



## Unit 1

### Key Questions:

*Where are Alaska's volcanoes? How many volcanoes are found in Alaska?*

### Grade levels:

At a basic level, these activities are appropriate for grades 3-6; with suggested extensions for older/ more advanced students

### Summary:

Alaska is home to over 100 volcanoes and volcanic fields that have been active within the last two million years. More than 40 of these have been historically active. Alaska's volcanoes comprise about 80% of all active volcanoes in the United States and 8% of all active volcanoes on earth that sit above water.

Most of Alaska's volcanoes sit along the 2,500 km-long Aleutian Arc. This chain of volcanoes stretches from Kamchatka to the Alaska Peninsula forming the northern arc of the Pacific "ring of fire". The slow northward motion of the Pacific tectonic plate controls the location of Alaska's volcanoes. As this large piece of the earth's crust is consumed beneath the North American plate, magma is formed at depth by a complex series of chemical reactions and eventually erupts at the surface to form volcanoes.

Although volcanoes are an exciting part of Alaska's natural history and current events, many people are unaware that Alaska is the state with the most volcanoes in the U.S. This unit will teach students about the geography of Alaska and the forces that determine where these exploding mountains are found.

### Materials:

- Volcanoes of Alaska Information Circular 38
  - \* download from this site
  - \* or order for \$3.00 from  
Alaska Division of Geological & Geophysical Surveys  
3354 College Road, Fairbanks, AK 99709  
Phone: (907) 451-5000 Fax: (907) 451-5050  
Email: [dggspubs@dnr.state.ak.us](mailto:dggspubs@dnr.state.ak.us)
  
- Computer(s) with Google Earth installed<sup>†</sup>
  - \* free download available at: <http://earth.google.com/>
  - \* alternatively, use a large topographic map of the state of Alaska, making some of the activities more focused on map reading skills and less interactive.

- One-page color maps of historically active volcanoes for each student
- Full-sized color map of historically active volcanoes for the classroom (if not using the Volcanoes of Alaska Information Circular 38)

### **†System requirements for Google Earth on the PC**

The Google Earth client requires certain system configurations in order to run smoothly.

#### Minimum configuration:

- \* Operating System: Windows 2000, Windows XP
- \* CPU: Pentium 3, 500Mhz – System Memory (RAM): 128MB RAM
- \* Hard Disk: 400MB free space
- \* Network Speed: 128 Kbits/sec
- \* Graphics Card: 3D-capable with 16MB of VRAM
- \* Screen: 1024x768, "16-bit High Color" screen

#### Recommended configuration:

- \* Operating System: Windows XP
- \* CPU: Pentium 4 2.4GHz+ or AMD 2400xp+
- \* System Memory (RAM): 512MB RAM
- \* Hard Disk: 2GB free space
- \* Network Speed: 768 Kbits/sec
- \* Graphics Card: 3D-capable with 32MB of VRAM
- \* Screen: 1280x1024, "32-bit True Color" screen

### **System requirements for Google Earth on the Mac**

The Google Earth client requires certain system configurations in order to run smoothly on the Mac.

#### Minimum Configuration:

- \* Operating System: Mac OS X 10.3.9
- \* CPU: G3 500Mhz
- \* System Memory (RAM): 256MB RAM
- \* Hard Disk: 400MB free space
- \* Network Speed: 128 Kbits/sec
- \* Graphics Card: 3D-capable with 16MB of VRAM
- \* Screen: 1024x768, "16-bit High Color" screen

#### Recommended Configuration:

- \* Operating System: Mac OSX 10.4.4
- \* CPU: G4 1.2Ghz
- \* System Memory (RAM): 512MB RAM
- \* Hard Disk: 2GB free space
- \* Network Speed: 768 Kbits/sec
- \* Graphics Card: 3D-capable with 32MB of VRAM
- \* Screen: 1280x1024, "32-bit True Color" screen



## Activity 1 - Map Reading

### *“Where Are Alaska’s Volcanoes?”*

**Activity type:** Hands-on computer or map reading activity.

**Time:** 1 hour, plus time for student presentations.

**Skills and objectives:** Map reading; geography of Alaska; volcano types; utilizing the initial steps of the scientific method: hypothesizing, observing, interpreting data, inferring, communicating.

**Gear Up:** Have a classroom discussion about students’ perceptions of volcanoes in Alaska. Have them guess how many there are, where they are, etc. Give a pre-assessment quiz to see if students can name all of the states in the U.S. with active volcanoes, if they know which state has the most volcanoes, how many volcanoes they can name, other countries with plentiful volcanoes, etc. [See sample quiz.]

Launch Google Earth and familiarize the group with how it functions. If students will be working on individual computers, be sure they are confident flying to different places, zooming in and out, and turning layers on and off. For this activity, students will need to begin with all layers turned off centered on the state of Alaska.

**1.** Challenge students to “explore” the state of Alaska to discover where volcanoes are found.

**2.** Instructions to students:

- Looking at the whole state of Alaska, hypothesize where volcanoes may be present.
- Write down your guess and explain why you gave this answer.
- Zoom into the region where you predicted volcanoes could be located.
- Do you see anything that could be a volcano? How do you know that what you are looking at is or isn’t a volcano? Use the tilt function to change your perspective on the landscape and get a different view. Take notes on your location (coordinates, geographical names, region of the state, etc.) and what you see there.
- If you find a geographical feature that you believe to be a volcano, save the image (*File, Save Image*) and give it a title (i.e. Suspected Volcano 1). Make a note of the location, what about the feature indicates it is a volcano, and the image file name.
- Zoom out to the whole state view and try another region. Repeat this process until you have found at least three volcano candidates.

- Once you have described the features you believe to be volcanoes, saved images of each feature, and recorded the location of each, you may go on to the next step.

- Turn on the 'Volcanoes' layer. (This is in the list of geographical features in the lower left-hand box).

- Did a volcano name appear by your feature? Check each of your suspected volcanoes to see if it really is a volcano.

- Record the name, volcano type, and one interesting fact about each volcano you found.

- If you didn't find any real volcanoes in your first search, look at some of the labeled volcanoes.

- Answer the following questions:

1. Where are most of the volcanoes in the state located?
2. About how many volcanoes are in Alaska?
3. What volcanoes are the closest to towns? (Turn on the populated places layer and zoom in, or look at a state map with towns and roads.)

**3.** Have students give a short presentation on the volcanoes they explored. If they are working in groups, have each person in the group talk about one of the volcanoes the group found. Presentations should include the volcano name, type (found by clicking on the name in Google Earth), location, and interesting facts. Older or more advanced students could be given the additional tasks of writing a small report about their volcanoes including maps, photos, information on the eruptive history, potential hazards, etc. and preparing a Power Point presentation for the class. The Alaska Volcano Observatory web site has a wealth of information to assist students at this point.



## Activity 1 - Map Reading

### *“Where Are Alaska’s Volcanoes?”*

#### **Materials:**

Computer running Google Earth

**or**

Topographic maps of Alaska

#### **Google Earth Tools to Master:**

*“fly”* – use the hand tool to spin the earth to the area of interest

*“rotate”* – turning arrow in lower tool bar, used to reposition area of interest

*“zoom”* - + and – symbols and slider bar in lower tool bar, use to get closer or farther away from area of interest (some layers are only visible from a certain distance)

*“layers”* – lower left hand box has many different options for what is seen on the maps

*“tilt”* – slider bar on right hand side of lower tool bar, used to adjust the look angle

#### **Instructions:**

1. Looking at the whole state of Alaska, hypothesize where volcanoes may be present.
2. Write down your guess and explain why you gave this answer.
3. Zoom into the region where you predicted volcanoes could be located.
4. Do you see anything that could be a volcano? How do you know that what you are looking at is or isn’t a volcano? Use the tilt function to change your perspective on the landscape and get a different view. Take notes on your location (coordinates, geographical names, region of the state, etc.) and what you see there.
5. If you find a geographical feature that you believe to be a volcano, save the image (File, Save Image) and give it a title (*example*: Suspected Volcano 1). Make a note of the location; what about the feature indicates it is a volcano, and the image file name.
6. Zoom out to the whole state view and try another region. Repeat this process until you have found at least three volcano candidates.
7. Once you have described the features you believe to be volcanoes, saved images of each feature, and recorded the location of each, you may go on to the next step.

- 8.** Turn on the 'Volcanoes' layer. (In the geographic features layer list).
- 9.** Did a volcano name appear by your feature? Check each of your suspected volcanoes to see if it really is a volcano.
- 10.** Record the name, volcano type, and one interesting fact about each volcano you found.
- 11.** If you didn't find any real volcanoes in your first search, look at some of the labeled volcanoes.
- 12.** Answer the following questions:
  - A.** Where are most of the volcanoes in Alaska located?
  - B.** About how many volcanoes are in Alaska?
  - C.** What volcanoes are the closest to towns? (Turn on the populated places layer and zoom in, or look at a state map with towns and roads.)
- 13.** Summarize and present your results as instructed by your teacher.



## *Activity 2 – Number Density*

### *“How Many Volcanoes Exist in Alaska?”*

**Activity type:** Hands-on, classification and map skills building exercise.

**Time:** 10-15 minutes for gear up exercise. 15 minutes for reading and discussion. 30-45 minutes to delegate tasks and complete exercise. 15 minutes for presentations. 20 minutes to research final answer (can also be given as a homework assignment if students have web access at home).

**Skills and objectives:** Classification; observation; interpreting and communicating data.

**Gear Up:** There are many different ways to count things. We can first classify something and then count the number in a group or, alternatively, we can consider the number of a given thing per a designated area. How we group our items determines how many will be in each group and the area we select will influence the population density (assuming a heterogeneous spatial distribution). This concept can be illustrated with a warm-up activity using common household/classroom items (buttons, dominoes, game pieces, etc.) or candies (M&Ms, Skittles, etc.).

Give groups of students a few dozen items to classify based on their own set of criteria. Have them count the items in each class and explain to the other groups how they came up with their classification scheme in order to count the items. Alternatively, have the other groups attempt to guess what criteria were used to distinguish groups. Then give the students different area parameters to constrain their counts (a desktop, a rubber band, or a piece of paper). They should be able to explain why their numbers are different given the total size or location of an area of interest. This thought exercise can be expanded through a discussion of how many kids are in the school, that this number will be different if they count by age, grade, classroom, etc.

The entire gear-up exercise is intended to be simple and fast paced. The idea is simply to get students thinking about classification and spatial distribution and how these parameters influence the number reported using concrete examples with which they are familiar. There is an infinite number of variations on the above outline, so feel free to use whatever resources are available or appropriate for your class!

#### **Instructions:**

1. After completing Concept 1, students should be able to navigate using Google Earth and be comfortable getting information about each volcano using the layer tool.

- 2.** Use the glossary in the Alaska Volcano Explorer web site to give students a brief overview of the different types of volcanoes and how volcanoes are classified as dormant, active or historically active.
- 3.** Have the class read the paragraphs about counting from their handout. Discuss answers to the questions posed therein as a class or in smaller groups.
- 4.** Enlist the help of the class as a whole to count all the volcanoes in the state. For younger students, help them to get organized and decide whether they will count by region (see the AVO website for help with this) or by volcano type. Older, or more advanced students should be challenged to determine how to make a volcano survey on their own (although all students should get the hint that the concepts from the warm-up exercise will make counting easier!).
- 5.** The students should present their findings before looking up any resources that will give them the 'correct' answer. The emphasis should be on clearly defining a classification or spatial scheme and gleaning an answer that is correct within that framework.
- 6.** After students have presented their findings, look at the AVO website as a class to see how the number of volcanoes in Alaska is determined. Regional map and alphabetical list: <http://www.avo.alaska.edu/volcanoes/> Discuss discrepancies between what is reported on the web and their own numbers. Why are there differences/ similarities?



## Activity 2 – Number Density

### *“How Many Volcanoes Exist in Alaska?”*

#### **Vocabulary:**

*Number density* – the number of a certain thing per unit area (*example*: population density = the number of people in a given area)

#### **Reading:**

Think for a minute about how you would answer the following questions: How many toys do you have? How many books do you have? How many leaves are on the trees? How many people are in your family?

Could there be different answers to these questions? Will the answer change if you group what you are counting in different ways? Let’s think about your family – if you just counted your parents and siblings, you would have a different number than if you included your extended family. How far out should you count; second cousins, great grandparents? How many people you count depends largely on your own definition of “your family”, and can get very tricky if you have a blended family or include non-blood relatives who are family to you.

When scientists give a number for a complex thing, such as the number of volcanoes or the number of insects, they have to be very clear about how they define the items they are counting so that the number means the same thing to everyone. Looking at a map of the state of Alaska with all of the volcanoes marked on it, you can quickly see that there are a lot of volcanoes out there. How you define “volcano” changes the total number!

Work with your class to split up the job of counting volcanoes so that they are all accounted for and that you share the work load evenly. Remember to define what you are counting before you get started. Good luck!