Life and death in the shadow of Vesuvius

The following Educator’s Guide for A Day in Pompeii was designed to promote personalized learning and reinforce classroom curriculum. The worksheets and classroom activities are appropriate for various grade levels and apply to proficiency standards in social studies, language arts, reading, math, science and the arts. Students are encouraged to use their investigation skills to describe, explain, analyze, summarize, record and evaluate the information presented in the exhibit. The information gathered can then be used as background research for the various Classroom Connections that relate to grade level academic content standards.

In order to best suit you and your classroom needs, this Educator’s Guide has been broken up into the following areas:

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Vocabulary

**Archaeologist** – A scientist who studies artifacts of the near and distant past in order to develop a picture of how people lived in earlier cultures and societies. These artifacts include physical remains, such as graves, tools and pottery.

**Artifact** – A hand-made object or the remains of an object that is characteristic of an earlier time or culture, such as an object found at an archaeological excavation.

**Caldera** – A cauldron-like depression in the ground created by the collapse of land after a volcanic eruption.

**Cinder cone volcano** – A type of volcano, also known as a scoria cone, which has a single vent, a bowl-shaped crater and steep sides (i.e. Paricutin).

**Composite Volcano** – A type of volcano, also known as a stratovolcano, which is usually tall and mountainous whose steep sides have been formed over time by repeated deposits of ash, lapilli, lava and pyroclastic flows (i.e. Vesuvius).

**Convergent plate boundaries** – Locations where lithospheric plates are moving towards one another. These plate collisions often produce earthquakes, volcanic activity and crustal deformation.

**Cryovolcano** – also known as an ice volcano, these types of volcanoes erupt volatiles such as water, ammonia and methane instead of molten rock.

**Dormant** – In a state of rest or inactivity; inoperative; (of a volcano) not erupting.

**Excavation** – To unearth or remove objects, bodies, buildings, etc. from the environment or site in which they were originally buried.

**Lava** – Molten rock that reaches the earth’s surface through a volcano or fissure.

**Lithosphere** – The rigid outer shell of the earth which includes the crust and a portion of the upper mantle.

**Magma** – Molten material beneath or within the earth’s crust, from which igneous rock is formed.

**Magmatic dike** – An intrusive, igneous body that cross-cuts pre-existing rock.

**Mosaics** – The art of creating images with an assemblage of small pieces of colored glass, stone or other materials.
**Plinian eruption** – A type of volcanic eruption, also known as a Vesuvian eruption, marked by columns of gas and volcanic ash extending high into the stratosphere and characterized by large amounts of pumice and very powerful continuous gas blast eruptions. This type of eruption was named after Pliny the Younger, a Roman writer who escaped Pompeii and described the A.D. 79 eruption of Mt. Vesuvius which killed his uncle.

**Pyroclastic flow** – A heavier-than-air emulsion of hot ash, pumice, rock fragments and volcanic gas that flows down the flank of a volcanic structure. Pyroclastic flows are considered as the most deadly of all volcanic phenomena.

**Shield volcano** – A type of volcano which is massive with broad sloping sides and are often built up from the sea floor and are formed almost entirely by lava flows (i.e. Mt. Kilauea).

**Subduction** – The process that takes place at convergent plate boundaries by which one tectonic plate moves under another tectonic plate, sinking into the Earth’s mantle, as the plates converge.

**Subterranean** – Existing, situated, or operating below the surface of the earth; underground.

**Stratovolcano** – see composite volcano

**Tephra** – Material produced and ejected into the atmosphere by a volcano and classified by size:
- **Ash** – particles smaller than 2 mm (.08 in) in diameter.
- **Lapilli or volcanic cinders** – particles between 2 and 64 mm (.08 and 2.5 in) in diameter.
- **Volcanic bombs or volcanic blocks** – particles larger than 64 mm (2.5 in) in diameter.

**Tremors** – A relatively minor seismic shaking or vibrating movement. Tremors often precede larger earthquakes or volcanic eruptions.

**Volcano** – is an opening or rupture in a planet’s surface or crust, which allows hot magma, volcanic ash and gases to escape from below the surface.

**Volcanology** – The study of volcanoes, lava, magma and related geological, geophysical and geochemical phenomena.

**Volcanologist** – A person who studies the formation of volcanoes and their current and historic eruptions.
Volcanism

Volcanoes destroy and volcanoes create

Volcanoes are mountains but they are very different from other mountains. They are not formed by folding and crumpling or by uplift and erosion. Instead, volcanoes are built by the accumulation of their own eruptive products--lava, bombs and tephra. A volcano is most commonly a conical hill or mountain built around a vent that connects with reservoirs of molten rock below the surface of the Earth. The term volcano also refers to the opening or vent through which the molten rock and associated gases are expelled.

Driven by buoyancy and gas pressure, the molten rock, which is lighter than the surrounding solid rock, forces its way upward and may ultimately break through zones of weaknesses in the Earth's crust. If so, an eruption begins and the molten rock may pour from the vent as non-explosive lava flows or it may shoot violently into the air as dense clouds of lava fragments. Larger fragments fall back around the vent, and accumulations of fragments may move down slope as ash flows under the force of gravity. Some of the finer ejected materials may be carried by the wind only to fall to the ground many miles away. The finest ash particles may be ejected miles into the atmosphere and carried many times around the world by stratospheric winds before settling out.

Molten rock below the surface of the Earth that rises in volcanic vents is known as magma whereas it is called lava after it erupts from a volcano. Originating many tens of miles beneath the ground, the ascending magma commonly contains some crystals and dissolved gases, but it is primarily a liquid composed principally of oxygen, silicon, aluminum, iron, magnesium, calcium, sodium, potassium, titanium, and manganese. Magmas also contain many other chemical elements in trace quantities. Upon cooling, the liquid magma may precipitate crystals of various minerals until solidification is complete to form an igneous rock.

Types of Volcanoes

As with most classification systems, there are heated debates on what is the best way to group volcanoes. While it may not be comprehensive, generally volcanoes are grouped into three main kinds; cinder cones, composite volcanoes (also known as stratovolcanoes) and shield volcanoes. This classification system does not take into account other volcanic structures however it is sufficient for introductory volcanism.
**Cinder cones**

Cinder cones, also known as scoria cones, are the simplest type of volcano. They are built from particles and blobs of congealed lava ejected from a single vent and are the most common type of volcano. As the gas-charged lava is blown violently into the air, it breaks into small fragments which solidify and fall as cinders around the vent to form a circular or oval cone. Most cinder cones have a bowl-shaped crater at the summit and rarely rise more than a thousand feet or so above their surroundings. Cinder cones are numerous in western North America as well as throughout other volcanic terrains of the world.

In 1943 a cinder cone started growing on a farm near the village of Paricutin in Mexico. Explosive eruptions caused by gas rapidly expanding and escaping from molten lava formed cinders that fell back around the vent, building up the cone to a height of 1,200 feet. The last explosive eruption left a funnel-shaped crater at the top of the cone. After the excess gases had largely dissipated, the molten rock quietly poured out on the surrounding surface of the cone and moved downslope as lava flows. This order of events (eruption, formation of the cone and crater, lava flow) is a common sequence in the formation of cinder cones.

During 9 years of activity, Paricutin built a prominent cone, covered about 100 square miles with ashes, and destroyed the town of San Juan. Geologists from many parts of the world studied Paricutin during its lifetime and learned a great deal about volcanism, its products, and the modification of a volcanic landform by erosion.

**Composite volcanoes**

Some of the Earth’s grandest mountains are composite volcanoes, also called stratovolcanoes. They are typically steep-sided, symmetrical cones of large dimension built of alternating layers of lava flows, volcanic ash, cinders, blocks, and bombs and may rise as much as 8,000 feet above their bases. Some of the most conspicuous and beautiful mountains in the world are composite volcanoes, including Mt. Fuji in Japan, Mt. Cotopaxi in Ecuador, Mt. Shasta in California, Mt. Hood in Oregon, and Mt. St. Helens, Mt. Rainier in Washington and most importantly for *A Day in Pompeii*, Mt. Vesuvius.
Most composite volcanoes have a crater at the summit which contains a central vent or a clustered group of vents. Lavas either flow through breaks in the crater wall or seep from fissures on the flanks of the cone. Lava, solidified within the fissures, forms magmatic dikes (intrusive, igneous bodies that cross-cut existing rock) that act as ribs which greatly strengthen the cone.

The essential feature of a composite volcano is a conduit system through which magma from a reservoir deep in the Earth’s crust rises to the surface. The volcano is built up by the accumulation of material erupted through the conduit and increases in size as lava, cinders, ash, etc., are added to its slopes.

When a composite volcano becomes dormant, erosion begins to destroy the cone. As the cone is stripped away, the hardened magma filling the conduit (the volcanic plug) and fissures (the magmatic dikes) becomes exposed, and it too is slowly reduced by erosion. Finally, all that remains is the plug and dike complex projecting above the land surface—a telltale remnant of the vanished volcano.

An interesting variation of a composite volcano can be seen at Crater Lake in Oregon. From what geologists can interpret of its past, a high volcano, called Mt. Mazama, probably similar in appearance to present-day Mt. Rainier was once located at this spot. Following a series of tremendous explosions about 6,800 years ago, the volcano lost its top. Enormous volumes of volcanic ash and dust were expelled and swept down the slopes as ash flows and avalanches. These large-volume explosions rapidly drained the lava beneath the mountain and weakened the upper part. The top then collapsed to form a large depression, which later filled with water and is now completely occupied by beautiful Crater Lake. A last gasp of eruptions produced a small cinder cone, which rises above the water surface as Wizard Island near the rim of the lake. Depressions such as Crater Lake, formed by collapse of volcanoes, are known as calderas. They are usually large, steep-walled, basin-shaped depressions formed by the collapse of a large area over, and around, a volcanic vent or vents.

**Shield volcanoes**

Shield volcanoes are built almost entirely of fluid lava flows. Flow after flow pours out in all directions from a central summit vent, or group of vents, building a broad, gently sloping cone of flat, domical shape, with a profile much like that of a warrior’s shield. They are built up slowly by the accretion of thousands of highly fluid lava flows called basalt lava that spread widely over great distances, and then cool as thin, gently dipping sheets. Lavas also commonly erupt from vents along fractures (rift zones) that develop on the flanks of the cone.
Some of the largest volcanoes in the world are shield volcanoes. In northern California and Oregon, many shield volcanoes have diameters of 3 or 4 miles and heights of 1,500 to 2,000 feet. The Hawaiian Islands are composed of linear chains of these volcanoes including Kilauea and Mauna Loa, two of the world’s most active volcanoes, on the island of Hawaii. The floor of the ocean is more than 15,000 feet deep at the bases of the islands. Mauna Loa, the largest of the shield volcanoes (and also the world's largest active volcano), projects 13,677 feet above sea level and its top is over 28,000 feet above the deep ocean floor.

In some eruptions, basaltic lava pours out quietly from long fissures instead of central vents and floods the surrounding countryside with lava flow upon lava flow, forming broad plateaus. Lava plateaus of this type can be seen in Iceland, southeastern Washington, eastern Oregon, and southern Idaho. Along the Snake River in Idaho, and the Columbia River in Washington and Oregon, these lava flows are beautifully exposed and measure more than a mile in total thickness.

**FUN FACT - Volcanoes are out of this world!**

*Did you know volcanoes are not just found on Earth? We don’t even have the largest known volcano!*

**Extraterrestrial Volcanoes**

Evidence of past volcanic activity has been found on most of the planets in our solar system and on many of their moons. Some of these past eruptions can be seen on our own moon as vast areas covered with ancient lava flows as well as on Mars where we can see the largest volcano in the solar system, Olympus Mons. In addition to our moon and Mars, hundreds of volcanic features have been mapped on the surface of Venus. These volcanic features and many more discovered in our solar system were formed million of years ago when our solar system was younger and the planets and moons had much higher internal temperatures.

Our recent observations of active eruptions are limited to Earth, Io, Triton and Enceladus. The eruptions on Triton and Enceladus are both believed to be cryovolcanoes or ice volcanoes which erupts volatiles such as water, ammonia or methane instead of molten rock.
**Advantages of Volcanoes**

Although volcanoes have the reputation of being very dangerous there are also advantages of living near a volcano. Volcanoes may be destructive, possibly killing people and animals, but they are also spectacular. Both active and dormant volcanoes can be beautiful and mysterious, providing an endless amount of material for scientists, photographers and admirers.

Volcanoes provide resources for energy extraction, also called geothermal resources, where heat from the earth's crust is being converted to energy. The big advantages to this type of energy are that it is very clean and the resources are nearly inexhaustible.

In addition, when a volcano erupts it throws out a lot of ash. This ash can be very harmful to the environment initially, but the ash layer, which contains many useful minerals, will be converted to a very fertile soil making farming near volcanoes very productive. Even after an eruption people still return because of the fertile soil around the volcano.

Volcanoes can also provide a big economical advantage, generating tourism for the areas surrounding the volcano. People are fascinated by volcanoes and love to visit them, paying for tours, hotels, food, local goods, etc. creating a booming tourist economy for the local communities.

Finally and most relevant for *A Day in Pompeii*, volcanoes can provide endless information for scientists. Geologist, meteorologist, archaeologist and many others are fascinated with volcanoes, devoting time and energy to studying them and reporting their findings. These studies such as seismic activity, geologic composition, meteorological phenomenon surrounding volcanoes and many other studies provide the scientific community with valuable information that can often be life-saving. Volcanoes can also provide a glimpse into history such as with Pompeii. The fall of volcanic ash is ideal for preserving surface conditions at the time of deposition. Archaeologists are then able to excavate these areas and study historic flora, fauna, cultures and much more.
Mt. Vesuvius is a composite volcano, or a stratovolcano, on the Bay of Naples, Italy, about 5.6 miles east of Naples. Although it is not currently erupting, Mt. Vesuvius is the only volcano on the European mainland to have erupted within the last hundred years.

Mt. Vesuvius is best known for its eruption in A.D. 79 that led to the burying and destruction of the Roman cities of Pompeii and Herculaneum. Due to the eruption, Mt. Vesuvius underwent major changes – its slopes were denuded of vegetation and its summit changed considerably due to the force of the eruption. Mt. Vesuvius has erupted many times since and is today regarded as one of the most dangerous volcanoes in the world because of the population of 3,000,000 people living nearby and its tendency towards explosive eruptions. It is the most densely populated volcanic region in the world.

Mt. Vesuvius is a distinctive "humpbacked" mountain, consisting of a large cone (Gran Cono) partially encircled by the steep rim of a summit caldera caused by the collapse of an earlier and originally much higher structure called Monte Somma. The Gran Cono was produced during the eruption in A.D. 79. For this reason, the volcano is also called Somma-Vesuvius or Somma-Vesuvio. This structure has given its name to the term "somma volcano", which describes any volcano with a summit caldera surrounding a newer cone.

The mountain started forming 25,000 years ago. It was then built up by a series of lava flows, with some smaller explosive eruptions interspersed between them. However, the style of eruption changed around 19,000 years ago to a sequence of large explosive eruptions, of which the A.D. 79 one was the last. The caldera started forming during an eruption around 17,000 years ago and was enlarged by later paroxysmal eruptions ending in the eruption in A.D. 79.

The height of the main cone has been constantly changed by eruptions but is 4,202 feet at present. Monte Somma is 3,770 feet high, separated from the main cone by the valley of Atrio di Cavallo, which is some 3 miles long. The slopes of the mountain are scarred by lava flows but are heavily vegetated, with scrub and forest at higher altitudes and vineyards lower down. Mt. Vesuvius is still regarded as an active volcano, although its current activity produces little more than steam from vents at the bottom of the crater.

Mt. Vesuvius was formed as a result of the collision of two tectonic plates, the African plate and the Eurasian plate. The African plate was pushed deep into the earth beneath the Eurasian plate by this collision. As the water-saturated sediments of the oceanic African plate were pushed down to hotter depths in the earth, the water boiled off and caused the melting point of the upper mantle to drop enough to create partial melting of the rocks. Because magma is less dense than the solid rock around it, it was pushed upward. Finding a weak place at the Earth's surface it broke through, producing the volcano.
Mt. Vesuvius is one of several volcanoes which form the Campanian volcanic arc. Others include Campi Flegrei, a large caldera to the northwest of Mt. Vesuvius, Mt. Epomeo, 12 miles to the west on the island of Ischia, and several undersea volcanoes to the south. The arc forms the southern end of a larger chain of volcanoes produced by the subduction process described above, which extends northwest along the length of Italy as far as Monte Amiata in southern Tuscany. Mt. Vesuvius is the only one to have erupted within recent history, although some of the others have erupted within the last few hundred years. Many are either extinct or have not erupted for tens of thousands of years.

Mt. Vesuvius has had an active history. The eruptions vary greatly in severity but are characterized by explosive outbursts of the kind dubbed “Plinian” after Pliny the Younger, a Roman writer who published a detailed description of the eruption of Mt. Vesuvius in A.D. 79. The famous eruption in A.D. 79 was preceded by numerous others in prehistory, including at least three significantly larger ones, the best known being the Avellino eruption around 1800 B.C. which engulfed several Bronze Age settlements. Between A.D. 79 and 1944 the volcano has erupted numerous times. On occasion, eruptions from Mt. Vesuvius have been so large that all of southern Europe has been blanketed by ash. For example, in 472 and 1631, Vesuvian ash fell on Constantinople (Istanbul), over 750 miles away. There has been no eruption since 1944, and none of the post-A.D. 79 eruptions were as large or as destructive as the Pompeian one. However, a few times since 1944, landslides in the crater have raised clouds of ash dust, causing false alarms of an eruption.

According to a stratigraphic study (a study of the layers of ash and debris), the eruption of Mt. Vesuvius in A.D. 79 unfolded in two phases: a Plinian eruption that lasted eighteen to twenty hours and produced a rain of over 9 feet of pumice southward of the cone at Pompeii, followed by a pyroclastic flow which reached as far as Misenum but was concentrated to the west and northwest. Two pyroclastic flows engulfed Pompeii, burning and asphyxiating the remaining villagers. Oplontis and Herculaneum received the brunt of the flows and were buried in fine ash and pyroclastic deposits.

Mt. Vesuvius is currently quiet, with only minor seismic activity and outgassing from vents in its summit crater, but more violent activity could resume in the future. It is estimated that 2.5 million people could be affected by a significant eruption of Mt. Vesuvius. Conditions are closely monitored. There is a plan in place for the evacuation of people nearest the volcano that assumes between two weeks and 20 days notice of an eruption.
Vesuvius Through the Ages

16,100 years ago
Pompeii Quadrilobe Plinian eruption
Pumice and ash erupt from the northern vents of Mount Somma.

8,000 years ago
Nuptio eruption
Deposits of pumice, lapilli, and ash flow on the northern slopes of Mount Somma.

3,800 years ago
Cassiopeia Plinian eruption
Deposits of pumice, lapilli, and pyroclastics surge onto the northern and western slopes of Cassiopeia, engulfing several Bronze Age villages.

79 AD
Vesuvius erupts, killing thousands, and burying Pompeii and Herculaneum. The eruption occurs in three phases—showers of hot pumice fragments, superheated pyroclastics flows pouring down the slopes, and finally, the "turbid" of volcanic ash that blanketed the region, ranging from 15 feet thick in Pompeii to over 40 feet of volcanic debris in Herculaneum.

472 AD
Pollina Subplinian eruption
An effusive eruption accompanied by lava flows and mudslides surges on the northeastern flank. Messalina, a Roman empress, is killed by the eruption. "Vesuvius...caused night during the day and covered all of Europe with fine ash."

472-1631
Vesuvius erupts at least fifteen times between 472 AD and 1631. Many of these eruptions were large, lasting several days at a time. Cassiodorus, a Roman writer, wrote in 522 AD, "...a great ash flow in the sky,征求意见...eruption were covered with sand to the top of the trees..."

1685-1698
Lava flows are active between 1685 and 1698 on the southern flank of Vesuvius towards Portici and Torre del Greco.

1700-1799
Six eruptions occur during the eighteenth century, with lava activity mainly present along the southern and western flank of Vesuvius near Torre del Greco. A significant flow occurs in 1760. Activity continues with flows throughout the later years of the century, eventually destroying Torre del Greco by the eruption of 1794.

1800-1861
Pyroclastic activity with lava flow continues on the southern flanks of Vesuvius towards Torre del Greco and Boscoreale early in the century. Lava flows occur from lateral vents on the southwestern flank towards Mata and San Sebastiano. Eruptions occurred every few years, including 1822, 1834, 1850, 1870, 1885, and 1886. An observatory is built on the side of Vesuvius to monitor volcanic activity.

1864-1903
Pyroclastic eruptions and lava flows pour from the side vents on the southern flank. Lava domes form near the crater of Vesuvius. The 1872 eruption was the most notable of the eight that occurred during the nineteenth century.

1906
Vesuvius erupts violently in April 1906, killing over one hundred people. The rising column of gas and volcanic ash reaches eight miles into the atmosphere. The volcano's summit is blown away, forming a large crater. The summit crater is now 650 feet lower after the eruption. Lava flows towards Matera Arsonzo.

1913-1944
Small lava flows occur repeatedly within the summit crater. In 1943, the flow reaches the village of Teggiano on the eastern flank and fills in the summit crater that was formed in 1906. In 1944, lava from the central cone breaches the crater rim and flows towards Mata and San Sebastiano. Five thousand inhabitants of Naples are evacuated by the Allied Fleet. Activity ceases on February 23, 1944.

1945-Present
Vesuvius has remained quiet—now. Vesuvius is monitored by The Vesuvius Observatory, Naples Section of the National Institute of Geophysics and Volcanology, a public sector scientific institute. The Vesuvius Observatory is responsible for monitoring the active volcanic area of Campania, Italy.
Pompeii

What nature destroyed, it also preserved

The city of Pompeii is a partially buried Roman city near modern day Naples. Along with Herculaneum, Pompeii was destroyed and completely buried during the two day catastrophic eruption of Mt. Vesuvius in A.D. 79. The eruption buried Pompeii under 13 to nearly 20 feet of ash and pumice, and it was lost for almost 1700 years before its accidental rediscovery in 1749. Since then, its excavation has provided an extraordinarily detailed insight into the life of a city at the height of the Roman Empire. Today, this UNESCO (United Nations Educational, Scientific and Cultural Organization) World Heritage Site is one of the most popular tourist attractions of Italy, with approximately 2,500,000 visitors every year.

The archaeological digs extend down to Pompeii's streets in A.D. 79. Deeper digs in older parts of Pompeii have also been conducted and along with nearby core samples, scientists have exposed layers of jumbled sediment. Three sheets of sediment have been found on top of the lava that lies below the city and, mixed in with the sediment, archaeologists have found bits of animal bone, pottery shards and plants. Using carbon dating, the oldest layer has been dated to between the 8th and 6th centuries B.C., about the time that the city was founded. The other two layers are separated from the oldest layers by well-developed soil layers or Roman pavement and were laid in the 4th century B.C. and 2nd century B.C. It is theorized that the layers of jumbled sediment were created by large landslides, perhaps triggered by extended rainfall.
The excavated town offers a snapshot of Roman life in the 1st century, frozen at the moment it was buried on August 24th A.D. 79. The forum, the baths, many houses, and some out-of-town villas like the Villa of the Mysteries remain surprisingly well preserved. Pompeii was a lively place and evidence abounds of literally the smallest details of everyday life including mosaics from homes and businesses as well as carbonized food.

In 89 B.C., after the final occupation of the city by Roman General Lucius Cornelius Sulla, Pompeii was finally annexed to the Roman Republic. During this period, Pompeii underwent a vast process of infrastructural development, most of which was built during the Augustan period. Worth noting are an amphitheatre, a palaestra with a central natatorium or swimming pool, and an aqueduct that provided water for more than 25 street fountains, at least four public baths, and a large number of private houses and businesses. The amphitheatre has been cited by modern scholars as a model of sophisticated design, particularly in the area of crowd control. The large number of well-preserved frescoes throws a great light on everyday life and has been a major advance in art history of the ancient world, with the innovation of the Pompeian styles.

At the time of the eruption in A.D. 79, the town could have had some 20,000 inhabitants and was located in an area in which Romans had their holiday villas. It is the only ancient town of which the whole topographic structure is known precisely as it was, with no later modifications or additions. Its streets are straight and lay out in a grid with houses and shops on both sides of the street. The Forum was the economic, religious, and political center of Pompeii. The main temples, municipal buildings, law courts, the Macellum, and the Mensa Ponderaria were grouped around it. Besides the forum, many other services were found: the Macellum (great food market), the Pistrinum (mill), the Thermopolium (bar that served cold and hot beverages) and cauponae (small restaurants). An amphitheatre and two theatres have been found, along with a palaestra or gymnasium. A hotel was found a short distance from the town; it is now nicknamed the "Grand Hotel Murecine".
The Eruption of Mt. Vesuvius

The inhabitants of Pompeii, as those of the area today, had long been used to minor quaking (indeed, the writer Pliny the Younger wrote that earth tremors "were not particularly alarming because they are frequent in Campania"), but on February 5th A.D. 62, there was a severe earthquake which did considerable damage around the bay and particularly to Pompeii. The earthquake, which took place in the afternoon, is believed to have registered between about 5 and 6 on the Richter scale. Temples, houses, bridges, and roads were destroyed. It is believed that almost all buildings in the city of Pompeii were affected. In the days after the earthquake, anarchy ruled the city, where theft and starvation plagued the survivors. In the time between A.D. 62 and the eruption in A.D. 79, some rebuilding was done, but some of the damage had still not been repaired at the time of the eruption. It is unknown how many people left the city after the earthquake, but a considerable number did indeed leave the devastation behind and move to other cities within the Roman Empire. Those willing to rebuild and take their chances in their beloved city moved back and began the long process of reviving the city.

August 24, A.D. 79 began as any other summer day in Pompeii. The town forum was bustling with commercial and political activity. The baths, temples, theaters and taverns were full of patrons. Just after the lunch hour, the ground shook and a great explosion thundered over the town. Mt. Vesuvius had erupted, spewing volcanic materials over the city and surrounding region. A column of ash and gases rose into the sky miles above the mountain. Small volcanic rocks and ash began to fall, covering the city. The debris was so thick that clouds of ash obscured the daylight.

Through the night, a steady accumulation of falling debris blanketed the open spaces in town and began to weigh upon rooftops, eventually collapsing them. Those residents trying to endure the deluge were trapped inside buildings; those trying to flee in the darkness were stranded.

The next day saw the onset of catastrophic, fast moving waves of toxic gases and hot, wet mud slides. Those who fled early most likely escaped. Those who stayed behind did not. Pompeii remained buried and forgotten for 1700 years.

The letters of Gaius Plinius Caecilius Secundus (known as Pliny the Younger) to the historian Tacitus are the only surviving eyewitness account of the A.D. 79 eruption of Mt. Vesuvius. After his father’s death, Pliny was raised in the household of his uncle, Pliny the Elder, who commanded the naval fleet at Misenum on the Bay of Naples. Pliny the Younger was 18 at the time of the eruption. His uncle died at Stabiae after sailing to the rescue of friends. Left behind with his schoolwork, the younger Pliny watched the horror of Mt. Vesuvius unfold, finally fleeing with his mother as the surge clouds approached Misenum. So accurate was Pliny’s account that this type of volcanic eruption is now called ‘Plinian’, in his honor.

The A.D. 79 eruption was documented by contemporary historians and is generally accepted as having started on August 24th A.D. 79, relying on one version of the text of Pliny's letter. However the archaeological excavations of Pompeii suggest that the city was buried about two months later. This is supported by another version of the letter which gives the date of the eruption as November 23rd A.D. 79. People buried in the ash appear to be wearing warmer clothing than the light summer clothes that would be expected in August. The fresh fruit and vegetables in the shops are typical of October, and conversely the summer fruit that would have been typical of August was already being sold in dried or conserved form. Wine fermenting jars had been sealed over, and this would have happened around the end of October. The coins found in the purse of a woman buried in the ash include one which includes a fifteenth imperatorial acclamation among the emperor’s titles. This cannot have been minted before the second week of September. So far there is no definitive theory as to why there should be such an apparent discrepancy.
Finding the Buried City

After thick layers of ash covered Pompeii and Herculaneum, they were abandoned and eventually their names and locations were forgotten. While the Romans attempted to revitalize the affected area, no community replaced Pompeii and the economy shifted to other towns in the region. The remains of families, works of art, buildings and roads lost so suddenly to Mt. Vesuvius lay undisturbed beneath the feet of Campania’s residents.

The first time any part of the buried cities was unearthed was in 1599, when the digging of an underground channel to divert the river Sarno ran into ancient Pompeian walls covered with paintings and inscriptions. The architect Domenico Fontana was called in and he unearthed a few more frescoes but then covered them over again, and nothing more came of the discovery.

In 1709, a workman sinking a well in the town of Resina struck marble seats in what was Herculaneum’s theater. Herculaneum is five miles from Pompeii on the shores of the Bay of Naples. This discovery initiated the excavations of these lost cities because Renaissance collectors were very interested in acquiring precious, authentic classical objects.

The first excavators were opportunists, but by the 19th century scholars and tourists were interested in the city of Pompeii and the people who had lived there. The emphasis was no longer on the value of discrete objects, but rather on the past lives that the artifacts revealed. By 1827 a street plan of uncovered areas of Pompeii was developed and the first tourist guidebook was published.

In the 1860s, Professor Giuseppe Fiorelli became director of the excavation and published *Pompeianarum antiquitatum historia*, the first definitive history of the excavations at Pompeii. During early excavations of the site, occasional voids in the ash layer had been found that contained human remains. It was Fiorelli, or one of his assistants, who realized these were spaces left by the decomposed bodies and so devised the technique of injecting plaster into them to perfectly recreate the forms of Vesuvius's victims. What resulted were highly accurate and eerie forms of the doomed residents who failed to escape, in their last moment of life, with the expression of terror often quite clearly visible. This technique is still in use today, with a clear resin now used instead of plaster because it is more durable, and does not destroy the bones, allowing further analysis.

Today, archaeologists have widened their interest. They are concerned with larger questions about society and politics that the site has the potential to answer. They consider the city as a whole and collect data about demographics and the distribution of resources. How many homes and gardens? How many had onsite access to fresh water? What does the presence of foreign sacred objects like the Hand of Sabazius, imported from Asia Minor, say about tolerance and diversity in Roman society?

The ruins of Pompeii are situated at coordinates 40°45′00″N 14°29′10″E, near the modern suburban town of Pompeii (nowadays written with one "i"). It stands on a spur formed by a lava flow to the north of the mouth of the Sarno River (known in ancient times as the Sarnus). Today it is some distance inland, but in ancient times it would have been nearer to the coast. Pompeii is about 8 km (5 miles) away from Mount Vesuvius. It covered a total of 163 acres, and would have been in the region of Campania.

Pompeii has been a popular tourist destination for 250 years. In 2008, it was attracting almost 2.6 million visitors per year, making it one of the most popular tourist sites in Italy. It is part of a larger Vesuvius National Park and was declared a World Heritage Site by UNESCO in 1997.
Cincinnati’s Ties to Pompeii
The University of Cincinnati is one of the foremost centers of Pompeian studies in the United States. The University of Cincinnati based Pompeii Archaeological Research Project: Porta Stabia (PARP:PS) is the largest archaeological excavations ever undertaken in Pompeii and represents the only American project currently excavating within the city. Directed by Professor Steven Ellis of the UC Classics department, the PARP:PS team consists of approximately 40 highly-qualified scholars including archaeologists, historians, philologists, anthropologists, scientists, and conservators from UC and other institutions around the world. Together, they are bringing to light a largely forgotten corner of ancient Pompeii that has great potential for enlightening Pompeian and Roman history.

Through the full range of archaeological inquiry – archaeological excavations, structural and artifactual analyses and geophysical surveys – PARP:PS is revealing the dynamic structural and social history of an entire Pompeian neighborhood. The research area covers a working-class district (modest houses, shops, workshops, and hospitality outlets) that sat in the shadow of the so-called 'entertainment district' - an area comprised of two theatres, a large public colonnaded courtyard (Quadriporticus), three temples and a forum. Here was the social and cultural centre of Pompeii. The project thus presents a unique opportunity to examine the complex decisions involved in the planning, integration and use of public and private space in the ancient city. The results are contributing to a more detailed and reasoned understanding of the roles that non-elites played in the shaping of an ancient city and how these families responded to various Mediterranean-wide socio-economic developments.

PARP:PS is at the cutting-edge of technological applications in archaeological methodology. For example, the team is fully equipped with iPads, meaning that all of the data collected in the field is done so using streamlined digital methods. The use of digital technology trench-side, instead of scribbling notes into paper notebooks or drawing architectural plans in pencil on mylar boards, which have to later be digitized and data-entered, ensures the information is more accurate, more easily acquired, faster to produce, and links directly through an on-site server to the Project’s central database. These new methods, and indeed the philosophies behind them, are helping to revolutionize archaeological field-work. Steven Ellis and PARP:PS team’s paperless methods even caught the attention of the late Apple CEO Steve Jobs, who featured the project's use of iPads in an article on Apple.com in 2010.

For more on the Pompeii Archaeological Research Project: Porta Stabia, see [http://classics.uc.edu/pompeii/](http://classics.uc.edu/pompeii/).
# A buried town gradually emerges

Pompeii was one of the first sites of an archaeological excavation. For that reason, the story of the town’s gradual rediscovery is also a story of archaeology, from its beginnings to the present day.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1709-16</td>
<td>A farmer sinking a well strikes the ancient theater of Herculaneum and finds ancient marble sculptures. The lid is acquired by an Austrian prince who has tunnels dug and plundered the site for antiquities.</td>
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<td>1738</td>
<td>The King of Naples and Sicily continues the treasure hunt, using miners, soldiers and prisoners. Hundreds of sculptures, columns, and frescoes are removed.</td>
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<td>1748</td>
<td>Attention turns to the site of another buried town nearby, which turns out to be Pompeii. The digging begins near the Herculaneum Gate and in part of the Amphitheater.</td>
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<tr>
<td>1750-64</td>
<td>Karl Weber, a Swiss army engineer, directs excavations at Herculaneum and Pompeii. He is the first to conduct systematic excavations and record the sites as they are uncovered.</td>
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<td>1765</td>
<td>Excavations at Herculaneum are suspended after the Temple of Isis discovered at Pompeii.</td>
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<tr>
<td>1779</td>
<td>A series of minor but spectacular excavations from Vesuvius attract sightseers to the region. To protect the exposed remains of Herculaneum from damage and theft, they are moved to a new museum in Naples.</td>
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<tr>
<td>1805-15</td>
<td>Italy is under French domination and Napoleon’s sister and brother-in-law become King and Queen of Naples. They have a passion for archaeology and under the supervision of a French architect, excavation of Pompeii accelerates, leading to the discovery of the Forum. After the French are defeated at the Battle of Trafalgar, Naples reverts to Italian rule.</td>
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<tr>
<td>1817</td>
<td>Sir William Gell, living in Naples, publishes Pompeiæsæ, the first English guidebook to Pompeii.</td>
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<td>1830-32</td>
<td>The Alexander Mosaic is discovered during the excavation of the House of the Faun. This complex mosaic covered an area of almost 2.5 square feet and portrays one of Alexander’s victorious battles over the King of Persia.</td>
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<td>1832-34</td>
<td>Following a visit to Naples, the English novelist Edward Bulwer Lytton writes The Last Days of Pompeii. The publication captures the popular imagination and increases Pompeii’s allure for tourists.</td>
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<tr>
<td>1850s-60s</td>
<td>With Pompeii now a popular tourist destination, more guidebooks are published and still more visitors come.</td>
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<td>1860-75</td>
<td>Archaeologist Giuseppe Fiorelli, new director of excavations at Pompeii, introduces many innovative methods. Frescoes are no longer removed from walls and sent to the Naples Museum. Fiorelli clears the streets of debris, gives a name and number to every building on the site, and invents the technique of making plaster body casts to ‘reclaim’ the Pompeii dead.</td>
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<td>1879</td>
<td>Official ceremonies mark the 1,800th anniversary of Pompeii’s destruction. In recognition of the site’s importance, it is decreed by Fiorelli’s successor, Michele Ruggiero, that Pompeii’s ancient appearance must be conserved and restored to the greatest extent possible. (That policy is still in effect.)</td>
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<tr>
<td>1880</td>
<td>A funicular railway is built to carry visitors up the steep slope of Vesuvius (still an active volcano). The popular song Funicolari, Funicolà commemorates the opening.</td>
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<tr>
<td>1894-1900</td>
<td>The excavation of Roman villas begins in the Boscoreale region, northeast of Pompeii.</td>
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<tr>
<td>1900</td>
<td>German art historian Augustus Mau devises a system of classifying Pompeian frescoes, identifying four different styles as a means of dating the wall-paintings.</td>
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A new superintendent, Vittorio Spinazzola, excavates the full length of Pompeii’s main street, the Street of Abundance (Via dell’Abbondanza), and every building along it. The works are published in three volumes in 1953.

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<td>Amedeo Maiuri becomes superintendent of excavations at Pompeii, a position he holds until 1961. After a cessation of 162 years, the excavations at Herculaneum begin again in 1937 under the supervision of Maiuri. He uncovers the frescoes in the Villa of Mysteries outside the Herculaneum Gate of Pompeii.</td>
<td>The palaestra (ancient gymnasium) near the Amphitheater is fully excavated and restored. Many bodies are found in the portico.</td>
<td>During World War II, Allied bombs fall on Pompeii striking several houses in the Street of Abundance. Vesuvius erupts for several months and parts of Naples are evacuated.</td>
<td>Volcanic rubble is in great demand for road building — excavation records for this period are extremely poor or nonexistent.</td>
<td>Pompeii is damaged by a severe earthquake in November. Documentation of the existing ruins becomes a priority.</td>
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<th>1997</th>
<th>2007</th>
<th>Present</th>
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<td>Pompeii, Herculaneum and associated sites are declared a World Heritage Site by UNESCO, the United Nations Educational, Scientific and Cultural Organisation.</td>
<td>The National Museum of Naples and the Superintendency of Pompeii join together to coordinate activities and the handling of artifacts at both the Museum and the archaeological sites.</td>
<td>About three-quarters of Pompeii’s 163 acres are now uncovered. Archaeologists are currently focused more on re-examining and understanding earlier discoveries, than on undertaking fresh excavations.</td>
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Classroom Connections

1. Have students define the following vocabulary words and explain how they apply to Pompeii.
   - Archaeologist
   - Artifact
   - Excavation
   - Tremors
   - Volcano
   - Volcanology
   - Volcanologist
   - Magma
   - Lava
   - Pyroclastic flow
   - Mosaics
   - Dormant

2. Ask students to research the three different types of volcanoes and how volcanic eruptions occur. Encourage them to classify the type of volcano Mt. Vesuvius is and investigate the events of the A.D. 79 eruption.

3. Distribute several “mystery objects” that students may not have seen or used before (hand crank mixer, cherry pitter, metronome, eight-track, floppy disk, etc.). Ask students to imagine what archaeologists might determine about the use of the objects and the information it reveals about the daily lives of people who used it.

4. Ask students how long they think the average museum visitor spends looking at an object in an exhibit. Record their responses. Research reveals that the average museum visitor spends 30 seconds looking at any one artifact or work of art. Show the class an object or photo for 30 seconds, then cover the object. Ask students to describe the object in as much detail as they can. Show the object to the students again and allow them to examine it closer, writing down additional details and observations. Remind the students to remember this activity as they are visiting the exhibit and recording their observations.

5. Have your students create their own mosaics to depict an object, favorite story or daily life. Mosaics may be made with tiles or even pieces of colored paper or magazines. Ask the students what they might conclude if they were an archaeologist who excavated their mosaic in the future. On your visit to Cincinnati Museum Center, you will have the opportunity to see the large mosaics in our rotunda that were created in 1932 as well as those from Pompeii, created before A.D. 79

6. Have your students complete the following worksheets to better grasp some of the details of the exhibit.
Examining Pompeii

Locate and label the following cities and physical features on the map below.

Rome     Mt. Vesuvius     Salerno
Pompeii   Gulf of Naples   Isle of Capri
Herculaneum  Tyrrhenian Sea  Stabiae
Misenum   River Sarno     Portici
Oplontis  Boscoreale     Terzigno
Naples     Torre del Greco  Ercolano
What Would You Do? An Escape Plan

Are you ready to put your planning skills to good use and help your family escape the unexpected? Here’s your chance to live like a Pompeian. Today you and your family live in Pompeii and you will need to prepare for the forces of nature that may occur at any moment. Follow the steps below to see how well you would handle the pressure.

Step 1 – Know the Facts: The first step in being prepared for the unexpected is to know the facts about your surroundings. Use several sources to research some of the hazards of living in Pompeii. Don’t forget that the volcano isn’t your only danger. List your findings below.

Step 2 – Make a Plan: Now that you know the facts about the dangers that await, it’s time to make a plan. What will you do when the first signs of danger begin? What will you take with you? Will you flee or stay?

Step 3 – Make a Kit: You have a plan, now it’s time to make an emergency kit. If you plan to stay, it should contain survival items. If you plan to flee, it should include necessities for your journey. What will your kit include?

Step 4 – Disaster: The unimaginable has happened. The earth begins to shake and Mt. Vesuvius begins to erupt (see “Eruption Timeline”). From the first tremors until the deadly hot mud flows, you have you less than 24 hours. Using the Eruption Timeline, determine whether you and your family will survive? Why or why not?
Eruption Timeline

The letters of Gaius Plinius Caecilius Secundus (known as Pliny the Younger) to the historian Tacitus are the only surviving eyewitness account of the A.D. 79 eruption of Mt. Vesuvius. After his father’s death, Pliny was raised in the household of his uncle, Pliny the Elder, who commanded the naval fleet at Misenum on the Bay of Naples. Pliny the Younger was 18 at the time of the eruption. His uncle died at Stabiae after sailing to the rescue of friends. Left behind with his schoolwork, the younger Pliny watched the horror of Vesuvius unfold, finally fleeing with his mother as the surge clouds approached Misenum. So accurate was Pliny’s account that this type of volcanic eruption is now called ‘Plinian’, in his honor.

Below is the approximate timeline of the eruption of Mt. Vesuvius, including excerpts from Pliny’s letters.

24 August A.D. 79

8 a.m.  A series of small emissions from Mt. Vesuvius.

“For several days past there had been earth tremors which were not particularly alarming because they are frequent in Campania; but that night the shocks were so violent that everything felt as if were not only shaken but overturned. “

1 p.m.  Mt. Vesuvius erupts suddenly and with great force. A cloud of volcanic materials soars high above the mountain, spreading out in the shape of a flat topped pine tree. Within 30 minutes, the surging dark cloud rises some 14 km above Mt. Vesuvius. Ash drifts over Pompeii.

“…a cloud of unusual size and appearance…being like an umbrella pine, for it rose to a great height on a sort of trunk and then split off into branches …“

3 p.m.  Mt. Vesuvius spews its contents higher and higher. As it rises, the volcanic material (mostly fragments of lapilli) cools and then hails down on Pompeii. Most residents flee, although some seek shelter or stay behind to guard their property. Volcanic debris begins to clog the River Sarno and the port, making them impassable to ships. Seismic shockwaves shake the area.

“…there was a danger from falling pumice stones …as a protection against falling objects they put pillows on their heads tied down with cloths… We also saw the sea sucked away…so that quantities of sea creatures were left stranded on dry sand.”

5 – 6 p.m.  Chunks of pumice, as big as 50cm, plummet from the cloud. Streets and roads are buried deep under the accumulated pumice, lapilli and ash, and the roofs of Pompeii buildings begin to collapse under the weight. The dense cloud now rises about 25km above Mt. Vesuvius, obliterating the sun. Darkness, broken only by flashes of lightning, adds to the terror of fleeing inhabitants.

25 August A.D. 79

1 – 2 a.m.  Scalding mudflows of volcanic debris mixed with steam spill from the volcano and down the slopes, choking the town of Herculaneum. Ash, lapilli and pumice continue to rain down on Pompeii; the debris now rising as high as the upper floors of buildings. It bursts through windows, doors and roofs, trapping and suffocating those hiding within.

“Soon great flames and vast fires shone from many points on Mt. Vesuvius; the gleam and light made more vivid by the night time shadows.“

4 a.m. The volcanic plume above Mt. Vesuvius, now 30 km high, grows too heavy and begins to collapse. The column cascades to earth, sending superheated ash and gases roaring in turbulent waves, called pyroclastic flows, down the volcano’s slopes. The first flow reaches Herculaneum, killing any inhabitants who still remained.
5 a.m. Strong earthquakes continue to shake the whole area. A second, even hotter surge further buries Herculaneum. At Pompeii, the rain of pumice eases, but darkness prevails as the massive ash cloud hides the rising sun. Some survivors try to flee their hiding places and escape the town. But it is hard to breathe in the ash-clogged air, or to walk – or even crawl – over the deep layer of volcanic fallout.

“We were followed by a panic-stricken mob of people wanting to act on someone else’s decision.”

6:30 a.m. The third pyroclastic surge, the strongest yet, reaches Pompeii from the north but is held back by the town’s wall.

6:30 – 7:30 a.m. A series of powerful surges overcome the walls and sweep over the town in massive waves of toxic gas and burning, smothering ash. Pompeii’s remaining inhabitants are killed instantly and the city is buried. Most who die at Pompeii perish in this phase of the eruption.

“…my mother implored…me to escape…I refused to save myself without her, and grasping her hand forced her to quicken her pace.”

8 a.m. The most destructive surge hits Pompeii, preceded by a storm of fire and lightning. The town’s tallest structures are burned, toppled and buried. The same surge reaches Stabiae and even as far as Naples. Luckily for Pliny the Younger, the surge loses momentum before it reaches Misenum, though the town is engulfed in a dense cloud of ash. Volcanic activity, electrical storms and mudslides continue for several days. By the time the eruption ends, Mt. Vesuvius’s summit has collapsed, leaving a crater 200 m lower. The entire region is annihilated — towns, vegetation, livestock, people. Only the tops of the highest walls remain unburied to show where Pompeii stood.

“Finally, the cloud lifted and vanished in a sort of smoke or fog…the sun even reappeared, but pale, as when there is an eclipse…the landscape looked changed and covered by a thick blanket of ash, as if it had snowed.”
Exhibit Walk-Through

Introduction Theater
A short movie opens the exhibit introducing visitors before continuing on to the first gallery. In this gallery visitors will be able to see the statue of Bacchus, the Roman God of wine and drink. Before leaving the gallery visitors will see a fresco of Bacchus and his love Ariadne.

City Life
Next, visitors are transported to the city of Pompeii, destroyed by Mt. Vesuvius but also preserved. This gallery focuses on the city’s everyday life such as commerce with the year round business of lush fruits, vegetables, grain, meat, fowl and seafood brought into the city from area farms or off fishing boats from the Bay of Naples. Pompeii’s residents typically ate three meals a day and bought their food from the many street vendors around the city selling breads, cheese, fruits, fish etc. Entertainment came in many forms; however a popular one was the Gladiators of the Roman world. Here you will be able to see a Gladiator helmet on display. Visitors will also be able to see and learn about burial practices in Pompeii. Around the corner the gallery continues with a video of life in the famous city before continuing into Luxury and Beauty. Women of Pompeii, like all Pompeian’s took great care in personal cleansing using perfumes, creams, powders and other cosmetics. They styled their hair and used jewelry as the final touch on their appearances.

Home Life
Homes in Pompeii served as both private family space and as a place of business. The size of a home reflected the power, social rank and wealth of the family that lived there. Furnishings were sparse in part to better appreciate the pictorial decorations of the rooms. Meals were eaten on reclining couches. These couches and the beds ranged from simple stonework to elaborately carved wood with headboards, footboards and decorated with ivory or silver. Pompeii’s frescoes are extremely valuable because they offer an insight into Roman art that was not available before. The frescoes found inside the homes in Pompeii provide examples of art with incredible beauty and bright color, shedding light on the techniques and styles favored by ancient Romans.

Garden
Step into a Pompeian garden. The gardens of Pompeii were the focal point of the household. Where there was not sufficient space for a complete peristilium (an open courtyard), the private side of the portico had walls decorated with pictures of natural scenes, often framed by false colonnades to give the illusion of enlarging the actual dimensions of the green space. Hunting scenes, wild animals fighting and exotic landscapes also appeared, expanding the limited domestic dimension into an apparently unconfined natural space. The gardens were completed by the widespread use of sculptures and decorative masks. In the garden gallery a statue of Venus is on display.

The Pyroclastic Experience
The Pyroclastic Experience allows visitors to experience the eruption of Mt. Vesuvius before moving on to the Cast gallery.

Casts Gallery
The Cast Gallery displays the most poignant finds among the ruins of Pompeii - those who did not flee during the first phase of eruption, when dry ash and lapilli rained down upon the city. These were the people who made a desperate run for it across the deep layers of accumulated ash. Instead of finding safety they were overwhelmed by the pyroclastic surges of scalding moist ash that swept the area during the night and early morning. The wet material encased their bodies where they fell and preserved in stark detail facial features, grim expressions and even the folds of their clothing. Eventually the bodies decomposed leaving an empty cavity in the now hardened ash.
Exhibit Student Worksheet

1. Select an artifact you find interesting within *A Day in Pompeii* and record the following:
   a. What does the artifact look like?

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

   b. Where was the artifact found?

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

   c. What do you think the artifact was used for?

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

   d. What can the artifact tell us today about the daily life of the average person in Pompeii around A.D. 79?

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
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2. Find examples of mosaics that were used to decorate wealthy homes. Select one of the scenes and describe the details of the design. Include the subject and colors used to create the mosaic.

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3. Record the events that occurred on August 24, A.D. 79 in Pompeii.

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4. Using artifacts and information within the exhibit, describe how the daily life of a Pompeian is similar to your life. How is it different?

__________________________________________________________________________
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__________________________________________________________________________

5. In the Interactive Hall, choose one of the volcanoes from around the room and record the following:
   a. Name of Volcano: _______________________________________________________
   b. Location of Volcano: ___________________________________________________
   c. Date of last eruption: ___________________________________________________
   d. Why is this volcano significant? __________________________________________
   e. Locate your volcano on the large floor map.

6. In the Interactive Hall, try your luck as an aqueduct engineer.
   a. What is the name of the pushing force when weight is applied to aqueduct (the top of the arch)? ____________________________
   b. What is the name of the side blocks that support the outward thrust of the load? ____________________________
   c. What is the name of the block that locks all of the other blocks in place by pushing outward and downward against them? ____________________________
   d. Did your aqueduct survive? Why or why not? ____________________________

7. Be a force of nature! In the Interactive Hall, see if you can create an “earthquake” by jumping on the seismograph pad. Good luck!
Classroom Connections: Language Arts/Social Studies

1. Have students use the information gathered at *A Day in Pompeii* to create a short story, journal or diary entry that reveals information about daily life in Pompeii before the eruption in A.D. 79. Students should include a description of some of the artifacts they saw on their visit to the exhibit and an explanation of their importance to archaeologists as they research daily life in ancient Roman life.

2. Students should research the following debate topics using a variety of resources and create a persuasive presentation. During each student’s presentation, they should establish a clear position on the topic. They should also include relevant evidence to support their position, address counter-arguments and possible solutions to the issue.

   **Topic #1:** Today, hundreds of thousands of tourists visit Pompeii’s rediscovered streets and enter the homes, shops, theaters and temples. It is the closest thing we have to traveling back in time 2000 years. But is it possible that tourists love Pompeii too much? The walls and floors of these structures have suffered eroding effects of sun, rain, wind and feet. The archaeological site is not protected in glass cases, like those protecting the artifacts in *A Day in Pompeii*. Some structures have suffered so much erosion that they have collapsed and are no longer viewable.

   Does the world have the right to see and learn from Pompeii today at the expense of the artifacts? What is the need for preservation and ensuring the site is accessible for future generations? Brainstorm solutions for this issue.

   **Topic #2:** Excavation of the site and research about the artifacts at Pompeii continue to this day. Large portions of the city are still unexcavated, perhaps filled with artifacts yet to be discovered. However, the same volcanic mater that buried Pompeii also made the soil fertile and now farmers’ fields cover much of the unexplored areas.

   What are the rights of the local citizens to keep their land and farms, at the expense of further excavations and discoveries? What is the importance of continuing the search and research of ancient Pompeii? Brainstorm solutions to this issue.

3. **Today Pompeii is a major tourist destination and continues to be an important archaeological site, providing new discoveries.** Ask students to use a variety of resources to collect data and research about what archaeologists are studying in the region today. What laws have been established to protect the area and how do they affect the excavations of Pompeii and the tourists’ experience?
4. Have students analyze information from a variety of primary and secondary sources about Roman life in Pompeii prior to the A.D. 79 eruption. Students will then use their research to complete one or more of the following projects.
   a. Students should reflect and record their research on Pompeii through first person monologues, poems, posters, charts, short stories, research papers, debates, slide or video presentations.
   b. Ask students to write a narrative about a visit to Pompeii in A.D. 79 before the eruption. The narrative should include a description of one type of building, one meeting with a Pompeian and one daily activity encountered on the trip. The narrative can be written from a first person, third person or omniscient point of view.
   c. Ask students to compare and contrast the daily life of people living in Pompeii with their personal daily activities.

5. The American author Samuel Clemens (aka Mark Twain) visited Pompeii and recorded his observations in his book, *Innocents Abroad*. Ask students to read this account of a visit to Pompeii and answer the following questions.
   a. What were the famous author’s impressions of Pompeii?
   b. What were your impressions and feelings about *A Day in Pompeii*?
   c. How are your observations different from those of Samuel Clemens? How were they similar?

6. Go back to Pompeii in A.D. 79 and have your class take on the roles of Pompeians. Have one student act as a reporter, interviewing the townspeople. Students will need to research their role and the reporter must determine what questions to ask. Each student should speak clearly and support their answers with well-researched facts, details, examples, quotations and/or stories. Students should be able to respond to questions regarding the day’s events, such as when the eruption began, the destruction they encountered, their plan of escape and how they feel about what is happening. After the activity, have your class compare and contrast the various individual solutions and viewpoints.

7. Have your students complete the following worksheets/activities.
Artifacts: Past and Present

Artifacts discovered by archaeologists help tell the story of past cultures. Using artifacts from *A Day in Pompeii* and present day, we will examine how objects can tell stories.

**PAST**

Select an artifact from *A Day in Pompeii* and complete the following:

a. Draw a picture of the artifact.

b. Describe the artifact’s shape, size, texture and other descriptive clues for someone who has not seen the object.

c. Draw conclusions about the functions of the object.

**PRESENT**

Select an object from your everyday life and complete the following:

a. Draw a picture of the object.

b. Describe the object’s shape, size, texture and other descriptive clues for someone who has not seen the object.

c. Pretend you are an archaeologist in the future who just discovered this object. Draw conclusions about the functions of the object.
Artifacts: Past and Present (Cont.)

1. How are the two objects you chose similar? How are they different?

2. How were you able to draw conclusions about the function of the object from Pompeii? What evidence supports your theory?

3. If you were an archaeologist in the future, do you think it would be easy to determine the function of your present day object? Why or why not?

4. What conclusions can you make about how daily life has changed since A.D. 79 using the artifacts you chose from the past and the present?
Classroom Connections: Science

1. Have your students create their own mini volcanoes. You will need the following for each model: small drink bottle (approx. 12 oz.), 60 mL of water, 1 tablespoon of baking soda, ¼ cup of vinegar, orange food coloring, a few drops of detergent, a small square of tissue, 6 cups of flour, 2 cups of salt, 4 tablespoons of cooking oil, 2 cups of water and a large mixing bowl.

   Making the volcano – Mix the flour, salt, cooking oil and 2 cups of water by hand in a large mixing bowl until smooth and firm. Use this dough to wrap around the drink bottle to create a volcano shape. You can go one step further and color the dough, add lava channels, vegetation, buildings, animals, etc. if you choose!

   Erupting the volcano – Place the 60 mL of water, the detergent, food coloring and vinegar in the drink bottle. Wrap the baking soda in the tissue and drop into the bottle. Watch your volcano erupt!

2. Have your students study the different types of volcanoes then create a mini model of each. You will need: scissors, a plastic sandwich bag, 1 small rubber band (the size that are used for dental braces), 3 film canisters with lids, water, safety goggles and 1 Alka-Seltzer tablet. Students should be given their supplies and told how to create each volcano. Before testing each volcano, students should create a hypothesis as to what will happen in each case. Students will then perform the experiments and record their findings. Don’t forget to have students wear safety goggles and remind them that a volcanologist never stands at the top of a volcano and looks down.

   **Shield volcano** – Fill one film canister half full with water. Cut a 3 inch by 3 inch square of plastic from the sandwich bag and have the small rubber band handy. Drop ¼ of an Alka-Seltzer tablet into the film canister with water and quickly place the plastic over the top of the film canister and secure it with the rubber band. The plastic cover should hold in the pressure causing it to bubble up. Students may gently feel the plastic to feel the built up pressure. You may need to move the rubber band down in order to keep the plastic from popping off.

   **Cinder cone** – Fill one film canister half full with water. Using the scissors, carefully poke a small hole in the film canister lid. Drop ¼ of an Alka-Seltzer tablet into the film canister with water and quickly place the lid (with a small hole) firmly on top. After a few seconds, the film canister should begin to bubble and spray water out the hole in the lid.

   **Composite/Stratovolcano** – Fill one film canister half full with water. Drop the remaining ½ of an Alka-Seltzer tablet into the film canister with water and quickly place the lid (without a hole) firmly on top. After a few seconds, the lid should pop off.

3. Have your students complete the following worksheets/activities.
Anatomy of a Volcano

After seeing *A Day in Pompeii*, you are now an expert volcanologist! With the help of the *Volcano Vocab* sheet, find and label the following parts of a volcano:

- Ash/gas cloud
- Base of volcano
- Bedrock
- Branch pipe
- Conduit/main pipe
- Crater
- Flank
- Lava flow
- Layers of emitted ash
- Lava flow
- Layers of emitted lava
- Lava flow
- Magma chamber
- Parasitic cone
- Bedrock
- Sill
- Throat
- Vent
- Vent
- Vent

[Diagram of a volcano with numbered parts labeled 1 to 15]
Volcano Vocab

**Ash/gas cloud** – particles smaller than 22 mm in diameter ejected into the atmosphere by a volcano

**Base of volcano** – the lowest part, bottom or supporting layer of a volcano

**Bedrock** – the solid rock that underlies the surface of loose material such as soil, sand, clay or gravel

**Branch pipe** – a break in a wall of a volcano allowing magma to flow from the conduit or main pipe toward the flanks

**Conduit/main pipe** – a break in the earth’s crust allowing magma to flow from the magma chamber toward the vent

**Crater** – a basin or circular depression in the ground, caused by volcanic activity, and may have a vent from which magma erupts as gases, lava, ash etc.

**Flank** – the side of a volcano

**Layers of emitted ash** – as ash is ejected from a volcano, it falls to the earth (often on the flanks of a volcano) creating lighter colored layers that may be covered over by layers of lava or debris often occurring several times causing bands of light and dark material

**Layers of emitted lava** – as lava is ejected from a volcano, it falls to the earth (often on the flanks of a volcano) or flows from the vent creating darker layers that may be covered by layers of ash, often occurring several times causing bands of light and dark material

**Magma chamber** – a large underground pool of molten rock found beneath the surface of the Earth

**Parasitic cone** – a cone-shaped accumulation of volcanic material, not part of the central vent, formed by eruptions from fractions on the flanks of a volcano

**Sill** – a sheet of magma which is parallel to the surrounding rock and stores magma compared to dikes which transport magma

**Throat** – where the width of the hole of the conduit pipe increases, giving the magma more space to flow out of the vent

**Vent** – the opening exposed on the earth’s surface where volcanic material is emitted
Catastrophic Volcanoes Closer to Home:  
A Scientific Look at Mt. St. Helens

Mt. Vesuvius was a long time ago and far away from where we live today. What would happen if we had a large volcano erupt in the U.S. today? Did you know that you parents probably remember a large volcanic explosion closer to home? We can take a look at Mt. St. Helens and see! Students will observe how the bulge developed on the north flank of Mt. St. Helens and how it created the largest volcanic avalanche recorded in historical times.

Background information:
The eruption of Mt. St. Helens in 1980 was not a surprise. For nearly two months, scientists had been monitoring changes at Mt. St. Helens in Washington. For a volcano to erupt, magma must move to the Earth’s surface. Increased earthquake activity, eruptions of steam and ash, and changes in the shape of the surface of the volcano all signal that magma is on the move toward the surface.

Inside the volcano, the solid rock that surrounds the molten rock often cracks from the increased pressure and causes earthquakes. Between March 20 and May 18, more than 10,000 earthquakes were recorded beneath Mt. St. Helens. The largest of these were felt by people living near the volcano. In addition to recording the discrete jolts characteristic of earthquakes, seismographs also detected continuous rhythmic vibrations called harmonic tremors. These numerous small earthquakes were further evidence that magma was moving within the volcano.

As magma made room for itself inside the volcano’s cone, the surface of the volcano swelled, or inflated. By early April, Mt. St. Helens’ north flank began to visibly bulge and crack. The bulge grew two to three meters (7 to 9 ft) a day and it moved outwards about 150 meters (450 feet) in two months.

When the 5.1 magnitude earthquake shook Mt. St. Helens on May 18, 1980, the bulge collapsed. The resulting avalanche was the largest volcanic avalanche in historical times. In turn, the sudden removal of masses of rock and ice by the avalanches triggered an explosive eruption of steam trapped in cracks and voids in the volcano and of gases dissolved in the magma. Unleashed by the abrupt release of pressure, magma, rock, ash and gases exploded from within the volcano’s north flank.

In just a few minutes, Mt. St. Helens’ symmetrical cone was transformed drastically. It was 400 meters (1,312 ft.) shorter and a gaping crater was gouged into its north side. The avalanche of rock, ice, water and fallen trees flowed as far as 9 kilometers (15 miles) down the valley of the North Fork Toutle River. Debris dumped into Spirit Lake raised the lakebed by more than 940 meters (295 ft.). The lake’s cool, crystal clear waters became a black stew of rocks, mud and floating trees. 70 percent of the glaciers that had once crowned the volcano were now gone as they quickly melted by the heat of the eruption and were carried away by the avalanche. The surrounding forests with trees up to 45 meters (150 ft.) tall were flattened and strewn like match sticks in the wake of the lateral blast and debris-laden avalanche.
Catastrophic Volcanoes Closer to Home:
A Scientific Look at Mt. St. Helens (Cont.)

Materials:
- 1500 mL glass beaker
- Bunsen burner or hot plate
- Damp sand
- Straight pin
- Several small balloons
- 1 bottle of soda water
- Rubber bands
- Large bowl to catch the “eruption”

Procedure:
1. Have students spend time researching Mt. St. Helens. Some possible questions for students to research are below.
   a. What events lead up to the eruption on May 18, 1980?
   b. What were the signs of an upcoming eruption and how were scientists studying Mt. St. Helens.
   c. How did the eruption occur?
   d. How much damage was caused during the eruption?
   e. What classification of volcanoes is Mt. St. Helens?
   f. What are some of the accounts provided by witnesses to the eruption?
   g. Is Mt. St. Helens still active?
   h. How is the area that was affected by the eruption recovering today?
2. Before students arrive, prep the beaker by placing ½ inch of the damp sand in the bottom of the beaker and leveling the surface of the sand. Partially inflate a balloon and close it off with a rubber band. Place the balloon on top of the sand in the beaker. Cover the balloon with sand to a depth of about 1 ½ inches. Level the surface of the sand.
3. Partially inflate a second balloon. Ask the students what would happen to the balloon if you were to heat the air inside of it. The balloon will expand because air expands when heated.
4. Tell the students that the inflated balloon represents the magma rising within Mt. St. Helens and that the sand represents the surface of Mt. St. Helens.
5. Show the beaker to the students and explain to them that you have partially inflated a balloon and placed it in the beaker and covered it with sand. Place the beaker on the Bunsen burner or hot plate. Heat the beaker until the balloon begins to expand. The surface of the sand should begin to bulge as the balloon is heated and expands.
6. Have the students observe the changes in the shape of the surface of the sand. What happens to the “land” as the “magma chamber” expands? How does this represent Mt. St. Helens and the eruption in 1980?
7. Ask students what would happen if you were to stick a pin into the balloon. It would pop or explode.
8. Why does the balloon react this way? The balloon bursts because the pressure inside the balloon is suddenly released and the gases can escape rapidly.
9. Ask students what happen when they open a bottle of soda. It fizzes because the gas in the soda escapes as the pressure is released.
10. Have students demonstrate this reaction by shaking a bottle of soda water vigorously and then releasing the cap. What happens? The soda water “erupts” out of the bottle.
11. Have students compare the soda bottle to the magma chamber. As long as the top is on the bottle, there is no eruption.
12. Have students compare the rock and ice that was unloaded by the avalanche at Mt. St. Helens to the soda cap. When the cap was suddenly removed, the pressure inside the volcano was suddenly released and the volcano erupted.
1. In Pompeii, mosaics were made by spreading mortar over the floor. Next, tiny squares of colorful stones or glass were pressed into the mortar to create a picture or design. The gaps between the tiles were then filled in with more mortar. Designs included scenes from mythology or literature, landscapes, hunting scenes and geometric patterns.

Have your class work together to design and create a classroom mosaic. This can be done in the traditional fashion with tiles and mortar or you can use scrap paper, magazines, foam board or even pieces of recyclables or trash to create your mosaic. Students should work as a class to choose a design such as an animal, landscape, portrait, geometric design, school mascot, etc. that will then be turned into the classroom mosaic.

2. Ask students to listen to music which was created to portray portions of ancient Roman life such as Synaulia, Ensemble DeOrgano graphia, Music from Ancient Rome Volumes I or II, etc.

Have students listen closely and record sounds they hear that might represent life in an ancient Roman town such as Pompeii.

3. As archaeologists began digging in Pompeii, they found voids in the ash layer that contained human remains. They soon realized these were spaces left by the decomposed bodies of those Pompeians that never escaped. The archaeologists devised the technique of injecting plaster into the voids which perfectly recreated the forms of the bodies with great detail such as their last facial expressions.

Have the students try making plaster casts of different objects, such as coins, shells, etc. to help them understand what plaster casting is and understand how and why archaeologists use this method in Pompeii.
Further Readings

Grades 1-8:
P. Dennis and N. Harris. *Volcano*. Hauppauge, New York: Barron’s, 2001

Middle and High School:

General Pompeii and Roman Information:

Online Resources:
http://pubs.usgs.gov/gip/volc/
www.volcanoes.com
www.dsc.discovery.com/tv/pompeii/
www.learner.org/exhibits/volcanoes/
www.pbs.org/empires/romans
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| Cincinnati Museum Center |
# Social Studies Standards

## Ohio Academic Standards

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### A Day in Pompeii Exhibit

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## Additional Notes

- **History**
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- **Citizen Rights & Responsibilities**
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**Note:**
- x indicates that the standard is covered.
- The table reflects the progression of standards from K-2 to 11-12 years.
## Visual Arts Standards

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<tr>
<td>Choosing and Evaluating a Range of Subject Matter, Symbols and Ideas</td>
<td>x</td>
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<tr>
<td>Understanding the Visual Arts in Relation to History and Cultures</td>
<td>x</td>
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<tr>
<td>Reflecting Upon and Assessing the Characteristics and Merits of their work and the work of others</td>
<td>x</td>
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<tr>
<td>Making Connections between Visual Arts and other Disciplines</td>
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