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Forces of Nature: Ring of Fire

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Rationale

My unit is intended for third grade students, but could easily be modified to educate other grade levels. The students who will be participating in this unit directly are students at Davis Street Arts and Academics Interdistrict Magnet School. While the students in my classes range in academic performance, they all love science. My classroom is an inclusion setting where special education students are mainstreamed to full participation in the general education curriculum with modifications. My special education students will receive lower leveled books on volcanoes, picture cards for vocabulary words and other means to assisting their learning such as graphic organizers and T charts. A peer leader will also be assigned to assists other students who might struggle with the reading and writing section of an activity.

Introduction

My unit is designed to engage third grade students in obtaining useful information about the science of natural disasters, particularly volcanoes and their effects on our planet, Earth. In this unit, students will not only study types of volcanoes, how they erupt, but they will also build a volcano, publish a book about volcanoes and demonstrate a clear understanding of how the Earth's surface works. All of the activities will coincide with the Davis Street Arts and Academics Interdistrict Magnet School curriculum and New Haven Public School standards. Hands-on learning and a multi-curriculum approach will provide the students with an exciting unit.

This unit coincides with the New Haven Science Strands. It also meets many of the New Haven Language Arts curriculum standards, by including a writing element and many reading activities. Studying Earth Science and Physical Science are part of the curriculum; the primary focus being on the changing Earth. This unit will address the changing Earth by discussing volcanic eruptions and their effect on our environment. Students will also develop skills in Scientific Inquiry such as forming an inference from observation and observing events such as a Natural Disasters. Students will also develop information on motion and design as outlined in the Physical Science standards. The motion of the Earth will provide my students with an understanding that our

Earth's plates are constantly in motion and when they collide, anything can happen!

This unit will be an inquiry based learning activity that follows our districts LEARNING CYCLE of engagement, exploration, explanation, elaboration, and evaluation. This lesson also addresses the third grade standard 3.3: "Earth materials have different physical and chemical properties", 3.1: "Materials have properties that can be identified and described through the use of simple tests"and 3.4: "Earth materials provide resources for all living things, but resources are limited and should be conserved".

There are many physical phenomenons which change the Earth's environment everyday. Children and adults are curious about the natural environment and are eager to have these natural disasters explained. My student often ask WHY, HOW, WHEN? Their curiosity is the driving theme of this unit.

Because Davis Street Arts and Academics Interdistrict Magnet School really embraces the Arts, via music, band and artistry, a section of my unit will also incorporate these activities. It is a section that does not correlate to any scientific lesson, just utilizing our facts learned and applying them to some fun and leisure!

Objective

My unit is divided into five sections, with an activity corresponding to each section. I feel the students will not only learn information about volcanoes, but they will remember this unit for a very long time because of the hands-on activities that are incorporated. With a visual and hands-on approach the students will not feel as if I'm lecturing to them. One modification that is helpful to special education students, with general education students also benefiting, is a hands-on approach. The first section which I call, "Ring of Fire" will allow both the students and myself the opportunity to explore and learn about how a volcano erupts, what are the types of volcanoes, where are they located and what happens after the eruption occurs. We will participate in a variety of inquisitive discussions and research through books, internet and library visits. This basic background information will assist me and my students with the ability to complete the activities at the end of the unit.

My second section is called "Volcabulary" (Volcano and Vocabulary together!). Students can learn more about volcanoes if they have a clear understanding of the vocabulary words they will encounter when reading, researching or having an oral discussion with the teacher. These vocabulary words and definitions will allow my students with information about volcanoes, to analyze volcanoes and their function on Earth. Following this section, the students will produce their very own vocabulary puzzle and then share them with their classmates. It will be interesting to see the words that students deem most important.

The third section of this unit allows students to make a connection by obtaining vital information about a real volcano, Mount Vesuvius, in Pompeii Italy. By connecting to one specific volcano and obtaining vital information about the past and present history of this amazing eruption, students will develop a clear understanding of the chaos and destruction that occurred during this event. Two historical fiction books called, "Vacation Under the Volcano", A Magic Tree House book and "Pompeii", an Usborne Young Reading book will be utilized during our Shared Reading.

Section four is a hands-on activity providing students with the opportunity to make a volcano and watch it erupt! Utilizing the information the students have gained over the five week lesson, students will make their own volcano, name it and explain to the class the phenomenon that occurs. Students will have the option of

explaining their volcanic eruption orally or in written form.

This last section is mainly for the Davis Street Arts and Academic curriculum. We are a Magnet School that embraces the Arts, Music and Band instruction. This unit will have a section to incorporate art and music. My students will learn the song, “Ring of Fire”by Johnny Cash! In addition to the music, students will also participate in artists activities.

I hope that this unit will encourage students to continue with their education. I hope to inspire them to one day become a scientist, or a volcanologist, even a seismologists or scientists that study earthquakes. With a combination of research and hands-on activities, students will feel they have accomplished something and successfully participated in a unit that they can then remember for the rest of their lives.

Ring of Fire

Throughout history people have a way of telling stories to try to explain why things happen. One story began many hundreds of years ago when the Romans began to wonder about volcanoes and why they erupted. They began to make up stories to explain this natural event. The Romans believed a God named Vulcan worked deep in the Earth’s crust making swords and armor for the other Gods. When Vulcan would become upset, he would explode! Other cultures also had stories to explain this eruption. The Hawaiians believed that a Goddess of Fire, Pele was living with her sister, Namaka, Goddess of the Sea. The two sisters had an argument and Namaka chased Pele from their home. Pele moved to a different island and was never pleased. She would have temper tantrums and explode! (Simon, 2006) According to Maori legend, the volcanoes around Lake Taupo in New Zealand were powerful giants that fought for the love of a female mountain, hurling hot rock and fire at each other to win her love! (Rooney, 2006)

I will have my students in their writing period make up stories to explain volcanic eruptions.

Today we now know how volcanoes erupt and how they are formed. A volcano is a term used to describe when hot molten rock or lava erupts from the Earth’s surface. The volcano erupts when pressure builds up deep inside the Earth. Melted rocks, called magma, flow up through a vent or crack in the Earth’s surface very quickly. This magma is flowing sometimes very slowly or sometimes very quickly. It then flows as lava out of the volcano, ash, steam, rock and dust blows out of the crack or hole and enters the Earth’s air. Convection is the way that the heat energy is transferred into gases and liquids. When the gas or liquid is heated the part closest to the heat source expands, becomes less dense and rises. The cooler and denser liquid sinks down. Convection currents carry ash from volcanoes up into the air. So now that we know that a volcano is an opening in the Earth where hot liquid rock called magma bursts out of, we need to examine the Earth’s crust to see what causes these cracks. (Watts, 1996)

The Earth is made of four layers. The layers are the inner core, the outer core, the mantle and the crust. The Earth has a solid crust. The crust is between three miles thick to 43 miles thick. The crust area that is three miles (5 km) is the Oceanic Crust. The Oceanic Crust or ocean floor is made up of heavy rocks such as basalt and dolerite. The second crust or Continental Crust is between 19-37 miles (30-60 km) thick. This crust makes up mountains, hills, landforms and is mostly made of lighter rocks such as granite, sandstone and limestone. There are various layers of rock within our crust. The first layer is Sedimentary Rock. The second layer is

Metamorphic Rock, then Igneous Rock and deep in the crust, Melted Rock. The students in third grade also participate in a rock science unit so information about these rocks will be beneficial. (Moores, 1995)

The mantle is located below the crust. It is 1,789 miles thick (2,885 km). Within the mantle of the Earth are thin layers. They are mostly solid rock and small amounts of molten rock called magma. The Earth's layer or crust is always moving. The areas of the Earth are divided into plates. There are seven main plates, and many small plates. (Moores, 1995)

The outer core of the Earth is 1,407 miles (2,270 km) thick and is made up of liquid iron and nickel. The inner core is 754 miles thick (1,216 km) and is 3,950 miles (6,371 km) down to the center of the Earth. The internal temperature is a very hot 5,432 F (3,000 C) at the core. With all this heat and then cooling no wonder the Earth's is in constant motion and undergoes eruption! So where and why do these eruptions occur? (Moores, 1995)

Volcanic eruption occurs most often in the area of the Earth we call the Ring of Fire. This area encircles the Pacific Ocean. The Pacific Ring of Fire is the name that scientists use to describe the area around the Pacific Ocean. This area has many volcanic eruptions and also earthquakes. Most of the volcanic eruptions occur in this area although volcanoes do erupt in other areas. The lithosphere or the two layers of solid rock made up of the upper mantle and the crust fit together like a puzzle. The volcanoes that erupt build islands, such as Hawaii, mountains, plains, lakes and the ocean floor. Imagine when the pieces collide together, hot melted magma erupts through the crack. We can not feel it but the earth is in constant motion. The plates push and pull at a rate of 3/4-8 inches (2-20 cm) a year. Sometimes the plates collide into each other. Imagine when the pieces collide together, hot melted magma erupts through the crack. When the plates push apart, magma from the mantle erupts and creates a new ocean crust. When the plates move together they form mountains. The area where these plates slide on top of one another is where the most earthquakes and volcanoes occur. It is called the Ring of Fire. (Adams, 2001)

The outer part of the Earth or lithosphere is the source of all volcanic eruptions. There are six major plates and many smaller plates. They consist of oceanic or continental plates. The plates under the ocean are about 70-80 km or 40-50 miles thick and the plates under the continents are 100-150 km or 60-90 miles think. The plates as discussed previously are in constant motion. They either slide into one another or they pull away from each other. Intense earthquakes and volcanoes occur during this movement. The plates are spreading apart, colliding into one another, subducting or one sliding down and the other plate moving on top and sliding by one another or transforming like the faults.

These movements occur in the ocean and on land. An ocean to ocean movement is when two plates within the Earths crust move and one plate subducts or moves down under the other plate. This movement forms an island volcano. Over millions of years, the volcanic eruptions that occur under water produce islands such as Japan and Philippines. The magma then rises to the surface and forms a volcano line. This is where mountains and volcanoes are formed. (Adams, 2001)

There are basic parts of a volcano. The crater is the depression at the summit of a volcano, connected by a vent or pipe to the magma chamber below. The caldera is a crater more than 1 km in diameter formed by the summit of a volcano when lava is drained from an underground magma chamber, causing the summit to be unsupported and collapse. A pit crater is a collapsed feature on the flank or summit of a volcano that is smaller than the main caldera at the summit of a volcano. The vent is a pipe like conduit from the magma chamber to the surface. There is also a secondary vent called the fumaroles that emits steam and gas. (http://library.thinkquest.org)

Additional activities: Students would benefit from viewing a picture of the Pacific Ocean and the Ring of Fire on a map. Enchanted Learning has numerous pictures for students to view. Students would benefit from a visual map of the world to locate islands. Next the students should picture a thin ocean plate meeting a thicker continental plate. They should picture the thin ocean plate subducting or sinking down. Have the students imagine living on a beautiful island with all the wonderful landscape. Have them picture the waves, the tides and the lovely ocean air. Now tell them they may be standing on a volcano! I will have the students imagine objects smashing into each other. This outer layer is like a jigsaw puzzle in motion. One piece of the puzzle smashes into the other causing one puzzle to lift up on top of the other.

Continental Plates or Tectonic Plates

The highest place on Earth is Mount Everest in the Himalayas. Yet at the height of 29,035 feet above sea level lie rocks and fossil from the ocean floor. How did this occur? Scientists have been working on this phenomenon for many years. The formation of this mountain and others begins when the Earths' plates collided into each other. Over time, this movement formed Mount Everest and all of our landforms. (Sands, 2004)

We did not understand this information about plate movement until in 1915 when a German Scientist named Alfred Wegener proposed the notion that our continents moved and have been moving for millions of years. He thought that the continents were plowing though the oceanic crust like ships through ice. At first many people and scientists thought his idea was mistaken, and besides the similarity in the rocks and plants of South America and Africa, he had no other evidence to prove his hypothesis. Many years later, scientists proved him right by discovering that the tectonic plates were indeed moving. The name given to our old world was Pangaea or Permian Period. This land shape took place a few years ago; 290 mya (million years ago!) Students should view a pictorial to observe the differences from the Permian Period to the Triassic Period, to the Jurassic Period then Cretaceous Period and finally to the Present day. Have the students identify various continents and observe their movement. So our continents are really in constant movement! (Sands, 2004)

Oceanic: All Aboard!

Volcanoes occur on the Earth's continents and under the ocean floor. The Pacific Ocean is over 64 million square miles. That is very large! We can only see the beautiful water and waves, but under ground the ocean floor has volcanoes, mountains, hills, and valleys. The Pacific Ocean has some of the longest mountain ranges of the world. These island volcanoes have erupted for over 75 million years. Many are now extinct. They have eroded, leaving coral reef. When these mountains peak through the surface of the water, it is a volcanic island or hotspot volcano. First a volcano at the bottom of the ocean erupts. Hot lava flows into the sea. The layers pile up and sides of the volcano thicken as the lava cools. The lava cools quickly because of the cool temperature of the water. The volcano erupts often and grows higher and higher. Finally the top of the volcano rises above the surface of the water. Now an island has formed. Beautiful Hawaiian Islands and Iceland were formed this way. Mauna Loa in Hawaii is the Earth's largest volcano. Most of its shape is concealed under the ocean, approximately 90%! Mauna Loa is also capable of producing 5 million tones of lava an hour!

Types of Volcanoes

If you look carefully at a mountain, lake or any land form, they all look different. Volcanoes also look different and erupt in different ways. There are many types or groups of volcanoes but the students in my classroom will concentrate on four of the most common types. Each type of volcano will have a group of students and

after their research about volcanoes is complete, they will make a volcano of that type. There are **Shield Volcanoes, Cinder Cone Volcanoes, Stratovolcanoes or Composite Volcanoes** and **Dome Volcanoes.** For this section of the unit the student should have a visual picture of each volcano type. NASA websites and also NOVA.com have pictures of these types of volcanoes. (Abbott, 2006)

Shield Volcano

A gently-sloping volcano that emits mostly basaltic lava (very fluid lava) that flows in long-lasting, relatively gentle eruptions. Explosions are minimal. Shield volcanoes can be very big. They are the largest volcanoes on Earth that actually look like the typical volcano we all visualize. Shield volcanoes are mostly basalt which is a type of lava that is very fluid when it erupts. The gentle slopes look like an ancient warrior's shield. That is were it gets its name. The gentle slope causes the flow to run easily and therefore there is no pile up. Water somehow gets into the volcanoes vent and due to the water the eruption is very explosive for only at the first few minutes, then later it is non-explosive. An example of a shield volcano is Kilauea in Hawaii and also Mauna Loa which is the world's largest volcano!

Cinder Cone Volcano

A cone-shaped volcano, also called a scoria cone, whose steep sides are formed by loose, fragmented cinders that fall to the Earth close to the vent. They are the simplest volcanoes because they are built from particles and blobs of congealed lava ejected from a single vent. As the gas charged-lava flows through a single vent, that usually only rises up to about 1,000 feet tall. There is usually a bowl-shaped crater at the top. The gas-filled lava erupts into the air, the lava fragments into pieces. These pieces form cinders and so it gets its name from these cinder shapes. Pacaya volcano in Guatemala, Central America has many eruptions. Cinder Cone Volcanoes are also located in western North America and in the Andes, Mountains of Peru. El Mish is an active cinder volcano.

Stratovolcano Also called Composite Volcanoes. The Composite Volcanoes are the most familiar. They are tall, symmetrical and are commonly steep-slide or slope steeply toward a small crater. They are usually formed by multiply, violent and tall eruptions which add to the height of the volcano. The first initial explosion is very violent and produces very little or even no lava flow but lots of ash. That eruption is followed by huge plinian eruption that puts out lots and lots of ash. There are more composite or stratovolcanoes in the world then any other kind of volcano. Mount Shasta in California and Mt. St. Helens in Washington State are good examples of this type of volcano. Students would benefit from watching a video of the Mt. St. Helen's eruption. Both are still considered active volcanoes even though they have not erupted in a long time. A steep-coned volcano explosively emits gases, ash, pumice, and a small amount of stiff, silica lava (called rhyolite). This type of volcano can have eruptions accompanied by lahars deadly mudflows. Stratovolcanoes kill more people than any other type of volcanoes. This is because of their abundance on Earth and their powerful mudflows, pyroclastic rock and ash. About 60% of the Earth's volcanoes are Stratovolcanoes.

Dome Volcano

This volcano has thick, slow-moving lava that forms a steep-sided dome. It gets its name from the dome shape. It is also called an Acid. Eruptions are characterized by viscous lava explosions which allow lava to flow for great distance and spill over and around the vent. The increase in temperature causes the dome to expand while the outer lava cools. This growth causes the newly hardened surface to splinter, causing loose debris to fall from its sides. This appearance is the reason for its name.

After a dome volcano erupts, it may become plugged with hardening lava. The plugged vent does not allow the gas to escape and as the pressure builds, the volcano explodes again as in the case of Mono Dome in California after it's most recent explosion. There are numerous dome volcanoes in Japan. This dome volcano oozes thick lava like the toothpaste from the tube experiment the students will participate in.

Types of Lava

The two most important properties of lava are its viscosity and the amount of gas dissolved in the liquid rock. There are three types of lava flow; Pillow, Pahoehoe, and Aa. Pillow flows are the most common and occur under the ocean. The lava forms large blobs and the underwater lava hardens. Pahoehoe lava means "smooth, unbroken lava"in Hawaiian. It is thin and has a smooth flow, mostly ropey flows. There is a small volume of hot, fluid basalt. When it solidifies the content is of a smooth surface. Aa means "stony with rough lava". The flow is of viscous magma and when it solidifies it is rough or rubbery and composed of broken lava blocks. (www.volcano.und.edu.com)

Size and Types of Eruption

There are four steps or events that occur during an eruption. First melted rock moves from deep inside the Earth toward the volcano crater. Next super hot gas rises in front of the melted rock. As the melted rock comes closer to the crater, gas escapes. Students can visualize bubbles from a soft drink or soda bottle. As the gas escapes the volcano begins to erupt. Last the melted rock pushes out of the vent in the volcano. Have the students visualize the smooth flow of honey being squeezed out of a honey bottle. Now have them visualize the honey bottle clogged up with dirt, rocks, and soil. You keep squeezing the bottle as hard as you can and then, there is a very large eruption with the honey exploding everywhere!

Lava flow also differs. It is named after how it looks as it cools and hardens. Pillow lava is the most common. This form is found along the mid-ocean ridge where volcanoes ooze pillow-shaped lumps of lava through the ocean floor crack. Sometimes Pillow lava can be found on dry land that was once part of the ocean floor. (Moores, 1995)

Pahoehoe lava is runny, thin and has a very fast moving flow that is smooth. They are often formed by small volumes of hot fluid basalt. The surface of Pahoehoe lava cools quickly and forms a thin smooth skin like shape, similar to a rope. They may embrace obstacles at a rate of 50 m. an hour. Underneath the surface the lava still flows because it has not cooled yet. When the lava flow finally cools, it solidifies to a smooth surface. (Moores, 1995)

Aa lava flow moves more slowly and is not as hot as Pahoehoe lava. Aa are emitted from the vent at high rates ranging from and up to 50 km. an hour. Aa is a viscous magma and has animated bursts of energy. They may bush down houses, wall and forests. When Aa lava cools and solidifies, it forms chunks of rocks, some being very thick and rough. (Moores, 1995)

Students can discuss the three different lava flows and decide if they lived near a volcano which type of lava flow they would prefer and why. Have the students imagine lava stopping short of their town as in the Mt Etna in Sicily, Italy eruption. The lava flow stopped short of destroying thousands of homes and then have them visualize Pompeii where the enter village was destroyed and buried.

The biggest volcanic eruption recorded took place on August 27, 1883 in Indonesia. When Krakatau Volcano

erupted, it killed over 36,000 people and destroyed over 160 villages. The explosion was over 25 times as powerful as a hydrogen bomb! The deadliest volcano, Tambora, also occurred in Indonesia in 1815. The gas and lava flow killed over 92,000 people. The largest volcano is located in Hawaii's Mauna kea. It is 33,000 feet tall from base to summit. Mount Everest in 29,000 feet tall and at ground level appears taller than Mauna kea. Some of Mauna kea is under the ocean so it appears to be shorter in size. (Sands, 1996)

Other facts about volcanoes that the students will be interested in are:

· The ash from Mount St. Helen's eruption flew up twelve (12) miles into the air!
· In 1883 Krakatoe erupted and was heard over 3,000 miles away!
· In Hawaii, Kilauea lava was thrown 2,000 feet into the air!
· Molten lava temperature is 4,000 degree Fahrenheit which is twelve (12) times hotter than boiling water! That's HOT! (www.northern-stars.com)
· In 1815 Mt. Tambora, Indonesia ejection of 30 km3 of volcanic debris causing a "year with no summer". Earth temperature dropped due to the ash blocking the incoming sunlight.
· Indonesia has the most volcanoes.
· United States has about 40 volcanoes in the lower 48 States; however Alaska has over 60 volcanoes!
· 5000 BC Mt. Mazama, Oregon explosion ejected 40 km3 of debris and then collapsed in form of a caldera. It is now filled with water and is called Crater Lake!

Types or styles of eruptions are named after volcanoes. The eruption variability depends on the magma composition, the amount of water present and the volcano type. The types are Strombolian, Vulcanian, Pelean (Peleean), Hawaiian and Plinian. The Plinian eruption is the most dangerous and the most explosive! Before discussing the types of eruptions, students can view a pictorial image of each type of eruption to understand the difference at www.geology.sdsu.edu/how_volcanoes_work.com . The eruptions are listed from the smallest eruption to the largest.

Hawaiian

This eruption is considered the smallest or calmest with large amounts of runny lava. The eruptions are highly fluid basalt lava in nature with low gas content and a thin lava flow. These eruptions come out of Shield volcanoes. The eruptions are about 2 km in height. Hawaiian eruptions are named after the volcanoes in Hawaii.

Strombolian

This eruption is considered small but varies to a high eruption with small sticky lava bombs, blocks, ash and gas. The eruption has a nickname of “Lighthouse of the Mediterranean”because of the Stromboli eruptions that occur between Italy and Sicily. The eruptions are short lived with a pasty lava flow with the eruption blasting tens or hundreds meter into the air. The eruption can be viscous in basaltic lava erupting from the throat of the volcano, with a high gas pressure and booming blast. Even though this eruption is noisier than a Hawaiian eruption it is not more dangerous. The eruptions are about 10 km in height. This eruption occurs in the stratovolcanoes such as Mt. Etna.

Vulcanian

This is more explosive than the Stromolian due to the magma and rocks plugging the vents. There is large gas pressure and build up so a large eruption occurs with a large ash exploding 20 km or higher. These types of eruptions are usually precursors to Plinian eruptions.

Plinian

This explosive eruption in which a steady, turbulent stream of fragmented magma and magmatic gases is released at a high velocity from a vent. Large volumes of tephra and tall eruptions occur. The eruptions are 30 km-55km.

The volcanoes are Active, Dormant or Extinct. An active volcano is erupting or has erupted in resent time. About 20 volcanoes erupt somewhere on Earth every day. It is estimated that between 1,300-1,500 volcanoes have been active during the last 10,000 years. An active volcano is Stomboli in Italy. It has been erupting for possibly 5,000 years! A dormant volcano is active but is considered “sleeping”. It will erupt in the future. In March of 1980, Mount St. Helen awakened from a long sleep! The energy released from this “sleeping” volcano was equal to ten million tons of dynamite! An extinct volcano is expected to never erupt again. Many of these volcanoes are in the Hawaiian Islands. (Simon, 2006)

Have the students discuss which type volcano they would prefer to live near and why. Also have a discussion with them about the fact that some volcanoes are considered “Extinct” but have been known to “Explode”.

“VOLCABULARY”

This session is a play on words: Volcano and Vocabulary together! Many science books contain a glossary and or a vocabulary word index. It is critical for students to understand the importance of their usage and how to use the vocabulary word correctly. Discuss with students that the glossary will assist them in not only understanding the word, how to pronounce the word, but also will tell them on what page the vocabulary word being discussed is on. Included in this unit are the vocabulary words that the teacher might deem as most important, however when the students develop their own vocabulary puzzle, they may chose alternative relative words.

A

· Ash- Is a harsh abrasive(aggressive) type of substance made up of small rocks, mineral, and

volcanic gas blown out of a volcano when it erupts
· Active- A volcano that has erupted in recorded history or is currently erupting
· Avalanche- A large mass of falling and or sliding material

B

· Basalt- Is a type of volcanic rock. This hard dark rock is composed of about 50% silica and is often rich in iron and magnesium. Basalt is a common type of rock in the Earth's crust, but mostly found in the sea floor

C

· Caldera- Depression from a collapsed volcano-form super volcanoes
· Cinder-Small fragments of lava that are about ½ inch or 1 centimeter across
· Cinder Cone-A volcanic cone built entirely of loose fragmented material
· Composite volcano-A steep volcanic cone built by both lava flows and pyroclastic eruptions
· Continental Drift-The horizontal movement of the earth's surface causes slow, relative movements of the continents toward or away from one another
· Core-The core is the innermost layer of the Earth. It consists of iron-nickel and is under great pressure. It is very hot. The inner core is solid and the outer core is molten

D

· Dormant-Literally, "sleeping." The term is used to describe a volcano which is presently inactive but which may erupt again in the future
· Disaster-A sudden event bringing great damage, loss or destruction

E

· Eruption/Erupt-The process by which solid, liquid, and gaseous materials are ejected into the earth's atmosphere and onto the earth's surface by volcanic activity
· Extinct Volcano-A volcano that is not presently erupting and is not likely to do so for a very long time in the future

F

· Fissure- Is crack in a rock. A volcanoes fissure is from which lava erupts
· Fault- A crack or fracture in the earth's surface

G

· Gas- Is a phase of matter in which the molecules are widely separated, move around freely and move at a high speed

H

· Hotspot- Spot deep within Earth that feeds magma to the surface, forming chains of hotspot volcanoes, such as Hawaii

I

· Igneous Rock- When molten rock cools and hardens igneous rock is formed. Some igneous rocks contain granite, obsidian, basalt and andesite porphyr

K

· Kilogram- (kg) Is a unit of mass defined as the weight of one liter of water. One kilogram is equivalent to 1,000 grams or 2.2 pounds.

L

· Lava- Is molten rock coming out of an erupting volcanoes
· Lithosphere- Is the solid rocky outer part of the Earth consisting of the crust and the upper mantle

M

· Magma- Is molten rock from which igneous rock forms. Magma is formed from many types of rocks, including basalt, andesite, dacite and rhyolite
· Mantle- A layer of the Earth located between the crust and the molten core

N

· Neck-Also called the volcano plug. Is a solidified lava that fills the conduit of a volcano

O

· Ocean Plates-The earth’s crust where it underlies the oceans floor

P

· Plate Tectonics-The theory that the earth’s crust is broken into about 12 fragments (plates,) which move in relation to one another, shifting continents, forming new ocean crust, and volcanic eruptions
· Plug- Solidified lava that fills the conduit or vent of a volcano

R

· Ring of Fire-The regions of volcanoes which surround the Pacific Ocean

S

· Seismograph-An instrument that measures motion of the ground
· Shield Volcano-A gently sloping volcano in the shape of a flattened dome and built almost exclusively of lava flow
· Silica-A chemical combination of silicon and oxygen
· Stratovolcano-A volcano composed of both lava flows and pyroclastic material

T

· Tectonic Activity-The deformation and movement within the Earth's outer layers

V

· Vent- An area or opening for gas or liquid to escape or relief pressure
· Viscosity- Describes the fluidity or runniness and stickiness of the lava. The higher the viscosity, the less runny lava
· Volcano-A vent in the surface of the Earth through which magma and associated gases and ash erupt; also, the form or structure that is produced by the ejected material
· Volcanologist- Scientist who studies volcanoes and their eruptions Vocabulary words and their definitions are from Enchanted Learning.com and from various Internet Goggle resources.

What's so great about Volcanoes?

Now that we know all the bad and dangerous effects of volcanoes is there any good that comes out of their eruptions? (Sands, 2005)

· We utilize many of the items that emerge from the eruption. We use diamonds, tin and gold from magma flow. Diamonds originate in the mantle under extreme heat and pressure. Beautiful diamonds called kimberlite are formed by rising magma.
· Obsidian was used many years ago to make tools.
· Basalt which is hard lava is used today to make roads. It is also used as building materials. Sulfur is added to rubber to make it stronger.
· Dentists use Pumice to clean our teeth!
· The ash and sulfur helps farmers renew or fertilize soil. Sulfur is mixed with phosphate to make a special type of fertilizer. The workers in Java Indonesia collect sulfur crystals from the volcano

Kawah Ijen.(Moores, 1995)
· Hot-springs and Geysers warm the areas of Yellowstone and the Geysers also produce heat to generate electricity!
· Volcanoes have formed Hawaii, Iceland, the Aleutian Islands and many other small islands on Earth.
· Buried Historical artifacts and people have been discovered.

What to do if you live near a volcano!

Move! Rule number one is to stay away from active volcanoes! But if you live near a dormant volcano you and your family should have a plan. Before the volcano erupts you should have a pair of goggles and a breathing mask. Your family should have an evacuation plan.

Disasters can strike quickly and without warning. Disasters such as volcanoes and earthquakes can be traumatic for adults and even more frightening for children. A very concrete plain should be in place and everyone should remain claim. Volcanologists have been studying volcanoes now for a long time and are able to predict eruptions though signs in our Earth's motion and examining past volcanic eruptions. A Volcanologist studies a volcano every day and watches for critical signs such as increase in ash, fumes from the crater, earthquakes and even some instruments can detect volcanic activity. Once volcanic activity is detected, evaluation skills are crucial.

During the evacuation avoid flying debris, hot gas, lateral blasts and lava flow. Listen to the radio or television for directions or important information. Some directions may want you to stay in your house while other instructions may ask you to evacuate. During the volcanic eruption if there is time, put on long pants and a long sleeved shirt. If you stay inside close all windows and doors. Avoid driving in your car, but if you do drive less than 35 MPH. It is important to avoid mudflows, river valleys and low-lying areas. If able, help neighbors who are disabled, elderly or young children.

Return home if and only if it is clear of ash debris. Stay off the streets; go directly to your house. Watch for fallen objects, weakened walls, downed electrical wires and gas leaks. Once in the house, discard all food that may have been contaminated by ash. Take pictures and record damage and cost of repairs. (WWW.fema.gov/hazard/volcano.shtm)

Mount Vesuvius, Pompeii, Italy!!!

In this section of the unit, students will visit a real volcano, Mount Vesuvius. Through historical fiction books and science material they will be able to make a connection to the volcano, how it erupts and the affects volcanoes have on people and their environment. The two books I have selected are POMPEII, by Karen Ball, a Usborne Young Reading book (2006) and Discovering Pompeii by Linda Cernak (2006).

August 24, A.D. 79 started out as an average day in the village of Pompeii, Italy but ended up as a day that would be remembered to this day and probably way into the future. Mount Vesuvius, a volcano in the Bay of Naples was sleeping. No one would have ever thought that within a few hours the city of Pompeii would be buried under pumice, ash killing over 2,000 people. Vesuvius was considered a sleeping or dormant volcano for it had not erupted in over eight hundred years. No one in the villages ever gave it any thought since in their lifetime there were no eruptions or even a rumble of noise from within the Earth's crust. Mount Vesuvius is located 15 km southeast of Naples in Southern Italy. It was just a beautiful landform until that eventful day. One morning that sleeping giant awoke! Small explosions began to alarm the people in the nearby villages, resulting in ash and small particles erupting, yet no one thought much about it. Many people in Pompeii continued their daily routine. By midday the volcano erupted violently shaking the ground, filling the air with smoke and ash. Within hours, Pompeii was buried under 10-20 feet of pumice and ash. Over 2,000 people died and were lost for two thousand years. What kind of volcano was this Mount Vesuvius? It was a Composite volcano. Mount Vesuvius was a steep mountain with a big hole at the top. When it exploded, lava and ash flowed out of the crater, not in a slow stream but with great force! Ash, dust, and rocks shot out with such force and with such intensity the town would not be discovered again until March 23, 1748! (Sands, 2006)

I will have the student picture an average lunchtime when suddenly the ground begins to shake! Within a few hours dust, ash and rock enter the air crashing down on their town. Some people run towards the harbor in the Mediterranean Sea, only to die when a large wave sinks their boat. Some villagers hide in their houses only to have the roofs cave in. Fear everywhere, ash everywhere, then dark days, never to be found for hundreds of years.

At first, a few of the survivors looked for their houses and lost members of their village, but there was no sight of even a building. But in 1709 a well digger began to dig and found a building and soon it was realized that the city of Pompeii was "alive" or found! It wasn't until March 23, 1748 that the explorers and scientists realized they had found Pompeii. For over 100 years people begin digging to find treasure and art. They "stole" these important historical artifacts. In 1850's Paleontogists, scientists who study fossil and Archaeologist, scientists who study ancient artifacts, along with Giuseppe Fiorelli planned a way to uncover the ancient city. They worked together for many years discovering the historical past of Pompeii and the eruption of Mount Vesuvius. Today Pompeii stands as a testament to an ancient civilization. Students will enjoy looking at pictures of artifacts, ancient buildings and even bodies of people who suffered extreme pain as the ash and lava hardened into solid rock over their bodies.

Activity 1: Ring of Fire Book

Pair and Share, Research

Who, What, Where, When, Why Question Book

Purpose: Students will make their own Volcano Book for a Publishing Party

Procedure: Teacher will arrange the students in the class into groups. The Pair and Share Worksheet and several science research books on volcanoes will be given to them. Students will follow the directions:

1. Before reading the book, read the title and discuss with your partner/partners what the book will be about.
2. Take turns reading orally a few pages of the book.
3. Take notes in your science journal.
4. Under the WHAT, WHERE, WHEN, WHY, HOW categories write facts
5. Write key vocabulary words under each category. (Example: HOW do volcanoes *erupt* ? WHEN *lava* flows, is it moving fast or slow?)
6. Draw a picture to show an interesting or important fact about each category.

Why? Davis Street School has an event for the third and fourth marking period called Publishing Party, where students write and publish their own books. I have decided to incorporate this event into my unit.

Activity 2: "Volcabulary"

Students will gain vocabulary knowledge
Students will make their own puzzle
Purpose of this activity is for student to enhance their vocabulary knowledge to develop better oral and written communication ability.

Procedure: Teacher will supply the students with various pictures of volcanoes, lava flow, eruptions and pertinent photographs relating to the vocabulary words in the Vocabulary section. At Davis we have several large Mondo oral language pictures of volcanoes and their eruptions that my students will utilize. Have students orally discuss the pictures using the vocabulary words. Teacher can model a few words. After the students have orally expressed their knowledge of the words, they can select 15-20 words for their puzzle.

During our technology class students will utilize their laptops and visit the site; www.puzzlemaker.com. There they will enter their vocabulary words as directed and then print. The teacher will copy the puzzles and will utilize the work sheets the next day in an independent literacy lesson.

Why vocabulary words? First it is important for student to build their vocabulary usage, instead of saying “that thing” all the time! And secondly if you can’t say it you can’t write it!

Activity 3: Pompeii

Reading center: Discovering Pompeii, by Linda Cernak

Purpose of this activity is to have the students make a connection to an historical event and one that they know really happened. My students enjoy historical fictions and relate better to a book of this genre.

Procedure: During Shared Reading lesson the teacher will read orally to students and discuss events from the book: POMPEII, Usborne Young Reading Book by Karen Ball, 2006.

Day One: Chapter 1 *A Warning* pages 5-8

Comprehension questions may be answered orally or in written form: Why were the people of Pompeii not alarmed by the tremor earlier in the year.

Day Two: Chapter 2 *Vesuvius Comes Alive* pages 9-22

Comprehension question: Why do you believe the people of Pompeii were not as concerned as the old man?

Day Three: Chapter 3 *The Spirit of a Hero* pages 23-28

Comprehension question: If you could change the title, want would you change it to and why?

Day Four: Chapter 4 *Panic under Vesuvius* pages 29-45

Comprehension question: Look at the picture on pages 42-43. What facts about volcanoes are in the picture?

Day Five: Chapter 5 *1860: A City Rediscovered* pages 46-64

Comprehension question: Why is this chapter called “A city rediscovered?”

In the independent center students will write a summary of the story. Students will receive a graphic organizer to write their response prior to writing out their summary.

Why? Students have a better understanding of Social Studies and Science if they can make a personal connection and this historical fiction book supplies an entertaining story that my students will enjoy.

Activity 4 A: Eruptions Happen!

Purpose of this activity is to demonstrate what happens when a volcano erupts.

Material

- Bottle (Plastic soda bottle)
- Vinegar
- Water
- Baking soda
- Tissue paper
- Thread
- Soil
- Large pan

Procedure: This is a science experiment that should take place out side on a nice day or in a science lab where the material can be easily cleaned.

Fill a bottle halfway with vinegar. Place the bottle in the middle of the large pan. Push soil up around the bottle until just the top neck is showing. You can use different height bottles to form various volcano types. Place a tablespoon of baking soda into the center of a piece of tissue paper. Roll the paper around the baking soda to form a packet that is narrow enough to slide the neck of the bottle. Tie both ends with thread. Hang the basket inside the bottle by the thread but do not let it touch the vinegar. When you are ready, drop the packet into the vinegar, stand back and observe.

What just happened? When the vinegar reacts with the baking soda it forms bubbles and gas and pushes the “lava”out of the “volcano”. Have students record their observation in their science journal.

Activity 4 B: Shifting

Purpose of this activity is to demonstrate how the continental separations work and to explain the Pangaea. The plates will start out together and then will brake apart to form Earth's plates.

Materials

· Cookie sheet
· Dirt, 2 cups (0.5 liter)
· Bowl, 1 qt. (1 liter)
· Spoon

Procedure: Have the students work together in small groups. Pour the dirt into the bowl. Add water and stir with the spoon until you have a thick mud. Pour the mud into the cookie sheet. Set the pan of mud in the sun for 2 to 3 days. After 2/3 days, push down around the sides of the dried mud. What you will observe is the surface of the dried mud cake crack. The mud is broken into pieces with jagged edges and all the pieces fit together.

Why did this happen? The continents of the earth like the mud cake, looks like large jigsaw-puzzle pieces. The coastlines of the continents have irregular shapes that appear to fit together. In the past, pressure within the earth may have broken a large land mass into pieces that now form the separate continents on the Earth. (Van Cleave, 1991) Have the students view a picture of the Continental Plates to compare.

Activity 4 C: Continental Drift

Purpose of this activity is to demonstrate to the student that the ground beneath their feet is slowing moving, and sliding like the Earth's continents.

Materials

· World map cut out cards (each continent)
· Globe and world map
· Scissors

Procedure: Cut the seven continents out of a world map print out. Explain to the students that Europe and Asia are two continents but form one land mass. Arrange the pieces on a table in front of each student just as they were before they were cut apart. Compare the globe view to view on the table. Push the pieces slowly toward one another until they “fit” together into one large land mass.

What did you notice? Ask the students if they continents fit together? Explain to the students and have them also do research on the German meteorologist Alfred Wegener.

He worked on the theory of continental drift. He believed that the continents were once connected but broke apart millions of years ago.

Activity 4 D: Squirt!

Purpose of this activity is to demonstrate the action of a shield volcano.

Materials

· Pencil
· Half-empty tube of toothpaste

Procedure: Hold the toothpaste tube in your hands. With the cap screwed on tight, push the tube to force the toothpaste toward the capped end. Now use the point of the pencil and make a hole in the tube near the cap. Watch the toothpaste slowly emerge from the hole and flow down the side of the tube. The pressure from the students fingers forces the liquid toothpaste out of the opening.

Why did this happen? Tremendous pressure within the Earth forces liquid rock called magma out of cracks or weak spots in the Earth’s surface. The liquid rock is called magma when it is within the Earth but it is called lava once it reaches the surface. The lava cools and hardens on the surface, forming a mound of rock around the opening. A new layer is added to the mound with each eruption. This layered mount is called a shield volcano. Shield volcanoes are long with gentle slopes, layers of lava that pile up over many years. The crust beneath a Shield volcano has been forced down by their incredible weight. Shield volcanoes in Hawaii are the biggest volcanoes on Earth, formed by lava piling up over hundreds of thousands of years. (Van Cleave, 1991)

Activity 4 E: Collision!

Purpose of this activity is to show students what happens when two plates collide. When two plates run into one another or collide, they usually push up a mountain range. The line where the two plates meet is called the fault line. The plate on top piles up into mountains and the plate on the bottom is pushed down into the

mantle where it is melted into new rock.

Material

· 4-6 cloth towels

Procedure: Stack several cloth towels flat on top of one another, matching the edges along one side. Different colored towels make it easier to see the layers. Place one hand at each end of the towel. Slowly push the ends toward one another. What happened? Have the students record their observation. Restack the towel in a flat pile. Repeat the

experiment, but this time; do not press the towels directly toward one another, but at an angle, pushing one slightly toward and the other slightly back.

What just happened? Students should record their observation.

Activity 5: Ring of Fire: The Musical

Purpose: Davis Street Magnet School is an Art and Music school. My unit will embrace reading, writing, science, social studies, art and music. I will coordinate with our music teacher and our band instructor to teach my students the song, “Ring of Fire”by Johnny Cash. If any of my students are in the Davis Street Marching Band, I will consult with the band teacher. If I have no students in Band, we will learn the song only!

Procedure: After consulting with the music teacher and band teacher, my students will receive copies of the lyrics and will listen to the song on the computer or from a CD.

Why? Mondo reading has a program where singing songs helps students with their memory, oral language and reading. Following the words as they sing helps students with their reading, word retrieval and fluency.

Why! The unit is called Ring of Fire!!

References:

Teacher resources

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Adams, Simon, *The Best Book of Volcanoes,* Kingfisher, Boston, Mass., 2002. Great resource for both teachers and students. Explains

the types of volcanoes.

Emiliani, Cesare, *And The Scientific Companion: Exploring the Physical World with Facts, Figures and Formulas,* Second Edition, Wiley Popular Science, New York, New York, 1995. Book used for the seminar.

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Howell, Laura, *The Usborne Internet-Link Library of Science: Earth and Space,* Scholastic Inc., New York, New York, 2002. Excellent internet connection with activities for students.

Moores, Dr. Eldridge, *Discoveries: Volcanoes & Earthquakes,* Barnes and Noble, New York, New York, 2003. Great resource for teachers, with pictures to help students visualize eruptions.

Rooney, Anne, *DK experience: Volcano* , New York, New York, 2006. Great information about volcanoes, types of lava, Pompeii and includes a fold out poster of volcanoes.

Sands, Stella, *Kids Discover: Volcanoes,* Volume 15, Issue 5, New York, New York, 2005. Best resource for teacher and students on a higher level.

Sands, Stella, *Kids Discover: Pacific Rim,* Volume 9, Issue 3, New York, New York, 1999. Information about the Pacific, Ring of Fire and under water volcanoes.

Simon, Seymour, *Volcanoes,* Smithsonian, New York, New York, 2006. Real pictures to shoe volcano lava flow, eruptions and types of volcanoes, both of teachers and students.

Van Cleave's, Janice, *Earth Science for Every Kid: 101 Easy Experiments that Really Work,* John Wiley & Sons, Inc., Canada, 1991. Great hands-on projects to incorporate in a science center, easy directions and good explanation.

Student resources

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Hort, Leonard, *Ring of Fire,* Newbridge Discovery Links, 2002. Great resource for students with a great glossary page for the vocabulary section.

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Simon, Seymour, *Volcanoes,* Smithsonian, New York, New York, 2006. Real pictures to shoe volcano lava flow, eruptions and types of volcanoes, both of teachers and students.

Internet resources

http://teacherplanet.com/resource/volcanoes.php

http://enchantedlearning.com/subjects/volcano/

http://vulcan.wr.usgs.gov/home.html

http://nationalgeographic.com/forcesofnature/interactive/index.html

http://science.howstuffworks.com/volcano.html

http://volcano.und.edu/vwdocs/movies/movie.html- Movie about volcanoes for students to view.

http://pubs.usgs.gov/gip/volc/types.html

http://library.thinkquest.org/17457/volcanoes/index.php

http://www.cotf.edu/ete/modules/volcanoes/vsizeserupt1.html this is a great website for teacher and student.

http://www.educ.uvic.ca/faculty/mroth/438/VOLCANO/TYPES.html has great information about the types of volcanoes.

http://facstaff.gpc.edu/~pgore/geology/geo101/volc.htm this is a great resource site for types of volcanoes along with pictures and activities.

http://volcano.und.edu/vwdocs/frequent_questions/grp1/question112.html answers questions about lava flow.

http://www.cotf.edu/ete/modules/volcanoes/volcano.html

http://volcano.und.nodak.edu/vwdocs/glossary.html excellent website for the vocabulary section of the unit.

http://www.nationalgeographic.com/forcesofnature/interactive/index.html?section=v

video and great visual of volcanoes and their eruptions.

http://www.homeschoollearning.com/units/unit_09-24-01.shtml

Resources about Pompeii for teachers and students

Ball, Karen, *POMPEII* , Usborne Young Reading, Usborne Publishing Co., London, England, 2006.

Cernak, Linda, *Discovering Pompeii* , Informational Nonfiction, Macmillan/McGraw-Hill, New York, New York, 2006.

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