger ring of gold, with two iron keys and some traces of cloth in which the coins had been wrapped"
3. Term for the liquid plaster: scagliola, gesso
4. Description of man's shoes: "a type of boots to which nails and the iron lasts of the soles still adhered"
5. Description of the man's face: "The nose and the cheeks could be seen clearly. The eyes were missing, as was the hair. In the open mouth, he was missing some teeth"
6. (a.) Fiorelli; (b.) Settembrini
7. Bones
8. They could see the imprint of his trousers
9. It was where the hole was through which the gesso had entered
10. drowned
11. (a.) 50 years old; (b.) Settembrini; (c.) Answers will vary. Some students might say "yes" because the description of the victim could fit a man who is 50. Some students might say "no" because there was no way for Settembrini to know for sure how old the victim was just by looking at the cast.
12. (a.) November, because they would not be wearing heavy clothing in the summer; (b.) Food: if there are remains of foods only available in the fall. Coins: with dates on them after August suggest the fall.

Name Class Date

Casting History

Student Activity

Advances in technology allow us to learn more about Vesuvius' victims without damaging the plaster casts. CT scans revealed that this child was a boy about four years old.

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The plaster casting method has been used for plant roots, wooden doors and shutters, and animals. This dog was found by the front door of the House of Orpheus, probably left to guard the home while the family fled.

In 1863, Italian archaeologist Giuseppe Fiorelli poured liquid plaster into an empty hole found by his team of excavators. He knew that the hole had been created when the layers of molten ash from Vesuvius hardened around one of the victims. After the plaster dried, the ash and dirt surrounding it were chipped away. The results were astonishing. No one expected to see the men, women, and children killed by Vesuvius in such striking detail.

In Part 1, you will work in groups to make a mold that simulates the body cavities found in Pompeii and create your own plaster casts using Fiorelli's techniques on old dolls. In Part 2, you will hear from Fiorelli himself when you compare two primary sources on the very first time this process was used in Pompeii.

Charred raisins and barley. How does knowing which foods were available help scientists determine when Vesuvius erupted?

Terms to Know: accretion, dowel, epoxy, excavators, lapilli, poignant, pyroclastic, resin, silicone, simulate, trowel, utilitarian, vapors

Name Class Date

Part 1

In this activity, you will begin by creating a mold that simulates the cavities found underground in Pompeii. Then, in Procedure 2, you will make a body cast from the mold using the same techniques as Giuseppe Fiorelli, Director of Excavations at Pompeii in the late 1800s.

• Old doll, dressed and accessorized • Petroleum jelly (Vaseline®) • Silicone rubber epoxy or other quick-set silicone rubber mix • Plastic food storage container, larger than the doll • Small wood dowel • Ruler • Scissors	• Funnel • Masking tape • Plaster of Paris • Mixing bowl • Spoon • Water • Paper towels • Sand paper

Procedure 1

1. Protect your work area!
2. Select a doll that you don't mind getting messy. It can be wearing clothes, jewelry, or other accessories if you like. Make sure your doll fits inside your plastic container lengthwise and that the container is much deeper than the doll when it is lying down.
3. Lay your doll lengthwise in your container. Measure the space from the top of its head to the side of plastic container above it. Cut the dowel to this length.
4. Remove the doll from the container. Apply a thin layer of petroleum jelly to your doll and to the dowel you just measured and cut.
5. Coat the inside of the container with petroleum jelly.
6. Mix the silicone rubber epoxy according to package directions.
7. Pour enough epoxy into the container that the doll will be submerged lying down without touching the bottom. Smooth the surface of this layer of epoxy.
8. Place one end of the dowel flush against an end of the container and the other against the top of the doll's head. Push it into the epoxy until it is half submerged. (This creates the space for you to pour plaster into the mold in Procedure 2.)
9. With the top of the doll's head against the dowel, press your doll face-down into the epoxy, so that the front half of the doll is submerged.
10. Allow the epoxy to dry, according to package instructions.
11. When the epoxy is dry, apply a thin layer of petroleum jelly on top of it and on the exposed part of the doll and dowel if the previous application (in Step 4) has come off.
12. Pour more epoxy over the doll until it is fully covered. Leave this layer to dry, according to package instructions.
13. When the epoxy is dry, take your new mold out of the plastic container.
14. Slowly separate the two halves of your epoxy mold. Remove the doll and dowel.

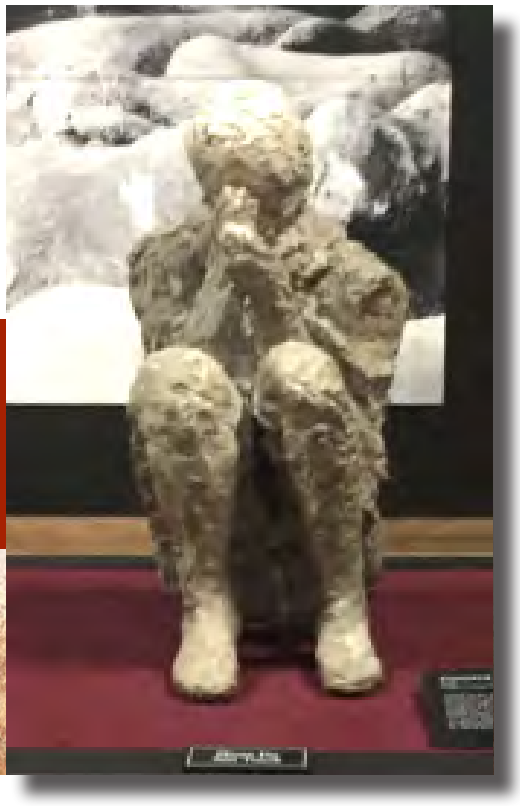
Name Class Date

Procedure 2

1. Use damp paper towels to wipe out the epoxy doll mold you made in Part 1. When the molds are clean, dry them with another paper towel.
2. Use a paper towel to grease the inside of mold with petroleum jelly. Make sure that you get the petroleum jelly into all cracks and small details of the mold.
3. Use the masking tape to put the two halves of your doll mold back together, as one block. Make sure the impressions where the dowel was placed on each side of the mold line up with each other on the top.
4. Follow the instructions on the container of plaster of Paris to mix it. Each container may have different instructions, so take care that you do not add too much water.
5. Slowly pour the plaster into your mold through the hole created by the dowel in Procedure 1. If you pour too quickly, you will end up with air bubbles. It may help to use the funnel.
6. When you have filled the mold to the top, hold it level with both hands and gently tap it on a table to help release the air bubbles. If the level of plaster in your mold settles down, add more to the top and repeat this step.
7. Set the mold aside to dry, according to package instructions.
8. When the plaster is dry, untape the mold and carefully separate its two halves. Remove the plaster body that formed inside.
9. Gently break off the stick of plaster from where you poured it into the mold. Use the sand paper to smooth down this and any other rough areas, such as the line where the two halves of the mold came together.

Discuss—Art or Science?

When the plaster casts were first made in the 19th century, some people felt that they should be considered as art, like sculptures. Others said the casts were either too upsetting or too utilitarian to be art. Based on the results you obtained with your cast of the doll, which side of the argument do you support and why?



Found in the eastern part of Pompeii, this cast is also known as the "muleteer" for the mule or donkey that was found nearby. Through the casting process, we know that this man crouched low to the ground and pulled his cloak over his mouth to shield himself.

Name Class Date

Part 2

Read and compare two primary sources describing the first plaster body cast from Pompeii, made with a method very similar to how you created the cast of the doll in Part 1.

The first description is from Fiorelli himself. He announced his discovery in a Naples newspaper on February 12, 1863.

> *On the third of this month, while digging in the small street that begins opposite one of the secondary doors of the Stabian Baths and issues in the vicinity of the Building of Eumachia, were found, at the height of five meters above the soil, about a hundred silver coins, four earrings, and a small finger ring of gold, with two iron keys and some traces of cloth in which the coins had been wrapped. In a close search of the earth, lest any of this precious treasure be missed, we came to a place where the earth gave way under the trowel, revealing a hollow cavity deep enough to reach in at arm's length and remove some bones. I realized immediately that this was the impression of a human body, and I thought that by quickly pouring in scagliola [plaster], the cast of an entire person would be obtained. The result surpassed my every expectation. After some days of difficult work, I had the pleasure to see arise the entire figure of a man, missing only a small portion of the right side, wrapped in a cloak, with long trousers and feet enclosed in a type of boots to which nails and the iron lasts of the soles still adhered. The open mouth and the swollen belly demonstrated quite clearly that he had died drowned by the waters and buried in the mud in which I found him enveloped.*

Luigi Settembrini, a friend of Fiorelli and a fellow scholar, published this description in the same newspaper the next day.

> *And lo and behold, a few days ago, while digging in a small street near the baths, and right in the middle of the street, there were found two pairs of gold earrings—one larger, one smaller—a gold ring, a hundred silver coins, and two iron keys, all in the same spot near a hole that led into a cavity. Fiorelli rushed up and with long tongs dug out some bones from the hole and filled the cavity with liquid gesso [plaster]. When the gesso had hardened and was scraped clean of the ash that adhered to it, it revealed the figure of a man lying on his back, with his mouth open, his chest and stomach swollen, as is usually seen in those who have drowned. The left arm was complete, extended, with the hand closed. At the tips of the fingers, the bones could be seen in the gesso. On the small finger, there was an iron ring. The right arm was missing because it was where the hole was through which the gesso had entered. On the left arm and on the chest is a certain accretion, which appears to be made by the clothing. The belly is bare. The trousers are rolled down over the thighs. On the feet were laced soles, and nails were visible on the bottoms. From the straps that wrapped the left foot, the large toe extended bare. He appeared to be a man of fifty years. The nose and the cheeks could be seen clearly. The eyes were missing, as was the hair. In the open mouth, he was missing some teeth. Here and there appears clothing material.*

Name Class Date

For #1-5, compare details in the two descriptions of how the first plaster cast was made at Pompeii in 1863. Complete the chart with text from the primary sources. Then, answer the questions that follow.

	Fiorelli	**Settembrini**
1. Location	"in the small street that begins opposite one of the secondary doors of the Stabian Baths and issues in the vicinity of the Building of Eumachia"	
2. Artifacts found		"found two pairs of gold earrings—one larger, one smaller—a gold ring, a hundred silver coins, and two iron keys"
3. Term for the liquid plaster		
4. Description of man's shoes		"laced soles, and nails were visible on the bottom…straps that wrapped the left foot"
5. Description of the man's face	"open mouth"	

Name Class Date

6. (a.) Which author gave a more detailed description of the setting and the objects found with the body? (b.) Which author gave a more detailed description of the victim's body?

7. What was removed from the hole before the plaster was poured?

8. Before Fiorelli's work in Pompeii, some historians disagreed on whether ancient Roman men wore pants or, if they did, when pants became fashionable. How does the clothing revealed in this cast answer those questions?

9. According to both Fiorelli and Settembrini the cast of the man was missing part of his right side. What reason does Settembrini give for the missing right arm?

10. How do both men think this victim die?

Name Class Date

11. (a.) How old was the victim when he died? (b.) Which author provides the man's age in his description? (c.) Do you think the age the author gives for the victim correct?

12. The plaster cast of this man and of other Pompeiians show some people wearing layers of warm clothing. Fiorelli described him as "wrapped in a cloak." The accepted date for Vesuvius' eruption has always been August 24th, but some scholars believe it actually happened in October or November. (a.) Which season does the clothing discovered in the casts support and why? (b.) Some of the artifacts you see in Pompeii: The Exhibition can also be used as clues to help solve this mystery. Explain how carbonized foods and coins could help determine what time of year Vesuvius erupted—summer or fall.