Grade 7 Program: The Earth's Crust

"Our Lessons Really Rock!"

Scenic Caves Nature Adventures

Scenic Caves Nature Adventures Education Program 2002

Scenic Caves Nature Adventures

Teaching Strategies and Learning Activities

Lesson #1

- ✓ Introduce the composition of the Earth's crust.
- ✓ Complete worksheet on the Earth's crust.
- ✓ Assign Classifying Rocks worksheet.

Lesson #2

- ✓ Collect the Classifying Rocks worksheet.
- ✓ "*Simulating Plasticity*" experiment.
- ✓ Record the results of the experiment

Lesson #3

- ✓ Introduce how earthquakes happen.
- ✓ Introduce the Richter scale.
- ✓ Assign earthquake questions.

Lesson #4

- ✓ Correct the earthquake questions.
- ✓ Visit the library and do the Earthquake research activity.

Lesson #5

- ✓ Correct the Earthquake research activity.
- ✓ Introduce the concept of Natural Disasters.
- ✓ Choose one of the Natural Disaster activities to assign.

Lesson #6

- ✓ Collect the Natural Disaster activity.
- ✓ Divide the class into small work groups. Divide the vocabulary words among these groups.
- ✓ Students search for the meanings of the words to present to the class.
- ✓ Present the information found.
- ✓ Hang the information around the room.
- ✓ Assign the vocabulary worksheet.

Lesson #7

- ✓ Correct vocabulary worksheet.
- ✓ Assign first set of research questions from the introductory package from Collingwood Scenic Caves (*Day 1)*.

Lesson #8

- ✓ Correct *Day 1* Caves' questions.
- ✓ Work on Internet Scavenger Hunt activity for Collingwood Scenic Caves.
- ✓ Assign *Day 2* Caves' questions.

Lesson #9

- ✓ Correct *Day 2* Caves' questions.
- ✓ Continue work on Internet Scavenger Hunt.
- ✓ Work on True/False worksheet.
- ✓ Assign *Day 3* Caves' questions.

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Lesson #10

- ✓ Collect Internet Scavenger Hunt and True/False worksheet.
- ✓ Correct *Day 3* Caves' questions.
- ✓ Work on *Day 4* Caves' questions.
- ✓

Lesson #11

- ✓ Collect *Day 4* Caves' questions.
- ✓ Field Trips to Collingwood Scenic Caves. **Please remind students to bring field-trip kit with them.**

The Earth's Crust

Introduction

It's hard to believe that while we rest comfortably on one of the world's most stable areas, people dodge the dangers brought about by earth-shattering earthquakes and sudden-impact volcanoes. Even with the development of more sophisticated detection equipment, natural disasters continue to take their toll on the world. So, why do we remain so apparently unaffected by these "earthly" events? Has there ever been a volcano in Canada? What in fact caused the formation of the Niagara Escarpment? Has there ever been a time when the Canadian Shield (so solid that scientists investigated burying radio-active materials in this rock) was not so solid? This unit will allow students to review rocks and minerals and then take them one step further - to investigate how earthquakes, volcanoes and landslides continue to have an impact on our changing world.

Student Demonstration

Students will use the computer to help update themselves about current geographic events related to volcanoes and earthquakes. They will trace the behaviour of one active volcano from the news and define what measures have been taken by authorities in order to moderate the devastating effects of the volcano. This information is available through either www.bconnex/~lepages/educate or www.discovery.earthalert.com. Students will then ask the question. What economic impact has this event left on the area? How has this event hurt the community, and how has it helped the community? Both long term and short term effects will be considered. Further investigations about the Niagara Escarpment itself will lead students to discover the economic benefits that are being harvested by aggregate companies in the area. Students must take sides on the issue of *"aggregate harvesting"* along the Niagara Escarpment and have the option of presenting their report to the Niagara Escarpment Commission or to the Ministry of Natural Resources.

Program Areas

Science and Technology, Geography, Language, Math

Vocabulary

rock, mineral, calcite, sedimentary, magma, volcano, earthquake, granite, limestone, plate tectonics, Pangaea, core, mantle, crust, fossil, strata, crystallization, igneous, weathering, transportation, core sampling, seismography, magnetometry, satellite technology, Middle Silurian period, Upper Ordovician, dolomite, magnesium, shale, sandstone, biosphere reserve, glaciers, watershed, Paleozoic Era, cap rock, Pleistocene,

Background Information -Rocks

Different rocks have different characteristics which allow us to tell them apart from one another. We have thousands of different classification systems: hard or smooth, rough, soft, shiny or dull. But what has caused them to be so different in the first place? Every rock is made from minerals. (Minerals are solid chemical substances) Rock is like cake in that it is "*baked*" from the combination of raw ingredients. In the case of a cake, the ingredients are flour, water, eggs. In the case of rock, the ingredients are minerals. What sets one type of cake apart from another is its distinctive additions - chocolate, bananas, nuts or cherries. What sets one type of rock apart from another are its distinctive array of minerals.

There are three basic types, or classes, of rock which are based on how the rocks were formed: ***igneous, sedimentary and metamorphic.***

Igneous Rock

Igneous Rock forms from cooled and hardened magma or lava that has escaped through volcanic vents (holes) in the earth. If the magma from the volcano escapes to underground holes that exist, it will take longer to cool, allowing the mixture to *"settle"*. This type of eruption is called *"intrusive"*. The Canadian Shield was formed from intrusive eruptions. As a result, these rocks have large crystals. An eruption that occurs outside of the earth's crust, is called *"extrusive"*. The lava is exposed to the outside atmospheric temperatures and is able to cool off quickly. The crystals that are formed as a result of rapid cooling are quite small.

Have you ever noticed that sometimes ice- cubes are cloudy and sometimes, they are clear? The difference is in the time that the water has taken to freeze. The longer the water takes to freeze, the more time the trapped air bubbles have to escape. A quick freeze traps the air inside the water (ice) and creates a cloudy appearance. This process is similar to the "clarity" of igneous rock. The word igneous means *"fire"* in Latin. Two common forms of this type of rock are granite and obsidian. Other examples include basalt and pumice.

Rocks are being continually worn down by wind and rain. Tiny grains of dirt, sand, mud and clay are worn off the rock and washed into streams, rivers, lakes and oceans where they settle to the bottom of the water. This is known as *"sediment"*. Minerals in the water mix with tiny sea animals and plants as they die and sink to the bottom of the water. These, then also become part of the sediment. Thus, sediment is composed of bones, leaves, teeth and other things that drop to the bottom of a lake or an ocean. The sediment builds up over years and finally after thousands and millions of years we end up with a really deep pile of sediment - to form the second type of rock: **sedimentary rock**.

Sedimentary Rock

This type of rock is usually found near rivers. Sandstone is sedimentary rock. Other examples include Limestone, Jasper, Gypsum, and Conglomerate.
The third type of rock is **metamorphic.**

Metamorphic Rock

Metamorphic means *"changed in form".* These rocks were once a different kind of rock. Examples include Quartz, Amethyst, Marble, Slate, Gneiss, Graphite and Coal. The rock was somehow buried beneath the surface of the earth where it was then exposed to heat and pressure for millions of years. Limestone (sedimentary rock) can be changed to marble and sandstone (sedimentary) can be changed into quartzite, also shale can be changed to slate. One type of rock *"metamorphoses"* into another type of rock.

Background Information - Minerals

Minerals are inorganic (non-living) substances that are made from the same chemicals and have the same crystal shape. The colour of a particular mineral is determined by what is mixed in with the mineral. Some are mixed with a metal that has a luster - this causes the mineral to shine. Minerals that do not contain metals look dull. More than four thousand minerals have been discovered including gold, silver, platinum, copper and diamond.

Geologists use the physical properties of a mineral to identify it in the field. These properties include colour, streak, luster, cleavage, specific gravity, and hardness.

A scratch test developed by a German mineralogist named Fredriech Mohs in 1822 is used to determine hardness. Hardness is measured on a scale of 1-10 by how easily a mineral can be scratched. Soft minerals which are more easily scratched are given low numbers. Hard minerals are given higher numbers.

Another way minerals are classified is by doing a streak test. The streak of a mineral is the colour of its fine powder.

Background Information - Fossils

Fossils are the remains of plants and animals that are found in rock. Some fossils are the actual plant or animal remains that have been mineralized. This process occurs when the original materials in an organism are replaced by minerals. Other fossils are impressions made in soft sediment by organisms, such as the tracks of animals left in mud.

Fossils are found most often in sedimentary rocks. The processes that create igneous rock and metamorphic rock usually destroy any pre-existing fossils.

Coal, oil, and natural gas are fossil fuels that are the remains of prehistoric plants and animals. These organisms died and were trapped beneath layers of sedimentary rock and lost most of the minerals they contained, leaving mostly carbon. The remaining carbon was heated to form fossil fuels. We use fossil fuels for fuel, heat, and in the production of synthetic materials such as plastics and fibers such as nylon, orlon, and dacron.

The Earth's Crust - in the beginning

The Earth was probably born from clouds of gas and dust thrown out by the Sun. The dust and gas began to spin around its own axis and formed a ball. At the centre of the ball was molten (melted) iron. The surface emitted superheated gasses: carbon dioxide, nitrogen and water vapour. As the heat escaped, the planet began to form and the molten rock developed a crust - similar to the crust that is formed on baked bread. Volcanoes released the molten rock that was trapped below the crust. Meteorites that stuck to the surface also punched holes in the crust where molten rock could escape. The lightest materials floated to the surface: gasses and water vapour escaped with the molten rock and then condensed to form clouds. These clouds existed for thousands of years - and with them came global rain storms. Thus the formation of the world's oceans. As the world cooled and the crust thickened, continents were formed from the lightest materials. The heaviest materials remained in the middle - iron remains at the core. Today, the world is still evolving. Cracks in the crust continue to grow and change. It is through these cracks that magma is released in the form of volcanoes.

Structure Of The Earth

The earth is made up of three layers. Covering the outside of the earth is a thin, solid layer called the *"crust".* The thickness of the crust differs from place to place. The parts of the crust that make up the sea floor are from 4-7 km thick. Under the continents, the crust is about 35 km thick and beneath some mountains, the crust is as much as 70 km thick. We know more about the crust than any other layer because we can see rock and soil. However, the crust makes up only one percent of the earth's volume.

Beneath the crust is a very thick layer called the *"mantle".* The mantle reaches to a depth of about 2,900 km beneath the crust. It makes up about 80 percent of the earth's volume and represents almost two-thirds of the earth's mass.

Deep in the earth's centre is a very dense core. It is made up of a solid inner core surrounded by a liquid outer core. The core makes up 19 percent of the earth's volume and nearly one-third of its mass. Of all the substances commonly found in the earth, only a mixture of iron and nickel is dense enough to account for the denseness of the core.

The crust is broken into distinct pieces, called *"plates".* These plates float on the molten material below. Since the molten material is a liquid, it moves. As a result, the hard crust floating on top is also subject to movement. The shifting of the plates is called *"plate tectonics".*

There are about ten plates that make up the crust of the earth. The plates lie very close together, but they can move in response to the pressure from built-up heat and gasses in the interior. The crust's plates sometimes push against each other, move apart, or slide past each other. This motion causes the earth to literally shake. The shake is called an *"earthquake".* This same pressure can also cause volcanoes.

Volcanoes are located above a pool of magma. The magma generates heat and gasses which become so great, that they must find a way to escape. The pressure can cause the land to swell.

Shield volcanoes form wide gently sloping mountains and islands. They have mild eruptions where thin runny lava oozes out of vents or cracks. They look like huge overturned shields. Sometimes shield volcanoes erupt under the ocean, and then they are built higher and higher until they form islands.

Cinder cones look like lamp shades. During their fiery outbursts, lava and ash go miles into the sky through a crater, a bowl-shaped crack.

The third kind of volcanoes are called *"volcanic domes".* They are a combination of a shield volcano and a cinder cone. First they erupt quietly with thin runny lava, then they erupt violently with lava, cinder and dust. Volcanic domes form towering mountains like upside down ice cream cones.

Continental Drift

At one point in earth's history, all the continents were attached as one super-continent known as *"Pangaea"*. Over a very long period of time, the pressures inside the earth that caused earthquakes and volcanoes cracked the crust of Pangaea, dividing it into several plates. The motion of the mantle and build up of gasses and heat caused the plates to continue to move apart and finally caused Pangaea to break into smaller pieces. These pieces are today's continents. This motion is called continental drift - which continues to change the location of the plates even today.

There are several interesting things that have been discovered that support this theory of the existence of Pangaea. The same fossils, for example, that are found in Africa are also found in South America. Since these animals could not have crossed the Atlantic Ocean, the two continents must have been joined at one time. Further, the shape of the east coast of South America fits like a piece of a puzzle into the west coast of Africa.

Technology

As the world's population grows, more and more people are being forced to live in potentially dangerous volcanic areas. Volcanic eruptions continue regardless of human habitation. This inhospitable co-existence poses ever-greater threats to life and property.

Mt. Rainier looms over the Seattle/Tacoma area, endangering a population of more than three million people. South of Mexico City, *Popocatépetl* has come to life again, putting a million nearby residents at risk. Another million people living in the Naples area are threatened by *Mt. Vesuvius's* continued unrest.

It is possible that these volcanoes will erupt once again - will people be able to flee before being harmed or killed by the volcano? Past eruptions can sometimes provide clues as to future behaviour. Thus, scientists look to find clues about past eruptions by studying the deposits left behind. Areas affected by lava flows, debris flows, tephra, or pyroclastic flows can be mapped, making disaster planning more effective. Further, scientists are becoming more and more skilled at spotting the warning signs of an eruption.

Before an eruption, magma moves into the area beneath the volcano and collects in a magma chamber, or reservoir. As it comes closer to the surface, as previously mentioned, the magma releases gasses. These particular events offer clues about the likelihood of an eruption. For example, the movement of magma produces small earthquakes and vibrations (seismicity). Magma gathering in a chamber causes slight swelling of the volcano's slopes. Gases released near the volcano can be measured for changes in quantity and makeup.

Erosion

Our landscape appears stable, but in fact, is subject to massive changes. Rocks are slowly crumbling. Winds grind down rocks. Fields are losing their soil. Water carries away sediment and deposits it somewhere else. The earth's surface is changing all the time. Water, wind, and ice are constantly at work, wearing away and building up the land.

Some changes take place in a very short time. Floods can change the course of a river in a few days. Dust storms can carry huge amounts of soil away very rapidly. However, most of the big changes in the earth's surface take thousands of years. At various times, the earth is exposed to along periods of extreme cold followed by periods of intense heat. Parts of the land we see now, were once under water. *The Niagara Escarpment*, for example, was once the shore of a shallow salt-water lake. The area to the west of the Escarpment was covered with water.

Some of these erosive changes are chemical, while others are physical. *Chemical* weathering (*acid rain*) causes chemical changes in the minerals of a rock. It usually proceeds more rapidly in warm, moist climates. *Physical* weathering occurs when rocks are reduced to smaller fragments without being changed chemically and it is more likely to occur in cooler, more dry climates. Among the physical processes of weathering are ice, water, wind, and changes in temperature.

Collingwood Scenic Caves demonstrates excellent evidence of physical weathering. Cracks in the rocks let air and water in. Weathering then goes on inside the rocks as well as on the outside. Water begins its eroding and dissolving action. When freezing occurs, the expansion of the water exerts tremendous pressure. This causes the rock mass to break into smaller pieces. This is the rock that is found at the bottom of the rock face.

Wind is a powerful erosive agent. Grains of blown sand can act like tiny chisels, scratching and scraping whatever surface they strike. In a sandstorm, cars can have their paint worn off in minutes.

Ice is another kind of erosive element. The glaciers moved incredible amounts of rock and soil. Over much of the southern part of our country is a layer of soil and rock that was not formed there. In some places this layer is 500 feet deep. This soil came from somewhere else. Huge glaciers, moved down from the north and then melted. They brought with them many cubic miles of rock, sand, and clay. As these glaciers moved along, they picked up rocks and ground them into fragments against one another. Rock particles embedded in the lower levels and sides of the glaciers scoured rock powder from the bedrock of the glacier's path. When the ice melted, the rock fragments and powder were either immediately deposited or carried away many miles by water flowing from the glacier. As the glaciers moved they also smoothed off hilltops and filled in valleys. Niagara Falls has its present form because of them. They also formed the Great Lakes and countless smaller lakes.

Erosion can also be caused by non-natural forces. Agriculture, construction and logging remove ground cover, which speeds the process of soil erosion. This causes two types of problems. First, the loss of soil impacts the land's ability to support plant life. Without plants, animals will not move into the area, and those already in the area will starve. Second, the soil that is eroded away ends up in the water. Millions of tons of sediment are added to bodies of water each year, as are the fertilizers, pesticides and other pollutants the sediment carries with it. This additional sediment changes the aquatic ecosystem, affecting the plants and animals in the water.

Landslides and *mudslides* are yet another form of disaster that has increased in frequency as a result of erosion due to the logging industry. Without trees to slow the flow of water down a hillside, the soil has nothing to hold it in place. In Bangladesh, a large amount of soil is lost to the ocean on a regular basis.

Soil

Soil is the result of the process of the gradual breakdown of rock - the solid geology that makes up the earth. As rock becomes broken down through a variety of processes, such as weathering and erosion, the particles become ground smaller and smaller. There are considered to be three main parts to soil; *'sand', 'silt'* and '*clay'.* These parts give the soil its mineral texture. In addition, as leaves and other organic material fall to the ground and decompose - there forms an '*organic'* layer.

Soil, like freshwater, is vital to many of Earth's ecosystems. Scientists estimate that each year the world loses about 11 million hectares of arable land (land that could be used for growing plants). Non-agricultural use of farmland, contaminant entering the soil, desertification and erosion are some of the causes. In the Western Province, erosion affects 12 percent of farmland. Loss of farmland in the United States may drastically reduce grain exports by the middle of the next century.

Nearly 90 percent of all trees harvested in Canada is done by clear-cutting, which exposes the soil to wind and water erosion.

Urban development replaces over one million hectares of farmland a year in North America. Today we need to learn how to reverse the damage that erosion has caused in many countries as a result of human interferences.

A number of tools can be used to record these warning signs. *Seismographs* can detect small earthquakes while *tiltmeters* and *geodimeters* can measure any slight swelling of a volcano. *Correlation spectrometers* (COSPECS) can measure amounts of sulfur dioxide--a gas that is released in increasing quantities before an eruption. Using these and other tools, it's possible to closely monitor activity at an awakening volcano.

Volcanologists are becoming more skilled at predicting the likelihood of an eruption. It remains, however, very difficult to pinpoint exactly when an eruption will occur. Often, moving magma doesn't result in an eruption, but instead cools below the surface (intrusive eruption).

Monitoring potential eruptions is expensive. With many volcanoes erupting only every few hundred or thousand years, it's not possible to monitor every site.

How Earthquakes Are Measured

A seismometer senses the earth's motion. From this record, scientists can calculate how much energy was released in an earthquake, which is one way to determine its magnitude.

Richter Magnitude is the scale most people are familiar with, but scientists use other more accurate scales. Another nonscientific way of measuring earthquakes is by their intensity or degree of shaking. Intensity is descriptive, and is determined by inspection of damage and other effects, with the greatest intensity being close to the *epicenter,* and smaller intensities further away.

The Modified *Mercalli* Intensity Scale is most commonly used. It uses Roman Numerals from I to XII to describe different earthquake effects.

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Name: _____

The Earth's Crust

- At the centre of the Earth is its **core.** The core is very hot and is about *3550* km in diameter.
- The core is surrounded by the **mantle.** The mantle is not as hot as the core, but it is hot enough to melt rock. It is made up of **magma.**
- Magma escapes from the mantle when a volcano explodes. Some magma is always moving outwards and presses against the Earth's crust.
- The Earth's crust has been broken into massive plates. The plates constantly move resulting in such things as earthquakes.

Make a diagram of the Earth using the following instructions

1) Draw a circle with a radius of 10 cm for the Earth's **crust.**
2) Draw a circle with a radius of 6.5 cm inside the crust for the **mantle.**
3) Draw a circle with a radius of 3.5 cm inside the mantle for the **core.**
4) Label the **crust, mantle** and **core.**

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Classifying Rocks

Consider the following features of rocks. Beside each classification, write at least two descriptions of the rock.

1) **Appearance:** (shape, size, texture)

_____

2) **Colour**

a) Dry _____

b) Wet _____

3) **Weight:** _____

4) **Hardness**

Scratch test _____

(If your rock can be scratched by a fingernail, write very soft in the box for rock one. If the fingernail did not scratch the rock, try the penny. If the penny makes a scratch, write soft. If there is still not a scratch mark, try the steel nail. If it leaves a scratch, record hard. If there is not a scratch, record very hard.)

Other observations: (location the rock was found, any similar rocks surrounding the area.....etc.)

_____

_____

_____

Simulating Plasticity

Problem: How can the property of plasticity be shown?

Objective: In this activity, students will use a cornstarch-and-water mixture to simulate the plasticity of the earth's mantle.

Materials: Each group of students will need 15 grams of cornstarch, 10 millilitres of water,2 small beakers, a metal stirring rod or spoon, and an eyedropper.

Procedure:

A) Place the 15 grams of cornstarch into one of the beakers. In the other beaker place 10 millilitres of water. Is the cornstarch a solid, liquid, or gas? The water?

B) Using the eyedropper, gradually add one eyedropper-full of water to the cornstarch. Stir the mixture.

3) Continue adding water, one eyedropper-full at a time. Stir the mixture after each addition. When the mixture becomes difficult to stir, do not add any more water.

D) Try to pour the mixture into your hand. Is the mixture a solid, liquid, or gas?

5) Try to roll the mixture into a ball. Does the mixture act like a solid, liquid, or gas?

F) How is the cornstarch-and-water mixture similar to the Earth's mantle? How is it different?

Answers: Students will be able to observe that cornstarch mixed with water behaves like a solid and a liquid, depending on how much pressure is applied to the mixture. When they squeeze it in their hand or roll it into a ball with consistent pressure, it has the characteristics of a solid. When they release the pressure, the mixture flows like a liquid. The trick to achieving this effect is in adding just the right amount of water to the cornstarch.

Earthquakes

Answer the following questions using complete sentences.

1) What is the definition of an earthquake?
2) What causes most earthquakes?
3) Where are earthquakes likely to occur?
4) How many earthquakes happen each year?
5) What was the greatest number of people killed in one earthquake?
6) What does the Richter Scale look like?
7) Does the ground really open up and swallow people?
8) Do earthquakes cause volcanoes?

Answers to short questions.

1) An earthquake is the sudden, sometimes violent movement of the earth's surface from the release of energy in the earth's crust.

2) The crust of the earth when it is subject to tectonic forces, bends slightly. But, because the crust is rigid, when the stress or pressure exceeds the strength of the rocks, the crust breaks and snaps into a new position. Vibrations called seismic waves are generated and travel both through the earth and along its surface. These seismic waves cause the movement we call earthquakes.

3) Within areas of the crust are fractures, known as faults, along which two crustal blocks have slipped or moved against each other. One block may move up while the other moves down, or one may move horizontally in one direction and the other in the opposite direction. Geologists and seismologists (scientists who study earthquakes and the processes that create them) have found that earthquakes occur repeatedly at faults, which are zones of weakness in the earth's crust.

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4) There are over a million quakes annually, including those too small to be felt.

5) An earthquake in China in 1556 killed approximately 830,000 people.

6) The Richter Scale is not an actual instrument. It is a measure of the amplitude of seismic waves and is related to the amount of energy released. This can be estimated from the

recordings of an earthquake on a seismograph. The scale is logarithmic, which means that each whole number on the scale increases by 10. A magnitude 6.0 earthquake is 10 times greater than a 5.0, a 7.0 is 100 times greater, and a magnitude 8.0 is 1,000 times greater.

7) This is an earthquake myth. Cracks and fissures appearing in the ground are a common effect of earthquakes. Most of these are narrow and shallow. In very large earthquakes changes in the level of the land can result in larger cracks that can cause a lot of damage to buildings, but people and buildings do not get swallowed by the ground.

8) No, there are different earth processes responsible for volcanoes. Earthquakes may occur in an area before, during, and after a volcanic eruption, but they are the result of the active forces connected with the eruption, and not the cause of volcanic activity.

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Name: _____

The Richter Scale

Strength *Estimated Damage*

1.0-3.4 Not felt at the Earth's surface.*3.5-4.8* No damage done, but tremors felt.4.9-6.1 Slight to moderate damage expected.6.2-6.9 Widespread building damage expected.

Strong enough to bend rail tracks and bridges. Serious damage

expected.

Very great damage over a wide region.

Would cause damage in many parts of the world.

corded) Would affect the entire Earth.

Earthquake Activity

1. Make a list of 7 known earthquakes.
2. Rank them according to severity on the Richter Scale.
3. Graph your results.

Teacher Resource on Earthquakes and Volcanoes

The following is a list of Earthquakes and Volcanoes your students may study for the Natural Disasters or Richter Scale activities.

Earthquakes

Year/Location	*Richter Strength*
1906 / San Francisco	7.9
1964 / Alaska	9.2
1970 / Peru	7.7
1967 / Guatemala	*7.5*
1976 / China	8.2
1978 / Iran	7.7
1994 / Los Angeles	6.7
1995 / Kobe, Japan	7.2
1995 / Neftegorsk, Russia	*7.5*

Volcanoes

Name of Volcano	*Location*	*Year*
Vesuvius, Pompeii	Italy	79
Krakatoe	Indonesia	1883
Pelee	Martinique	1902
Vestmannaeyjar	Heimnaey	1972
Saint Helens	USA	1980

Name: _____

Natural Disasters

In small groups, research some natural disasters (volcanic eruptions, earthquakes) that have had major impacts in the world. Complete a fact to present to the other groups.

Disaster:_____

Date of disaster: _____

Place of disaster: _____

Number of deaths due to disaster: _____

Damage done by disaster: _____

_____

_____

_____

_____

_____

Other interesting facts about the disaster:_____

_____

_____

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Name: _____

Natural Disasters

When we look at the headlines in a newspaper, many of them announce disasters that have occurred. A **disaster** is an event, often of a sudden nature, that results in property damage or loss of life.

A natural hazard that can be of a sudden nature can be: an earthquake, a tropical storm (hurricane, cyclone, tornado, typhoon), volcanic eruption, forest fire, flood, avalanche, landslide, or a mudslide.

Some disasters develop more slowly. These types of disasters are: drought, ecological harm (such as acid rain, air pollution, over fishing, clear cutting of forests etc.) or rising water levels.

Still other disasters are considered human-caused. These may include major fires, wars, or accidents (such as airplane crashes, oil spills, mine explosions etc.).

A **natural disaster** is a natural event that causes great loss of life and major property damage.

1. Using the attached list of **Selected World Disasters,** rank the top ten world disasters according to death tolls.

2. Compare the top ten disasters you have found using either:
    a) vertical bar graph,
    b) horizontal bar graph, or
    c) a circle graph.

3. Which natural disasters are most numerous? Which are most disastrous?

Earth & Space Systems - Gr. 7.....22

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Name:

Selected World Disasters*

Year	*Disaster/Location*	*Death Toll*	
79	volcano, Pompeii	2000	1556
earthquake, China	830 000	1669	
volcano, Sicily	20 000	1737	
earthquake/tornado, India		300 000	1755
earthquake, Lisbon	60 000	1865	steam
boat explosion, U.S.A.		1 653	1871
forest fire, Wisconsin		1 200	1883
volcano/tidal wave, Indonesia		36 000	1887
river flood, China	900 000	1889	burst
dam, U.S.A.	2 200	1900	
hurricane, Texas	6 000	1902	
volcano, Martinique	38 000	1912	
Titanic sinks	1 500	1917	
explosion, Halifax	1 653	1920	
earthquake/landslide, China		200 000	1923
earthquake, Japan	142 802	1962	
avalanche, Peru	3 500	1963	
volcano, Bali	1 022	1963	
hurricane, Caribbean		6 000	1970
cyclone/tidal wave, Bangladesh		266 087	1972
earthquake, Nicaragua		5 000	1976
earthquake, Guatemala		23 000	1976
earthquake, China	240 000	1978	
earthquake, Iran	15 000	1979	
hurricane, Caribbean		2 068	1980
earthquake, Algeria		5 000	1980

earthquake, Italy	3 150	1981	river
floods, China	1 517	1981	
earthquakes, Iran	2 500		

1983	earthquake, Turkey	1 330	1984
typhoon, Philippines		1 360	1984
poisonous gas leak, India		2 100	1985
cyclone/tidal wave, Bangladesh		10 000	1985
earthquakes, Mexico		7 200	1985
volcano, Columbia	25 000		

*Statistics taken from: Physical Geography A World Perspective, Harcourt Brace & Company, Canada. 1988. (p. 93).

Scenic Caves Nature Adventures

Name: _____

Vocabulary Worksheet

Complete the following vocabulary activity by placing the letter of the correct definition beside the corresponding term.

____ rock	a) a sudden shift of rock from a point in the Earth's crust.
____fossil	b) the instrument used to measure waves in an earthquake.
____seismograph	c) one of several massive pieces of the Earth's crust.
____ mantle	d) the centre of the Earth.
____ igneous	e) the practice of cutting all trees in an area.
____core	f) composed of three parts: sand, silt and clay.
____plate	g) slow moving mass of ice, rock, sand and clay.
____geodimeter	h) resulting from a volcanic eruption.
____glaciers	i) recognizable remains of plants and animals.
____shield volcano	j) fiery, resulting from fire.
____plate tectonics	k) the layer of the Earth that is below the crust.

____earthquake l) the weathering down of the physical environment.

____erosion m) one super-continent.

____soil n) used to measure the intensity of earthquakes.

cutting o) wide, gently sloping mountains and island that have mild eruptions.

____Pangea p) a large mass of stone forming a cliff, promontory or peak.

____continental drift q) the shifting of the Earth's plates.

ma r) instrument used to measure the swelling of a volcano.

____Richter scale s) the break up of the Pangea into smaller pieces.

Earth & Space Systems - Gr. 7.....26

Scenic Caves Nature Adventures

Name: *Answer Guide*

Vocabulary Worksheet

Complete the following vocabulary activity by placing the letter of the correct definition beside the corresponding term.

P	rock	a) a sudden shift of rock from a point in the Earth's crust.
I	fossil	b) the instrument used to measure waves in an earthquake.
B	seismograph	c) one of several massive pieces of the Earth's crust.
K	mantle	d) the centre of the Earth.
J	igneous	e) the practice of cutting all trees in an area.
D	core	f) composed of three parts: sand, silt and clay.
C	plate	g) slow moving mass of ice, rock, sand and clay.
R	geodimeter	h) resulting from a volcanic eruption.

G	glaciers	i) recognizable remains of plants and animals.
O	shield volcano	j) fiery, resulting from fire.
Q	plate tectonics	k) the layer of the Earth that is below the crust.
A	earthquake	l) the weathering down of the physical environment.

L	erosion	m) one super—continent.
F	soil	n) used to measure the intensity of earthquakes.
E	clear cutting	o) wide, gently sloping mountains, island that have mild eruptions.
M	Pangea	p) a large mass of stone forming a cliff, promontory or peak.
S	continental drift	q) the shifting of the Earth's plates.
H	magma	r) instrument used to measure the swelling of a volcano.
H	Richter scale	s) the break up of the Pangea into smaller pieces.

Earth & Space Systems - Gr. 7.....28

Scenic Caves Nature Adventures

Name: _____

The Earth's Crust

State whether the following statements are true or false.

_____ 1. The Earth is made up of three layers: the core, the mangle, and the crust.

_____ 2. The thickness of the crust varies from place to place.

_____ 3. The core of the Earth is very dense an make up about 19 percent of the Earth's volume.

_____ 4. The crust if broken into distinct pieces called the Pangea.

_____ 5. The movement of the Earth's plates causes earthquakes.

_____ 6. Volcanoes are located over a pool of magma.

_____ 7. Physical weathering occurs when rocks are reduced to smaller fragments by the process of weathering.

_____ 8. Collingwood Scenic Caves are an excellent example of physical weathering.

_____ 9. Glaciers had very little impact on the land they traveled across.

_____ 10. Arabic land is increasing yearly

_____ 11. Trees harvested in Canada are largely done by clear cutting.

_____ 12. Urban development replaces 100 000 hectares of farmland a year in North America.

_____ 13. The large super-continent is known as "Pangea".

_____ 14. Scientists today have very little way of predicting when a volcano will erupt.

_____ 15. Geodimeters are used to predict earthquakes.

_____ 16. A scientist named Maurice Richter invented a scale to measure the magnitude of earthquakes.

_____ 17. Earthquakes are most likely to occur where there are fractures in the Earth's surface, known as faults.

_____ 18. Earthquakes cause volcanoes.

_____ 19. An earthquake that measures above 6.2 on the Richter Scales will cause widespread damage.

_____ 20. Fewer natural disasters happen today than in the past.

Earth & Space Systems - Gr. 7.....30

Scenic Caves Nature Adventures

Name: Answer Guide

The Earth's Crust

false 1. The Earth is made up of three layers: the core, the mangle, and the crust.

true 2. The thickness of the crust varies from place to place.

true 3. The core of the Earth is very dense an make up about 19 percent of the Earth's volume.

false 4. The crust if broken into distinct pieces called the Pangea.

true 5. The movement of the Earth's plates causes earthquakes.

true 6. Volcanoes are located over a pool of magma.

true 7. Physical weathering occurs when rocks are reduced to smaller fragments by the process of weathering.

true 8. Collingwood Scenic Caves are an excellent example of physical weathering.

false 9. Glaciers had very little impact on the land they traveled across.

false 10. Arable land is increasing yearly.

true 11. Trees harvested in Canada are largely done by clear cutting.

false 12. Urban development replaces 100 000 hectares of farmland a year in North America.

true 13. The large super-continent is known as "Pangea".

Scenic Caves Nature Adventures

false 14. Scientists today have very little way of predicting when a volcano will erupt.

false 15. Geodimeters are used to predict earthquakes.

false 16. A scientist named Maurice Richter invented a scale to measure the magnitude of earthquakes.

true 17. Earthquakes are most likely to occur where there are fractures in the Earth's surface, known as faults.

false 18. Earthquakes cause volcanoes.

true 19. An earthquake that measures above 6.2 on the Richter Scales will cause widespread damage.

false 20. Fewer natural disasters happen today than in the past.