



## What Is This Module About?

Have you ever gone to the countryside and seen a volcano? A **volcano** is a hill or mountain made up wholly or in part of molten or hot rocks and steam. Have you ever seen a volcano erupt? Would you like to learn more about volcanoes particularly those found in our country?

This module is made up of two lessons:

Lesson 1 – *Famous Philippine Volcanoes*

Lesson 2 – *Effects of Volcanic Eruptions*



## What Will You Learn From This Module?

After studying this module, you should be able to:

- ◆ identify and describe some volcanoes in the Philippines in terms of their locations and whether they are active or dormant;
- ◆ explain how a volcanic eruption occurs;
- ◆ name some beneficial/harmful effects of volcanic eruptions;
- ◆ enumerate precautionary measures that can be taken in preparation for a volcanic eruption; and
- ◆ give the necessary steps to undertake after volcanic eruptions.



## Let's See What You Already Know

Before studying this modules, take this simple test first to find out how much you already know about the topics in this module.

- A. Match the descriptions in Column A with the names of volcanoes in Column B. Write the letters of the correct answers only.

### Column A

- \_\_\_\_\_ 1. The volcano that is shaped like a near-perfect cone
- \_\_\_\_\_ 2. The smallest volcano in the world
- \_\_\_\_\_ 3. An active volcano found in Negros Island
- \_\_\_\_\_ 4. Dubbed as the “sleeping giant” that erupted after 400 years
- \_\_\_\_\_ 5. The only active volcano found in Mindanao

### Column B

- a. Mt. Hibok-Hibok
- b. Mayon Volcano
- c. Mt. Pinatubo
- d. Mt. Kanlaon
- e. Taal Volcano

- B. Enumerate the following.

- 1. Two beneficial effects of volcanic eruptions
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
- 2. Two harmful effects of volcanic eruptions
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
- 3. Two precautionary measures that can be taken in preparation for a volcanic eruption
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_

Well, how was it? Do you think you fared well? Compare your answers with those in the *Answer Key* on pages 31 and 32 to find out.

If all your answers are correct, very good! This shows that you already know much about the topics in this module. You may still study the module to review what you already know. Who knows, you might learn a few more new things as well.

If you got a low score, don't feel bad. This means that this module is for you. It will help you understand some important concepts that you can apply in your daily life. If you study this module carefully, you will learn the answers to all the items in the test and a lot more! Are you ready?

You may go now to the next page to begin Lesson 1.

## Famous Philippine Volcanoes

Do you know that our country has many active volcanoes as well as inactive ones? Do you know where they are located? You will learn more about volcanoes in this lesson.

At the end of this lesson, you should be able to:

- ◆ pinpoint the location of some active volcanoes in the Philippines; and
- ◆ tell something about the following:
  1. Mayon Volcano;
  2. Taal Volcano;
  3. Mt. Hibok-Hibok;
  4. Mt. Kanlaon; and
  5. Mt. Pinatubo.

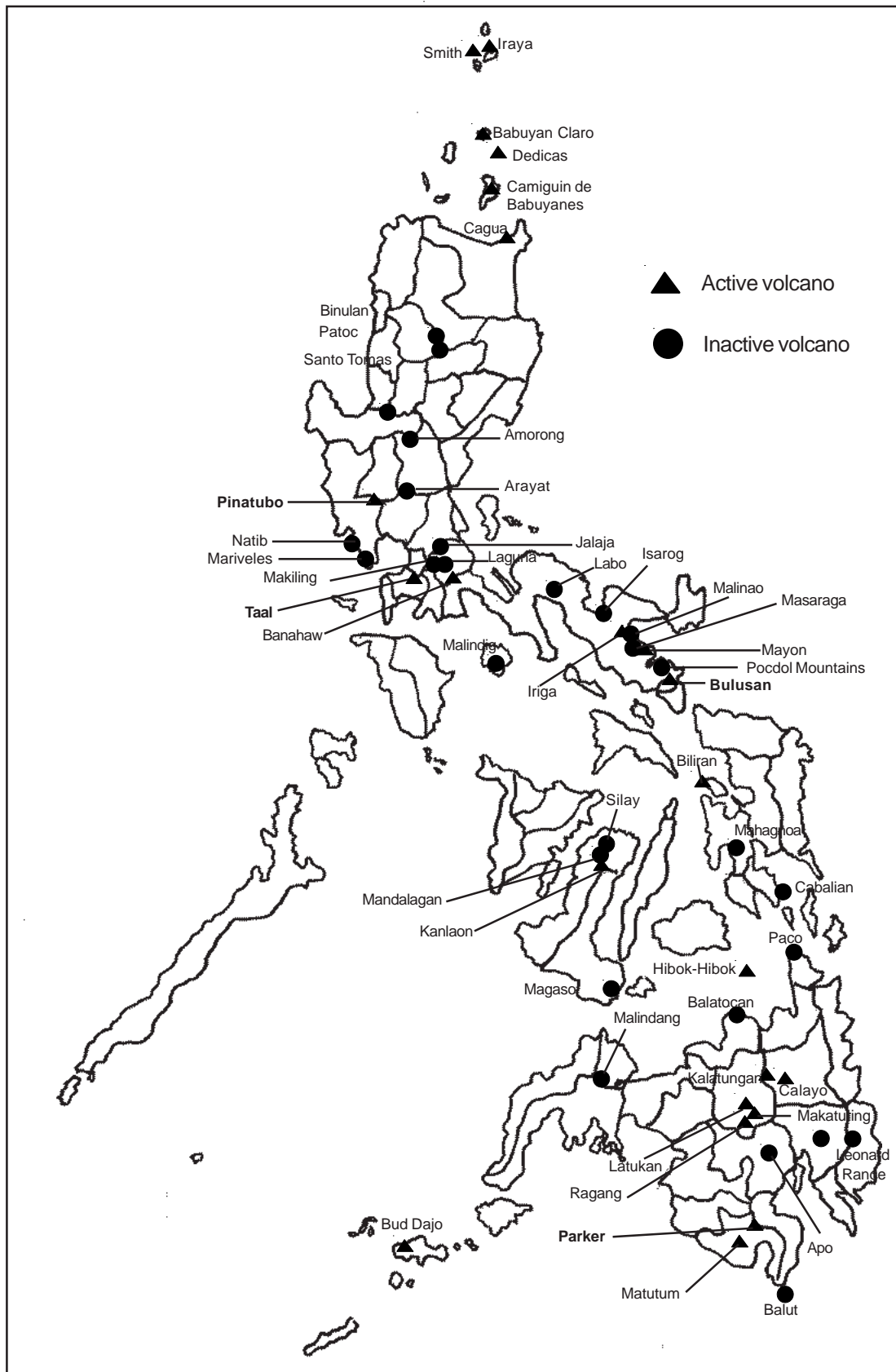


### Let's Try This

1. Study the map on the next page.
2. Locate the active volcanoes on it.
3. Write your answers in the table below.

Name of Active Volcano	Location
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

## Philippine Volcanoes



Source: [http://www.reliefweb.int/mapc/asi\\_se/cnt/phil/phl\\_volc.html](http://www.reliefweb.int/mapc/asi_se/cnt/phil/phl_volc.html).

Compare your answers with those in the *Answer Key* on page 32. How well did you do?



## Let's Learn

What is a volcano?

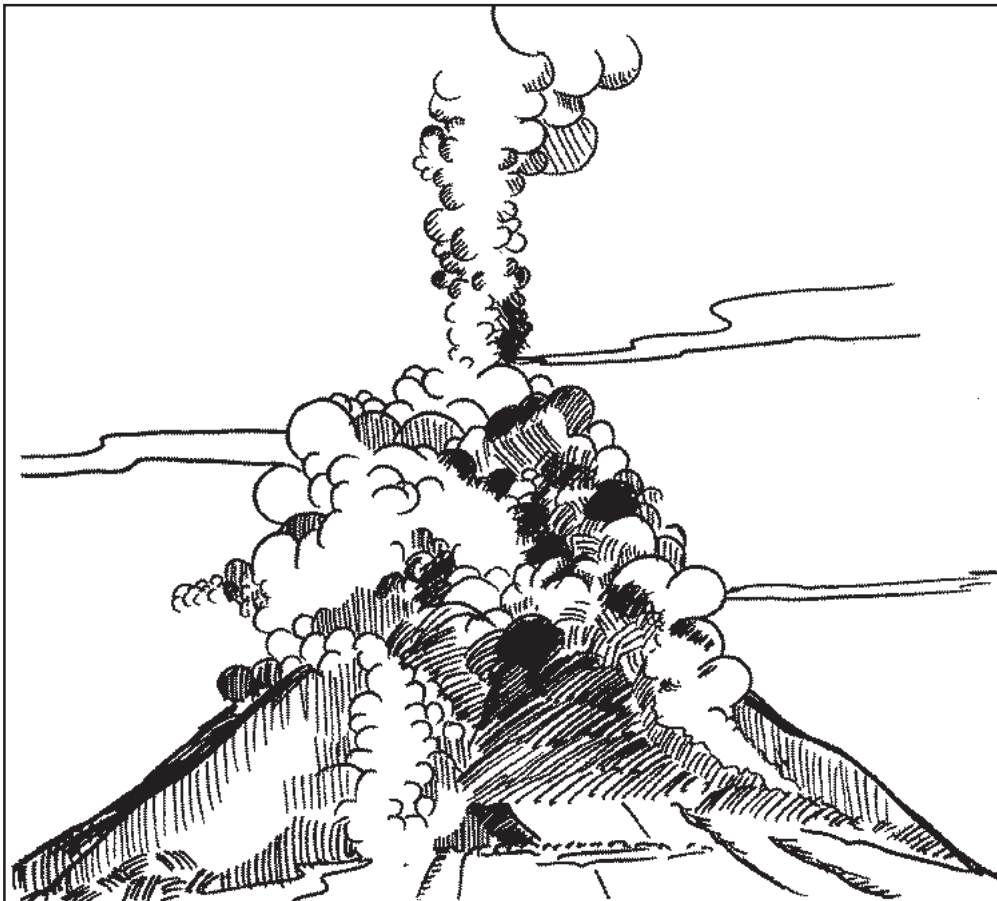
A **volcano** is an opening on the earth's surface, typically a conical hill or mountain, composed wholly or in part of ejected materials usually ashes and lava.

The opening is called the **crater** and the path through which the ejected materials pass is the **pipe**.

When molten rocks come out of the ground they are collectively called **lava**. This hardens and forms a cone or dome with a tunnel and a vent in the middle. The more lava that comes out, the taller and wider the volcano gets after the eruption.

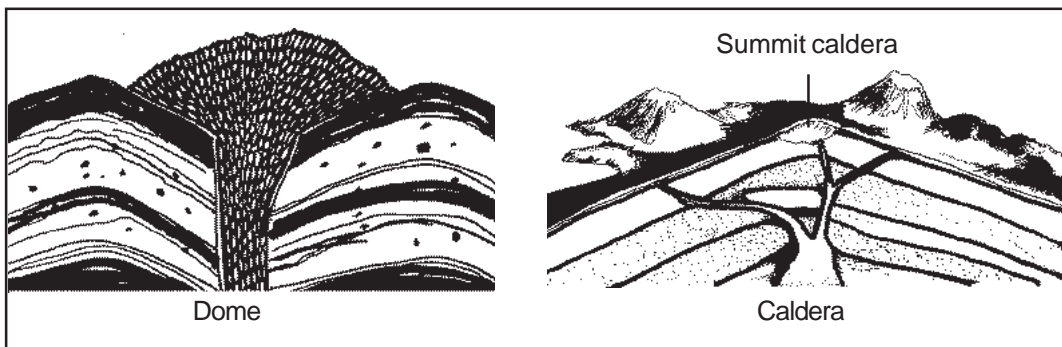
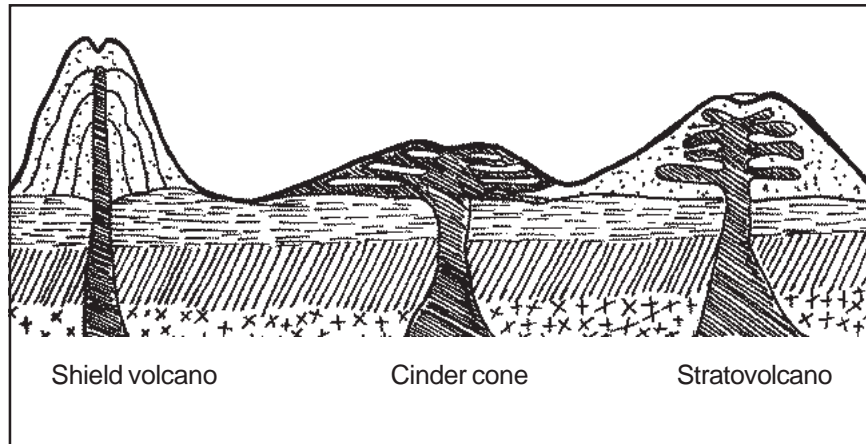
A volcano may sit quietly for hundreds or even thousands of years but this does not mean it is inactive. You know that a volcano will erupt when the ground around it begins to shake. You will hear rumbling noises from deep inside the earth and see clouds of dark smoke rise from the top of the volcano.

Volcanoes erupt in different ways. Some volcanoes shoot a stream of glowing lava high into the air like a giant fiery fountain. Another kind spits out solid chunks of red-hot rocks. Some volcanoes pour rivers of lava through cracks in their sides. Some send clouds of glowing, super-hot steam and gases rushing down the mountainside. And still some blow themselves to pieces when they erupt.



## Types of Volcanoes

There are five types of volcanoes: shield volcanoes, cinder cones, stratovolcanoes, domes and calderas. Each has a characteristic eruptive style and therefore a characteristic form.



### *Shield Volcanoes*

**Shield volcanoes** are built almost entirely of fluid lava flowing and pouring 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. Lava also commonly erupt from vents along fractures (**rift zones**) that develop on the flanks of the cone.

### *Cinder Cones*

**Cinder cones** are the simplest volcanoes. They are built from particles and blobs of congealed lava ejected from a single vent. As the gas-charged lava blows violently into the air, it breaks into small fragments that 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.

## *Stratovolcanoes*

Some of the earth's grandest mountains are **stratovolcanoes**—also called composite volcanoes. They are typically steep-sided, symmetrical cones with large dimensions built of alternating layers of lava flows, volcanic ashes, cinders, blocks and bombs and may rise to as much as 8000 ft. above their bases.

Most stratovolcanoes have a crater at the summit which contains a central vent or a clustered group of vents. Lava either flows through breaks in the crater wall or from fissures on the flanks of the cone. Lava, solidified with the fissures, form dikes that act as ribs which greatly strengthen the cone.

The essential feature of a stratovolcano 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 materials erupted through the conduit and increases in size as lava, cinders, ashes, etc. are added to its slopes.

When a stratovolcano 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 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.

## *Domes*

Volcanic or lava **domes** are formed by relatively small, bulbous masses of lava too viscous to flow any great distance; consequently, on extrusion, the lava piles over and around its vent. A dome grows largely by expansion from within. As it grows, its outer surface cools and hardens then shatters spilling loose fragments down its sides. Some domes form craggy knobs or spines over the volcanic vent, whereas others form short, steep-sided lava flows known as **coulees**. Volcanic domes commonly occur within the craters or on flanks of large stratovolcanoes.

## *Calderas*

**Calderas** are depressions formed by collapsed volcanoes. They are usually large, steep-walled, basin-shaped depressions formed by the collapsed volcano on a large area over and around a volcanic vent or vents. Calderas range in form and size from roughly circular depressions 1 to 15 mi. in diameter to huge elongated depressions as much as 60 mi. long.



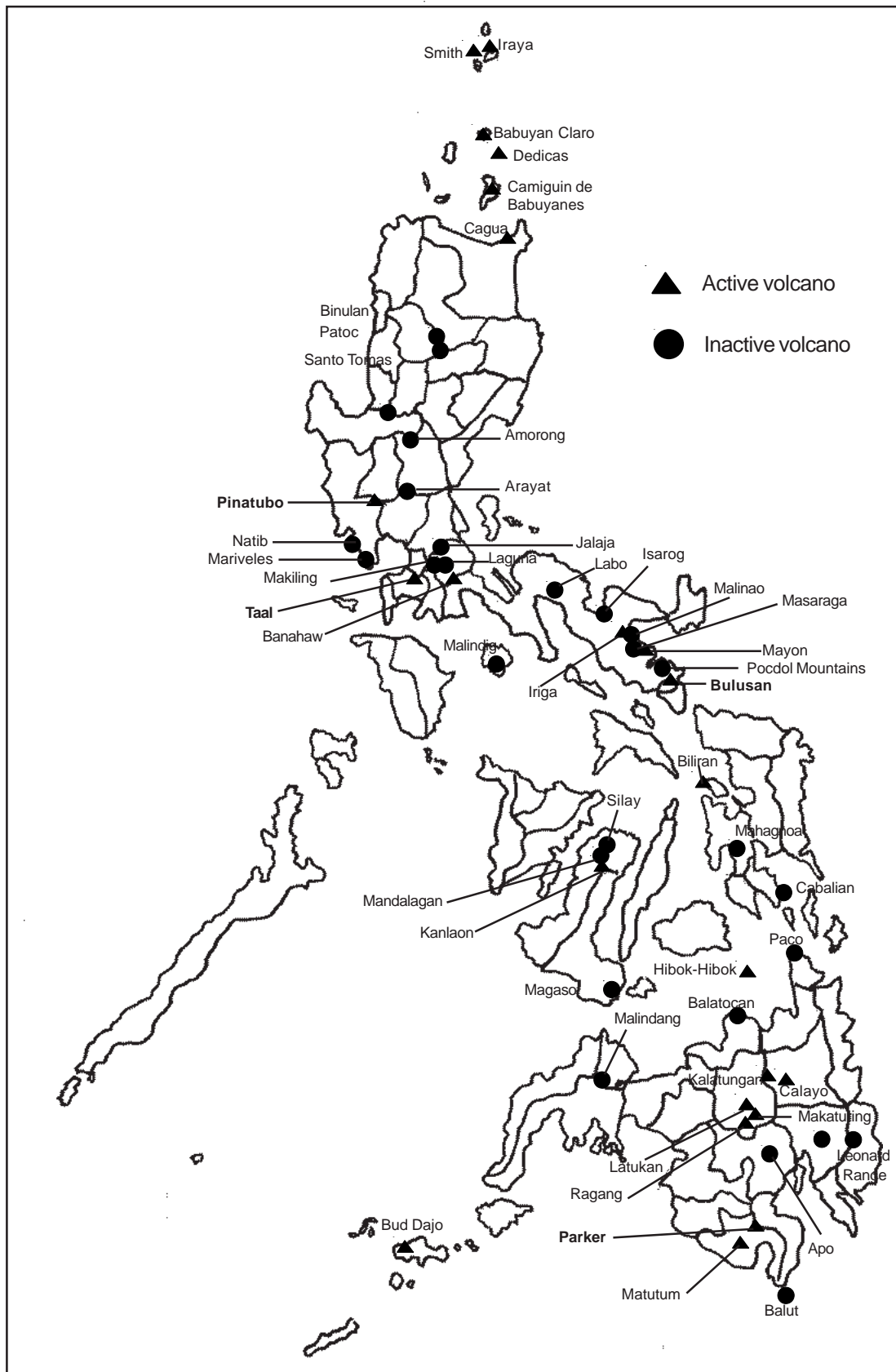
## Active and Inactive Volcanoes

Volcanoes can be classified as either active or inactive based on their recorded history. An **active volcano** is defined as one which has erupted within historic times such that accounts of its eruption have been documented by man. A volcano is said to be **inactive** if it has not erupted within historic times and its form is beginning to change because of weathering and erosion. Active volcanoes are more likely to erupt compared to inactive ones. This does not mean though that inactive volcanoes will never erupt even after their long rest. The table below lists the active volcanoes in the Philippines and their respective locations.

Volcano	Location
Mayon	Legaspi City, Albay
Taal	Talisay, Batangas
Kanlaon	Negros Oriental
Bulusan	Sorsogon
Ragang	Cotabato
Smith	Babuyan Island Group
Hibok-Hibok	Mambajao, Camiguin Island
Didicas	Babuyan Island Group
Babuyan Claro	Babuyan Island Group
Camiguin de Babuyanes	Babuyan Island Group
Cagua	Cagayan
Banahaw	Lucena City
Calayo	Valencia, Bukidnon
Iraya	Batanes
Pinatubo	Zambales
Iriga	Iriga, Camarines Sur
Biliran	Biliran
Bud Dajo	Jolo Island
Matutum	Cotabato
Kalatungan	Bukidnon
Makaturing	Lanao, Mindanao
Parker	South Cotabato

Look at the following map. Is there an active or inactive volcano near your hometown?

### Philippine Volcanoes



Source: [http://www.reliefweb.int/mapc/asi\\_se/cnt/phil/phl\\_volc.html](http://www.reliefweb.int/mapc/asi_se/cnt/phil/phl_volc.html).

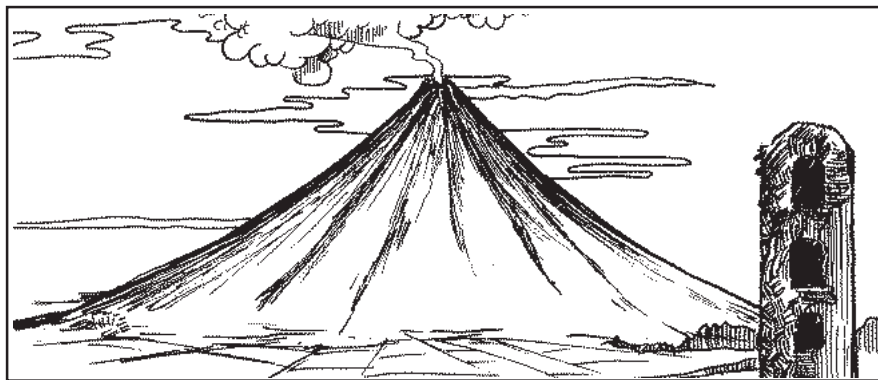
The Philippine archipelago has approximately more than 200 volcanoes. Of these, 22 are considered active and several of these have erupted in recent times. Mayon and Taal are the most active followed by Hibok-Hibok, Kanlaon and Pinatubo.

### Mayon Volcano

Mayon Volcano is located in the eastern part of Albay province, 300 km southeast of Manila. It is one of the most famous tourist attractions of the country and well-known for its near-perfect cone shape.

The volcano reaches up to 2462 m above sea level. It covers an area of 314.1 sq. km as estimated from a 62.8-km base circumference, which encompasses the towns of Camalig, Malilipot and Sto. Domingo.

Mayon Volcano is classified as a stratovolcano or a composite volcano. It is composed of deposits formed by different types of volcanic activity such as airfall deposition, pyroclastic flows, rain-triggered debris flows and lava flows. These deposits, varying in size from ashes to small boulders, formed from the eruption of fragmented rocks which are eroded downslope with the help of gravity and prevailing winds.



Since 1616, Mayon Volcano has had 46 recorded eruptions. The most violent and destructive eruption so far happened on February 1, 1814, where at least 1200 people died due to lahar. The nearby towns of Camalig, Cagsawa and Budiao were severely damaged while half of Guinobatan was ruined. The latest eruption occurred from February 24 to March 7, 2000. Mayon Volcano is thus considered the most active volcano in the Philippines.

The eruptions of Mayon Volcano are commonly of the **vulcanian** type, which is characterized by a sudden release of accumulated gases, bringing with it fine ashes or blocks from the magma. This type of eruption occurs with great force and forms huge cauliflower clouds in the air. The smooth shape of the volcano indicates that its eruptions have never been violent enough and have always occurred at the crater.

Despite the destructive nature of Mayon Volcano and all volcanoes in general, it can't be denied that Mayon Volcano has made Albay a rich agricultural region. The volcano's fertile slopes and bordering plains, coupled with abundant rainfall, have benefited the surrounding towns of Camalig, Guinobatan, Daraga, Legaspi, Sto. Domingo, Ligao and Malilipot, providing suitable environments for growing abaca and coconuts, two of Bicol's major crops, as well as rice and vegetables.

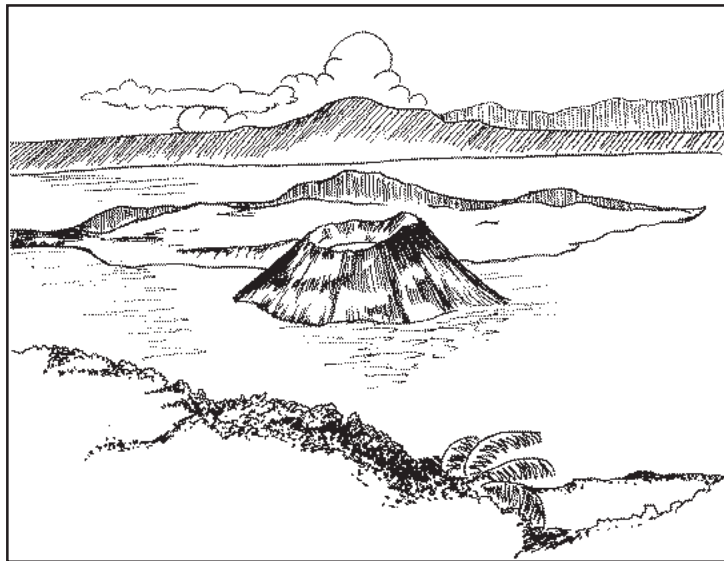
## Taal Volcano

Taal Volcano is situated near the center of Taal Lake in Batangas, about 60 km southeast of Manila. Its highest point on the eastern rim of the main crater is only 311 m above sea level making it one of the world's lowest volcanoes. It is a complex volcanic system composed of the small volcanic island and about 35 underwater volcanic landforms.

The volcanic island covers an area of 23 sq. km and is surrounded by a 127 sq. km lake which is believed to have originated from prehistoric volcanic activities. The central portion of the island is occupied by the main crater in which 12 of Taal Volcano's eruptions occurred (1749 to 1911). Other such eruption sites are Binintiang Malaki, Binintiang Munti, Pira-Piraso, Caluit and Mt. Tabaro.

Taal Volcano is composed primarily of **tuff** or porous rock and of consolidated ashes with occasional coarse fragments. It is made up of at least 35 cones and 47 craters or depressions formed either by eruptions or by collapsing due to intense pressure. The cones have been formed from **base surges** or rapid-moving mixtures of volcanic debris and steam, from airfalls or from the spreading of lava. Twenty-six of these cones are tuff cones, five are cinder cones and four are **maars**, circular depressions produced from volcanic activities.

Taal Volcano's biggest eruption occurred in 1572. However, the most devastating eruptions happened in 1754 and 1911. The 1754 eruption leveled the towns of Sala, Lipa, Tanauan and Taal which were subsequently relocated where they are now. The 1911 eruption completely destroyed the island and claimed 1034 lives. Ashes from the volcano reached as far as Manila and covered an area of 2000 sq. km.



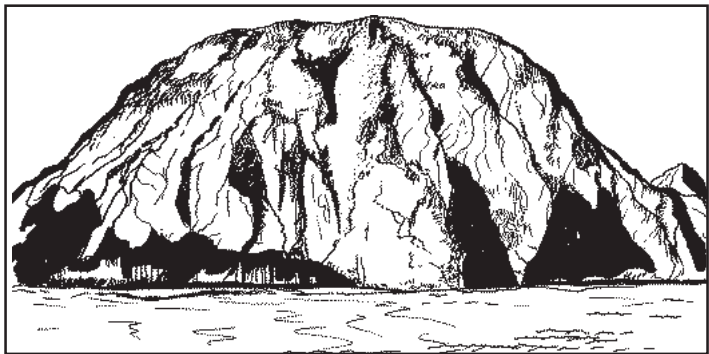
Despite the hazards of living within the vicinity, Taal Volcano has been attracting migrants because of its fertile soil and fishing grounds rich with several varieties of milkfish, carps, *maliputo* and *tawilis* with which Taal Lake is famous for.

## Mt. Hibok-Hibok

Mt. Hibok-Hibok is located at the northeastern part of Camiguin Island, about 10 km off the north coast of Mindanao. There are five other prominent volcanoes in the island but Hibok-Hibok is presently the only volcano that is manifesting activity.

Mt. Hibok-Hibok's latest activity started in August 1948 and lasted until September 1953. The peak of the eruption occurred in December 1951 when an avalanche with hurricane speed and a very high temperature rolled down toward Mambajao causing damage along the way. Trees were burned up and uprooted, houses were leveled, animals and men were charred or mummified. The eruption damaged hundreds of thousands worth of properties and claimed about 500 lives.

The eruption of Mt. Hibok-Hibok is of the **pelean** type which is considered as one of the most dangerous types and is characterized by viscous magma that gives off ashes and pyroclastic materials and the presence of **nuee ardente** or glowing clouds of gases.

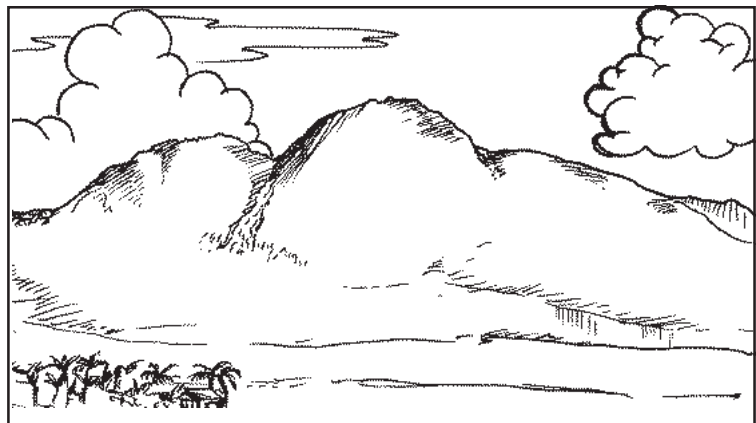


Despite the destruction caused by the 1950 eruption, Camiguin Island flourished. Its soil became fertile enough to be conducive for the production of agricultural products such as coconut and copra which the island is known for.

## Mt. Kanlaon

Mt. Kanlaon is a large stratovolcano situated in the north-central portion of Negros Island. It is part of the natural boundary that separates Negros Occidental and Negros Oriental. The volcanic arc along the Negros Trench also includes Mt. Silay in the north and Mt. Mandalagon and Mt. Cuernos de Negros in the south.

Mt. Kanlaon reaches up to 2435 m high and covers a base area of 707 sq. km. It consists of a multitude of craters and parasitic cones aligned linearly with a caldera in the center. The volcanic edifice is made up of airfall deposits, lava agglutinates, lava flows, pyroclastic flows and lahar.



The earliest recorded eruption of Mt. Kanlaon was in 1866. From that time, it already had at least 15 eruption periods including the one occurring in 1988, the latest. The recorded eruptions have so far been mild consisting only of ashes and steam with occasional lava flows and pyroclastics. However, presence of older deposits suggests more violent eruptions in the past.

Although a large portion of the volcano is considered a forest reserve, sugarcane haciendas and various other agricultural sites producing vegetables and rice have found homes on Mt. Kanlaon's slopes. La Castellana, La Carlota City and Kanlaon City have barangays within the danger buffer zone placing the settlers in perennial danger.

### **Mt. Pinatubo**

Mt. Pinatubo is located in the central portion of the Zambales Range, a mountain belt bordering the western side of Luzon and extends 220 km north from Lingayen Gulf in the north to Bataan in the south. The other major volcanic centers forming this belt are Mt. Natib and Mt. Mariveles. All three have vents at their craters characterizing them as stratovolcanoes. Smaller volcanic cones include Mt. Malasimbo, Mt. Balakibok and Mt. Negron.

Mt. Pinatubo reaches up to 1745 m high. Mt. Natib and Mt. Mariveles are 1278 m and 1388 m, respectively, making Mt. Pinatubo the highest among the three major volcanic centers.

Volcanic deposits found in Mt. Pinatubo include granite-like rock materials, rocks containing crystals and other rock fragments.

On April 2, 1991, after about 450 years of inactivity, Mt. Pinatubo started showing signs of restiveness. Five vents at its northwestern slope started emitting white steam plumes at varying intensities. In June 1991, the volcanic activity resulted in one of the world's most violent and destructive eruptions ever recorded. Can you recall this event? Write down two to three sentences relating your experiences.



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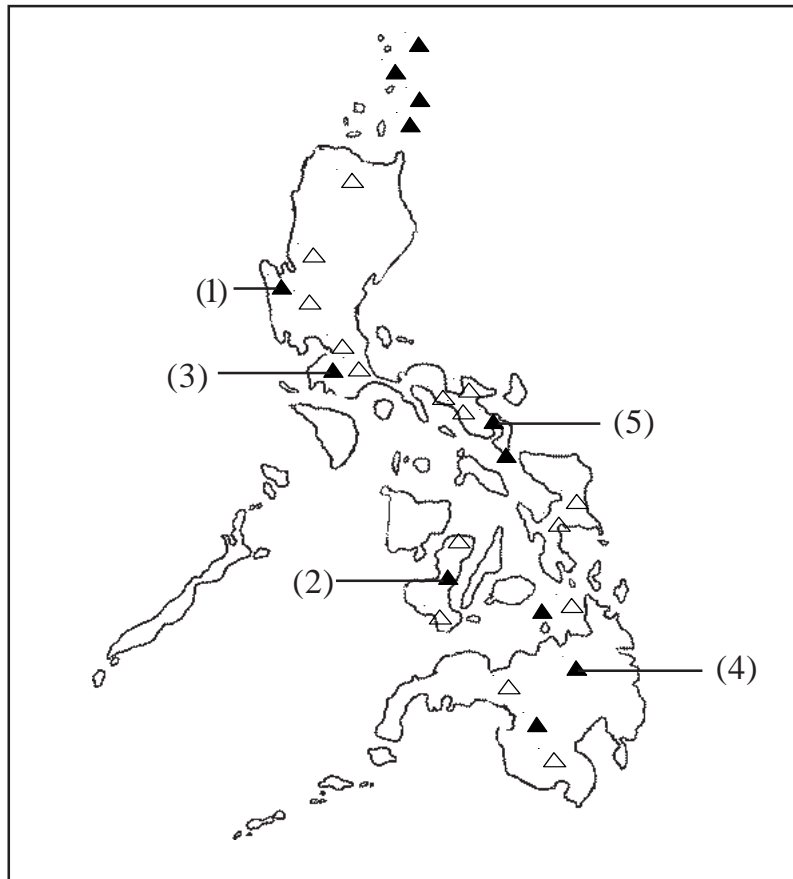


## Let's See What You Have Learned

A. Identify what is being referred to. Write your answer in the blank.

- \_\_\_\_\_ 1. The volcano that is well-known for its beauty and near-perfect cone shape.
- \_\_\_\_\_ 2. Its most violent eruption happened in 1951 in an island near Mindanao.
- \_\_\_\_\_ 3. It's the world's smallest and lowest volcano.
- \_\_\_\_\_ 4. It is a large stratovolcano found in Negros Island.
- \_\_\_\_\_ 5. Its eruption in 1991 was considered one of the world's most violent and destructive ones ever.

B. Using the map below, identify the volcanoes marked by numbers 1 to 5.



Compare your answers with those in the *Answer Key* on page 33. How well did you do?



## Let's Remember

- ◆ Mayon Volcano found in Albay, Bicol is well-known for its beauty and near-perfect cone shape.
- ◆ Taal Volcano found in Talisay, Batangas is one of the world's lowest and smallest volcanoes.
- ◆ Mt. Hibok-Hibok in Camiguin Island, Mindanao had its most violent eruption in December 1951.
- ◆ Mt. Kanlaon in Negros Island is an example of a stratovolcano.
- ◆ Mt. Pinatubo, which belongs to a chain of volcanoes found in the western portion of Luzon, last erupted in June 1991. This eruption was considered one of the world's most violent and destructive ones ever.



## Effects of Volcanic Eruptions

In Lesson 1, you learned all about volcanoes. You learned what a volcano is, what its types are, what active and inactive volcanoes are and some of the most famous Philippine volcanoes and their locations.

This lesson will now tell you about the effects of volcanic eruptions.

After studying this lesson, you should be able to:

- ◆ name the beneficial and harmful effects of volcanic eruptions;
- ◆ list some precautionary measures one can undertake in preparation for a volcanic eruption; and
- ◆ enumerate necessary steps to take after a volcanic eruption.




## Let's Try This

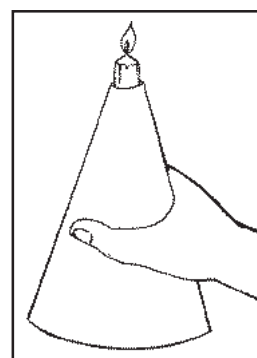
Do the following the activity.

**Objective:** To make a model volcano.

**Materials:** a candle a stapler  
a piece of cardboard some matches  
a pair of scissors

## Procedure

1. Make a cone using the cardboard. Staple its sides to form the cone.
  2. Cut a hole on the top part of the cone. Be sure that the hole is about the size of the candle.
  3. In an open space, let the candle stand on the ground. Push the cone down the candle. Be sure that part of the candle can be seen.
  4. Light the candle.
  5. Observe the candle as it melts. Be sure it does not burn the cone.
- 



**Note:** You can replace the candle with a flashlight and a red cellophane at the mouth of the cone. Shape the cellophane like fire at the opening of the cone.

Now, try answering the following questions.

1. What does the cone represent?

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2. What does the candle represent?

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3. What happened as the candle continued to melt? What does this represent?

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Are your answers similar to what are given below?

1. The cone represents the volcano.
2. The candle represents the magma and other materials that are spewed out by the volcano during an eruption.
3. The wax flowed down the sides of the cone just like the lava and other materials that move down the slope of a volcano during an eruption.



## Let's Learn

### Beneficial Effects of Volcanic Eruptions

Despite the destructive effects of volcanic eruptions, some products of volcanism may also be beneficial to mankind. Weathering of volcanic ashes and pyroclastic materials makes the soil fertile making it suitable for the production of major export crops such as coconuts, abaca, sugarcane, *maguey*, ramie and tobacco. Volcanic materials such as perlite, pumice and scoria are being utilized in the industry as well as other mineral deposits like borax and sulfur.

When a volcano becomes inactive, its residual heat is trapped to provide geothermal steam for power generation and for nonelectrical industrial use. There are a number of geothermal fields all over the archipelago. Four of them are presently under development and production, namely, Tiwi (Albay), Makiling-Banahaw (Laguna), Tongonan (Leyte) and Palimpinon (Negros).

## Uses of Geothermal Energy

1. *Electrical power generation*—geothermal energy power plants provide extremely cheap and reliable supply of electricity.
2. *Industrial applications*—geothermal steam is used for heating, drying, salt making, fish canning, boric acid production or refrigeration. The Philippine Institute of Volcanology and Seismology (PHIVOLCS) has developed technologies for the industrial utilization of geothermal steam in salt making and fish canning.
3. *Recreational and health applications*—hot springs and warm mineral springs are used for recreational and medical purposes.

## Harmful Effects of Volcanic Eruptions

Many people have suffered from destructive effects of eruptions. A few of them are given below.

1. *Ashfall*. An **ashfall** is a heavy downfall of volcanic ashes that can cause harm to human beings, animals, crops, machinery and buildings. Fine volcanic ashes can be breathed in and cause respiratory diseases if inhaled over prolonged periods. Heavy ashfalls can also cause extreme darkness, damage aircraft engines and crops, make roofs collapse if allowed to accumulate in big quantities and cause metal corrosion by acid-bearing ashes.
2. *Pyroclastic flow*. **Pyroclastic flows** are extremely hot (up to 1000°C) often incandescent and turbulent blasts of volcanic fragments (the size of boulders, pebbles, sand or dust) and hot gases that sweep downslope close to the ground at hurricane speed up to 100 kph. These are horizontally directed, usually following topographic depressions and gullies. Because of their high density and mobility, pyroclastic flows are fatal to nearly all life-forms that lie along their paths. Standing inanimate objects are either buried or destroyed upon direct impact or charred by extreme heat.
3. *Lahar (Mudflow)*. **Lahars** commonly called mudflows are flowing mixtures of volcanic materials and water. Loosely consolidated ashes and pyroclastic flow deposits on the slopes of the volcano are easily eroded and then mobilized by heavy rains, causing a debris-water mixture (with the consistency of wet concrete) to cascade downslope. Lahars usually follow preexisting gullies and ravines. They are slower than pyroclastic flows but usually cover longer distances and wider areas on the lower slopes. There are distinct patterns of lahar behavior. In areas where the slope gradient is relatively high, the impact of lahar is erosional. Lahars erode foundations of structures on elevated areas along riverbanks. Lahars tend to be deposited in areas where the gradient is low, covering them with boulders, sand and mud. It can also destroy buildings and infrastructures, block drainage channels, raise riverbeds and cause flooding in some areas.

4. *Flooding.* Moderate to heavy rains that do not trigger lahars will transport large quantities of sediments to lowland areas. These sediments fill up river channels causing rivers to overflow and flooding in lowland areas. This hazard may continue for years or decades after an eruption.



5. *Phreatic explosion.* A volcano can be expected to exhibit occasional **phreatic explosions** with plumes reaching heights of 5000 to 20000 m. These can cause light to moderately heavy ashfalls in downwind areas and possibly cause damage to aircrafts. These explosions may persist for months or even years but decrease in intensity and recurrence with time.
6. *Secondary explosion.* When water seeps into the still-hot pyroclastic flows, steam explosions referred to as **secondary explosions** occur ejecting ashes and ballistic fragments to as high as hundreds to thousands of meters from the source. These are expected to pose danger for two to three years or for as long as the pyroclastic flow deposits remain hot.

7. *Earthquake.* Though volcano-related seismicity has been declining, post-eruption earthquakes can still cause ground motions strong enough to damage or destroy weak or unstable structures. These earthquakes are expected to affect the entire volcanic and adjacent areas within the next several months to a year after an eruption.



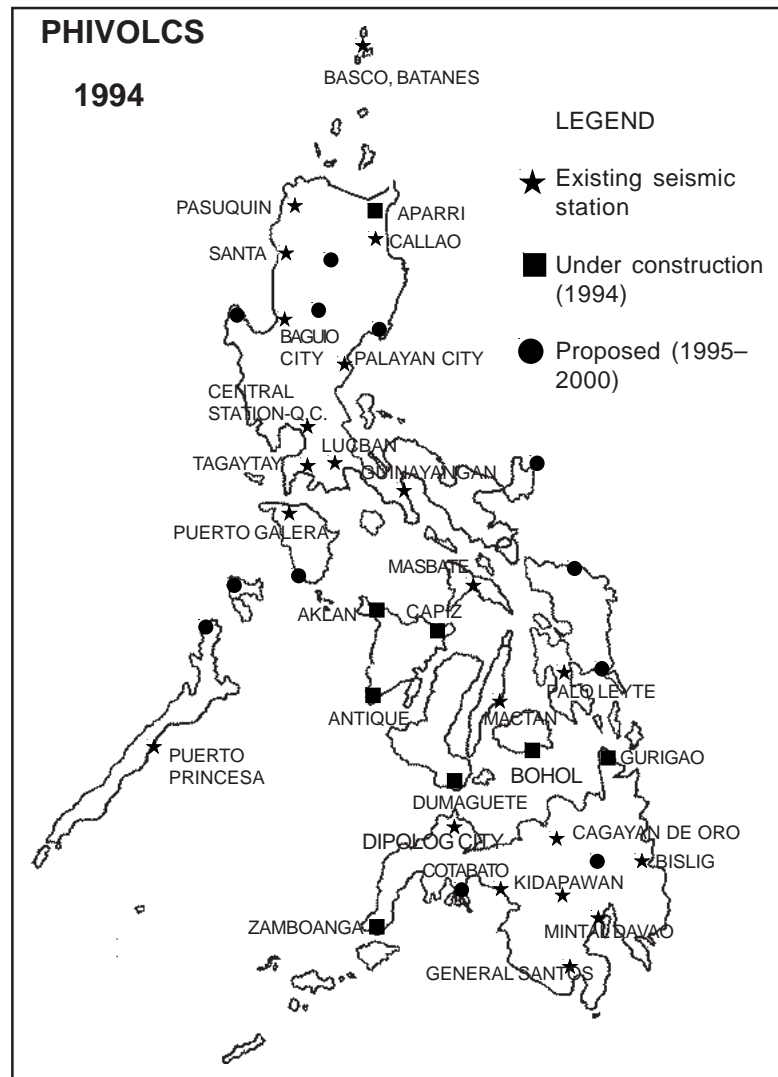
### **Precautionary Measures in the Face of Hazards Posed by Volcanic Eruptions**

Considering that there are many volcanoes located in various parts of the country, people should know what measures to take in the face of an impending volcanic eruption.

1. Avoid low places or areas vulnerable to avalanches, rock falls, lava flows and mudflows.
2. To minimize mudflows, refrain from deforesting the slopes of volcanoes.
3. During ash showers, people with respiratory ailments should stay outside the ash shower area so as not to aggravate their conditions. But others should also cover their noses preferably with a wet piece of cloth.
4. In-between heavy ash showers, ashes that have accumulated on rooftops should be scraped off to prevent collapse or destruction of the rooftops due to pressure.
5. Construct earthquake-resistant structures in areas near active volcanoes.
6. Those living on or around volcanoes should always have ready means of transportation.

7. Comply strictly with PHIVOLCS prohibitions against settling in permanent danger zones or areas within a 4- to 6-km radius from the summits of active volcanoes. Also, heed warnings and orders for evacuation issued by PHIVOLCS and the Provincial Disaster Coordinating Commission (PDCC) in times of volcanic unrest.

### Seismic Monitoring Network



### Steps One Should Undertake After a Volcanic Eruption

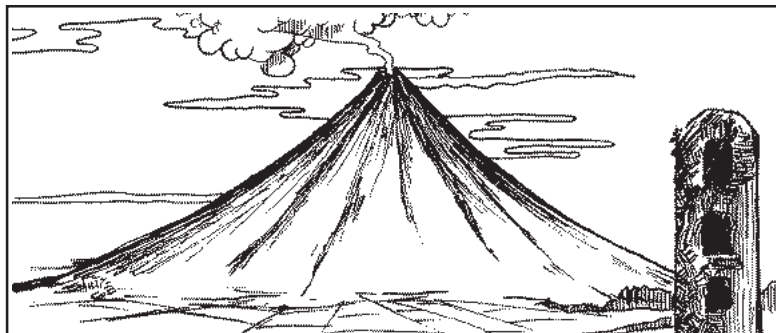
- ◆ Wait for instructions to return home.
- ◆ Repair damaged portions of your property.
- ◆ Remove ash deposits.
- ◆ See to it that the water is safe to drink.
- ◆ Protect yourself from diseases.



## Let's See What You Have Learned

Encircle the letter of the correct answer to each of the following.

1. Which of the following best describes an inactive volcano?
  - a. growth of plants in a small area
  - b. plant growth on almost its whole surface
  - c. smoke coming out of its crater
  - d. gases coming out of its crater
2. Which of the following tells that Taal Volcano is active?
  - a. numerous recorded eruptions
  - b. rich fishing grounds
  - c. numerous craters
  - d. plant growth in the area
3. Which of the following can be considered a harmful effect of volcanic eruptions?
  - a. formation of lakes which can become rich fishing grounds
  - b. contribute to the soil's fertility
  - c. produce materials used for building houses
  - d. pollute the air and environment
4. When a volcano erupts, magma and hot gases come out of it. What do you call the magma that comes out of the ground?
  - a. lahar
  - b. lava
  - c. rock
  - d. mineral
5. What type of volcano is illustrated below?



- a. shield volcano
- b. cinder cone
- c. stratovolcano
- d. caldera

Compare your answers with those in the *Answer Key* on page 33. How well did you do?



## Let's Remember

- ◆ Volcanic eruptions, though destructive, can have beneficial effects as well. They can contribute to the soil's fertility, produce materials for use in industrial processes and generate geothermal energy.
- ◆ The harmful effects of volcanic eruptions include:
  1. ashfalls;
  2. pyroclastic flows;
  3. lahars;
  4. flooding;
  5. phreatic explosions;
  6. secondary explosions; and
  7. earthquakes.
- ◆ People should observe the following precautionary measures in the face of volcanic eruptions:
  1. avoid low places or areas vulnerable to avalanches, rock falls, lava flows and mudflows;
  2. refrain from deforesting the slopes of volcanoes;
  3. stay outside the ash shower area so as not to aggravate already existing respiratory conditions;
  4. scrape accumulated ashes on rooftops to prevent them from collapsing due to pressure;
  5. construct earthquake-proof structures in areas near active volcanoes;
  6. always have ready means of transportation; and
  7. strictly comply with PHIVOLCS prohibitions against settling in permanent danger zones.



- ◆ People should take the following steps after a volcanic eruption:
  1. wait for instructions before returning home;
  2. repair damaged properties immediately;
  3. remove accumulated ash deposits;
  4. make sure that the water is potable before actually drinking it; and
  5. protect themselves from diseases.

Well, this is the end of the module! Congratulations for finishing it. Did you like it? Did you learn anything useful from it? A summary of its main points is given below to help you remember them better.



## Let's Sum Up

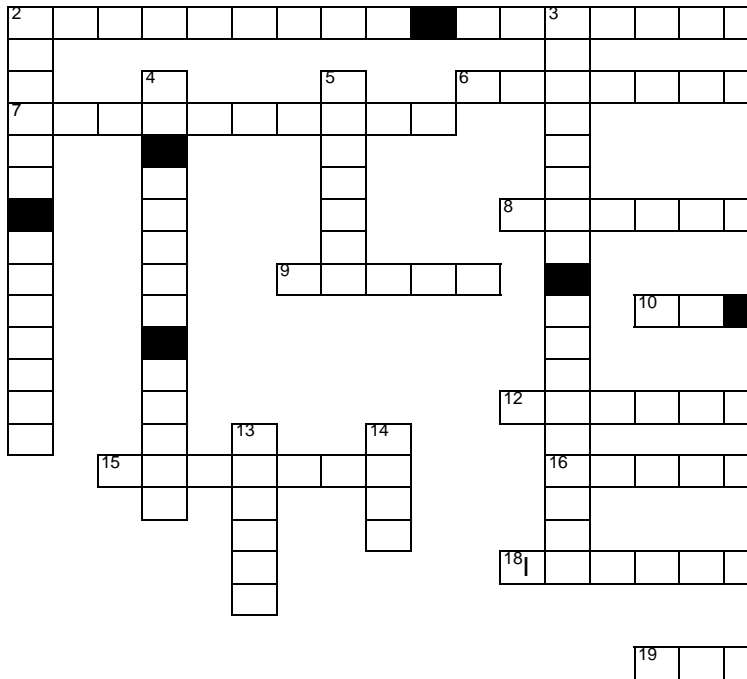
- ◆ A **volcano** is a hill or mountain composed wholly or in part of ejected materials usually molten hot rocks and steam issues.
- ◆ The different types of volcanoes include shield volcanoes, cinder cones, stratovolcanoes, domes and calderas.
- ◆ An **active volcano** is one that has erupted within recent times as documented by man.
- ◆ An **inactive volcano** is one that has not erupted within historic times and whose form is beginning to change due to weathering and erosion.
- ◆ Volcanic eruptions, though destructive, can have beneficial effects as well. They can contribute to the soil's fertility, produce materials for use in industrial processes and generate geothermal energy.
- ◆ The harmful effects of volcanic eruptions include:
  1. ashfalls;
  2. pyroclastic flows;
  3. lahars;
  4. flooding;
  5. phreatic explosions;
  6. secondary explosions; and
  7. earthquakes.

- ◆ People should observe the following precautionary measures in the face of volcanic eruptions:
  1. avoid low places or areas vulnerable to avalanches, rock falls, lava flows and mudflows;
  2. refrain from deforesting the slopes of volcanoes;
  3. stay outside the ash shower area so as not to aggravate already existing respiratory conditions;
  4. scrape accumulated ashes on rooftops to prevent them from collapsing due to pressure;
  5. construct earthquake-proof structures in areas near active volcanoes;
  6. always have ready means of transportation; and
  7. strictly comply with PHIVOLCS prohibitions against settling in permanent danger zones.
- ◆ People should take the following steps after a volcanic eruption:
  1. wait for instructions before returning home;
  2. repair damaged properties immediately;
  3. remove accumulated ash deposits;
  4. make sure that the water is potable before actually drinking it; and
  5. protect themselves from diseases.



## What Have You Learned?

A. Complete the following crossword puzzle using the given clues.



### Across

2. When water seeps into the still-hot pyroclastic flow, a steam explosion referred to as a \_\_\_\_\_ occurs ejecting ashes and ballistic fragments to as high as hundreds to thousands of meters from the source.
6. A \_\_\_\_\_ is an extremely hot, often incandescent and turbulent blast of volcanic fragments and hot gases that sweeps downslope close to the ground at a hurricane speed of up to 100 kph.

### Down

1. \_\_\_\_\_ is one of the world's lowest and smallest volcanoes located near the center of Taal Lake in Batangas.
2. A \_\_\_\_\_ is a type of volcano built almost entirely of fluid lava flows.
3. A \_\_\_\_\_'s plumes can reach heights of up to 5000 to 20000 m.
4. A \_\_\_\_\_ is a volcano dome located at the northwestern end of Camiguin Island approximately 10 km off the north coast of Mindanao.

7. An \_\_\_\_\_ causes ground motions strong enough to damage or destroy weak or unstable structures.
8. A \_\_\_\_\_ is the simplest type of volcano.
9. A \_\_\_\_\_, commonly called a mudflow, is a flowing mixture of volcanic materials and water.
10. \_\_\_\_\_ is a large stratovolcano located in the north-central portion of Negros Island.
12. \_\_\_\_\_ occurs when moderate to heavy rains that do not trigger lahars transport a large quantity of sediments to lowland areas.
15. A \_\_\_\_\_ is a hill or mountain composed wholly or in part of ejected materials usually molten hot rocks and steam issues.
16. A \_\_\_\_\_ is a typically steep-sided symmetrical cone of large dimension built of alternating layers of lava flows, volcanic ashes, cinders, blocks and bombs and may rise to as much as 8000 ft. above their bases.
18. A volcano is said to be \_\_\_\_\_ if it has not erupted within historic times and its form is beginning to change because of weathering and erosion.
5. A \_\_\_\_\_ is formed when a volcano collapses.
11. \_\_\_\_\_ is a part of the chain of volcanoes which borders the western side of Luzon and lies in the central portion of the Zambales Range.
13. An \_\_\_\_\_ volcano is defined as one which has erupted within historic times such that accounts of its eruption has been documented by man.
14. A \_\_\_\_\_ is formed by relatively small, bulbous masses of lava too viscous to flow great distances.
17. An \_\_\_\_\_ is a heavy downfall of volcanic ashes that can cause harm to human beings, animals, crops, machinery and buildings.
19. \_\_\_\_\_ lies at the eastern portion of Albay and is about 300 km southeast of Manila.

B. Enumerate the following.

1. Types of volcanoes

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_

2. General classifications of volcanoes

- a. \_\_\_\_\_
- b. \_\_\_\_\_

3. Famous Philippine volcanoes (mentioned in this module)

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_

4. Beneficial effects of volcanic eruptions

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

5. Uses of geothermal energy

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

6. Harmful effects of volcanic eruptions

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_
- f. \_\_\_\_\_
- g. \_\_\_\_\_

7. Precautionary measures in the face of hazards posed by volcanic eruptions

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_
- h. \_\_\_\_\_
- g. \_\_\_\_\_

8. Steps one should undertake after a volcanic eruption

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_

Compare your answers with those in the *Answer Key* on pages 34 and 35. Did you get all the answers right? If you did, that's very good. You may now proceed to the next module. If you did not, do not worry. Just go back to the parts of this module you did not understand very well before proceeding to the next module. I'm quite sure that after a second look at the topics here, you'll do a better job.



## Answer Key

### A. Let's See What You Already Know (*pages 2–3*)

- A. 1. (b)
- 2. (e)
- 3. (d)
- 4. (c)
- 5. (a)

### B. Possible answers

- 1.
  - a. Soil resulting from weathering of volcanic ashes and pyroclastic materials is fertile.
  - b. Eruptions produce materials with industrial uses.
  - c. Once a volcano has become inactive, its residual heat could be tapped to provide geothermal steam for power generation and for nonelectrical industrial use.
- 2.
  - a. ashfalls;
  - b. pyroclastic flows;
  - c. lahars;
  - d. flooding;
  - e. phreatic explosions;
  - f. secondary explosions; and
  - g. earthquakes.
- 3.
  - a. Avoid low places or areas vulnerable to avalanches, rock falls, lava flows and mudflows.
  - b. To minimize mudflows, refrain from deforesting the slopes of volcanoes.
  - c. During ash showers, people with respiratory ailments should stay outside the shower area so as not to aggravate their conditions.
  - d. In-between heavy ash showers, ashes that have accumulated on rooftops should be scraped off to prevent collapse or destruction of the rooftops due to pressure.

- e. Construct earthquake-proof structures in areas near active volcanoes.
- f. Those living on or around volcanoes should always have ready means of transportation.
- g. Comply strictly with PHIVOLCS prohibitions against settling in permanent danger zones.

## B. Lesson I

*Let's Try This (pages 4–5)*

Volcano	Location
Mayon	Legaspi City, Albay
Taal	Talisay, Batangas
Kanlaon	Negros Oriental
Bulusan	Sorsogon
Ragang	Cotabato
Smith	Babuyan Island Group
Hibok-Hibok	Mambajao, Camiguin Island
Didicas	Babuyan Island Group
Babuyan Claro	Babuyan Island Group
Camiguin de Babuyanes	Babuyan Island Group
Cagua	Cagayan
Banahaw	Lucena City
Calayo	Valencia, Bukidnon
Iraya	Batanes
Pinatubo	Zambales
Iriga	Iriga, Camarines Sur
Biliran	Biliran
Bud Dajo	Jolo Island
Matutum	Cotabato
Kalatungan	Bukidnon
Makaturing	Lanao, Mindanao
Parker	South Cotabato



*Let's See What You Have Learned (page 15)*

- A.
  - 1. Mayon
  - 2. Hibok-Hibok
  - 3. Taal
  - 4. Kanlaon
  - 5. Pinatubo
- B.
  - 1. Pinatubo
  - 2. Kanlaon
  - 3. Taal
  - 4. Hibok-Hibok
  - 5. Mayon

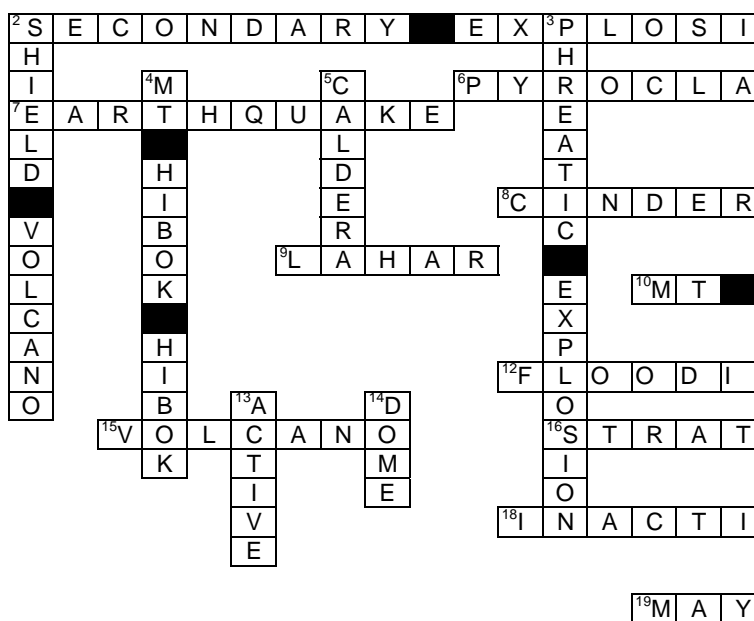
**C. Lesson 2**

*Let's See What You Have Learned (page 23)*

- 1. (b) Plant growth isn't possible immediately after a volcanic eruption.
- 2. (c) The presence of numerous craters shows that Taal Volcano can erupt any time.
- 3. (d) Eruptions can cause pollution which is harmful to people's health.
- 4. (b) lava
- 5. (c) stratovolcano

## D. What Have You Learned? (pages 27–30)

A.



- B.
1.
    - a. shield volcano
    - b. stratovolcano
    - c. cinder cone
    - d. dome
    - e. caldera
  2.
    - a. active
    - b. inactive
  3.
    - a. Mayon
    - b. Taal
    - c. Hibok-Hibok
    - d. Kanlaon
    - e. Pinatubo
  4.
    - a. Soil resulting from weathering of volcanic ashes and pyroclastic materials is fertile.
    - b. Eruptions produce materials with industrial uses.
    - c. Once a volcano has become inactive, its residual heat could be tapped to provide geothermal steam for power generation and for nonelectrical industrial use.

5.
  - a. electrical power generation
  - b. industrial applications
  - c. recreational and health applications
6.
  - a. ashfalls
  - b. pyroclastic flows
  - c. lahars
  - d. flooding
  - e. phreatic explosions
  - f. secondary explosions
  - g. earthquakes
7.
  - a. Avoid low places or areas vulnerable to avalanches, rock falls, lava flows and mudflows.
  - b. To minimize mudflows, refrain from deforesting the slopes of volcanoes.
  - c. During ash showers, people with respiratory ailments should stay outside the shower area so as not to aggravate their conditions.
  - d. In-between heavy ash showers, ashes that have accumulated on rooftops should be scraped off to prevent collapse or destruction of the rooftops due to pressure.
  - e. Construct earthquake-proof structures in areas near active volcanoes.
  - f. Those living on or around volcanoes should always have ready means of transportation.
  - g. Comply strictly with PHIVOLCS prohibitions against settling in permanent danger zones.
8.
  - a. Wait for instructions to return home.
  - b. Repair damaged portions of your property.
  - c. Remove ash deposits.
  - d. See to it that water is safe to drink.
  - e. Protect yourself from diseases.



## Glossary

**Active volcano** A volcano that has erupted within historic times such that accounts of its eruption have been documented by man.

**Airfall deposition** Composed of separate materials varying in size from ashes to small boulders.

**Ashfall** A heavy downfall of volcanic ashes that can cause harm to human beings, animals, crops, machinery and buildings.

**Basalt lava** The accretion of thousands of highly-fluid lava flows that spread widely over great distances and then cool as thin, gently dipping sheets.

**Base surge** A rapidly moving mixture of volcanic debris and steam.

**Caldera** A depression formed by a collapsed volcano.

**Cinder cone** The simplest type of volcano.

**Conduit** A volcanic plug.

**Coulee** A short, steep-sided lava flow.

**Crater** A funnel-shaped depression opening upward near the summit of a volcano from which materials such as ashes and lava are ejected.

**Dome** Formed by relatively small, bulbous masses of lava too viscous to flow any great distance, consequently, on extrusion, the lava piles over and around its vent.

**Fissure** A dike.

**Inactive volcano** A volcano that has not erupted within historic times and whose form is beginning to change because of weathering and erosion.

**Lahar** Commonly called a mudflow, a flowing mixture of volcanic materials and water.

**Lava** The magma that has erupted from a volcano or fissure and flowed on to the earth's surface or the ocean floor.

**Maar** A shallow to deep circular depression of volcanic origin.

**Permanent danger zone** An area within a 4- to 6-km radius from the summit of a volcano.

**Phreatic explosion** An explosion that has plumes reaching heights of 5000 to 20000 m.

**Pipe** A tunnel connecting the crater and the molten materials inside the earth through which the ejected materials pass.

- Plinian eruption** Considered to be one of the most dangerous eruptions because it is characterized by extremely viscous lava and the formation of glowing clouds.
- Pyroclastic flow** Extremely hot, often incandescent and turbulent blast of volcanic fragments and hot gases that sweeps downslope close to the ground at hurricane speed of up to 100 kph.
- Pyroclastic flow deposit** Composed of separate materials varying in size from ashes to small boulders.
- Rift zone** A vent along a fracture that develops on the flank of the cone.
- Secondary explosion** A steam explosion that occurs when water seeps into the still-hot pyroclastic flow and ejects ashes and ballistic fragments to as high as hundreds to thousands of meters from the source.
- Shield volcano** A volcano built almost entirely of fluid lava flows.
- Stratovolcano** Also called a composite volcano.
- Tuff** Porous rock.
- Volcano** A hill or mountain composed wholly or in part of ejected materials usually molten or hot rocks and steam issues.
- Vulcanian** Explosive in nature.



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