Dinosaur Passage to Pangaea

K-12

Educator's Guide

TANDEM MOTION PICTURE STUDIOS

Cinema Group

DEAR EDUCATOR,

The Educational resources in Tandem Motion Picture Studio's DINOSAUR PASSAGE TO PANGAEA EDUCATOR'S GUIDE were developed to bring the Earth's fascinating geological past to life for you and your students. Within these pages you will find:

- Activities with step-by-step instructions for classroom use.
- Lesson overviews and guiding questions to introduce concepts and terms.
- Artwork and support materials.
- Student handouts to enhance activities and at-a-glance learning.

These resources and more are available at www.cinemagroup.net

We hope you and your Students enjoy the ultimate Field Trip!

Accompany two Geology Students who embark on the ultimate time-traveling adventure...

The movie DINOSAUR PASSAGE TO PANGAEA transports students 180 million years into the past to the site of one of the greatest geological events in history: the separation of the supercontinent Pangaea.

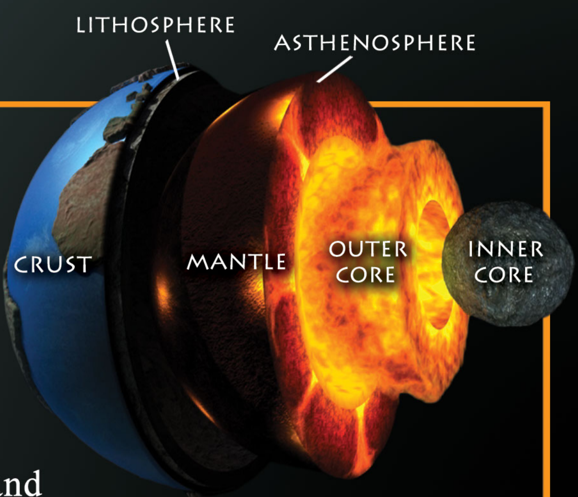
Your Students will witness incredible geological wonders and learn the mysterious process that created our present-day continents. From racing across the landscape atop Dinosaurs to plummeting to the center of the Earth, DINOSAUR PASSAGE TO PANGAEA is the perfect educational film about the tectonic forces that forged our world.

DINOSAUR PASSAGE TO PANGAEA was created using the labor-intensive process of Stop motion Animation. Each frame of the movie was created by moving the characters bit by bit then snapping a picture. 24 pictures is one completed second! Each character utilized 50 different mouth pieces to give the illusion of expression and lip-sync. The film took 3 years to produce and is a wonderful way to educate children about Geology.

The lessons in this guide were designed to support the educational use of DINOSAUR PASSAGE TO PANGAEA through standards-based learning. The purpose of these lessons are to engage students in an array of scientific and geological concepts through inquiry-based activities.
These lessons include:

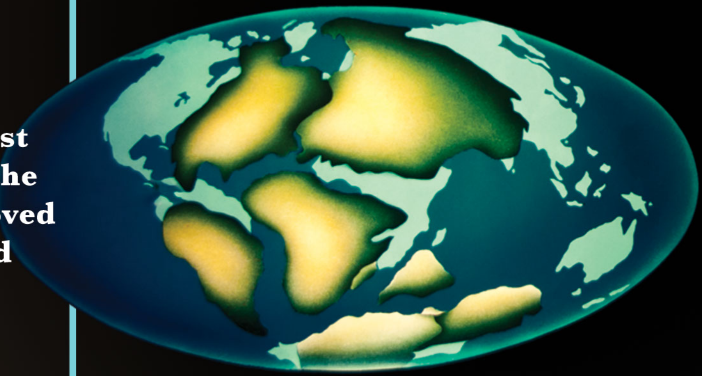
Earth's Many Layers

Our Earth is under constant change. The dynamic and sometimes violent processes underneath our feet shape our environment, adapt life and renew the Earth. Students will discover the layers within the Earth and how they set continents, oceans and life in motion.

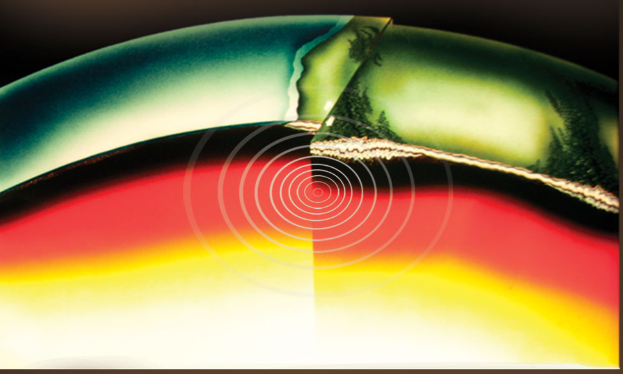


Continental Drift

For all of recorded geologic time, crustal plates have been in motion. Students will learn how, for over the last 300 million years, the continents have moved from a consolidated supercontinent called Pangaea to their present independent positions.



Earthquakes and Tsunami



When the Earth's crustal plates collide, separate or slide by one another, immense pressure sometimes escalates along these Fault Zones. Students discover how this dangerous energy can suddenly release in an earthquake. Like a ripple in a pond, the surge of energy sends ripples through the ground with devastating effect, sometimes resulting in Tsunamis.

The Ring Of Fire

Most of the Earth's volcanoes, earthquakes and great linear mountain systems occur in narrow zones that girdle the planet. Students learn how the "ring of fire" is the most important of these zones with its sea floor trenches, active and dormant volcanoes and destructive earthquakes.

Volcanoes and Mountains

From a human point of view Mountains and Volcanoes can be awe-inspiring and devastating. Students see how, from a geologic point of view, they are stunning surface-building processes.

CONTENTS

GEOLOGISTS: THE ROCK HUNTERS

If Geology is the study of the solid earth, its rocks and minerals, then Geologists are the 'rock hunters' of earth science. Without ground-based observation to confirm or expand on space-based tools, we would have an incomplete or even inaccurate picture of our planet. Geologists understand how the dynamic forces which shape our earth work, and use this knowledge to predict their affect on mankind.

Earthquakes, volcanoes and soil erosion affect all of us. Even if the geological event occurs halfway around the world, we are all touched to a greater or lesser extent. Food grown in Nebraska depends on accurate soil sampling, land erosion monitoring and water drainage information all provided by earth scientists with a geological background. Fishermen who experience a 'drought' of fish look to geologists to explain silting, underwater seismic events or other phenomena in order to react appropriately.

More than just naming rocks and digging up fossilized bones, geologists tell us the story of the earth. That story goes back billions of years, and leaves its impression in the very ground we walk on. If that story is one you want to help tell, a career in geology and earth science is for you!

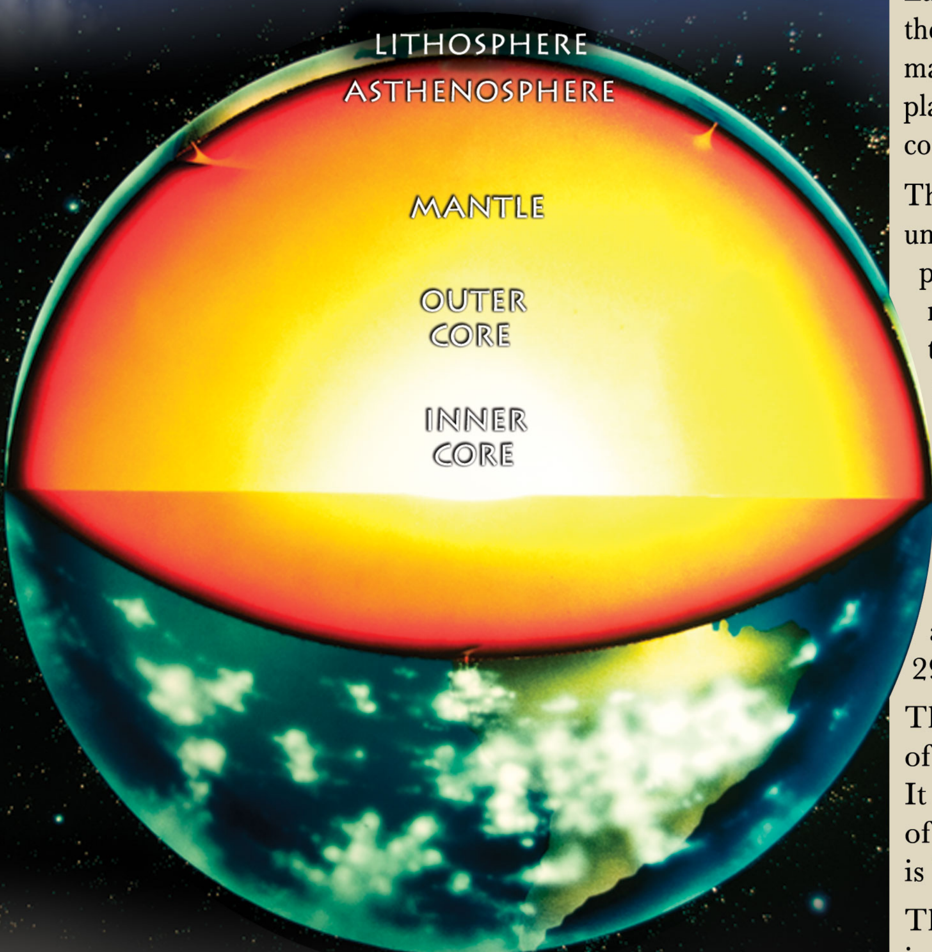
ROCK CLASSIFICATIONS

Igneous Rocks - Latin for *"Born Of Fire"*, these rocks form either underground or above ground. Underground, they are formed when the melted rock, called magma, deep within the earth becomes trapped in small pockets. As these pockets of magma cool slowly underground, the magma becomes igneous rocks. Igneous rocks are also formed when volcanoes erupt, causing the magma to rise above the earth's surface. When magma appears above the earth, it is called lava. Igneous rocks are formed as the lava cools above ground.

Sedimentary Rocks - For thousands, even millions of years, little pieces of our earth have been eroded, broken down and worn away by wind and water. These little bits of our earth are washed downstream where they settle to the bottom of the rivers, lakes, and oceans. Layer after layer of eroded earth is deposited on top of each other. These layers are pressed down more and more through time, until the bottom layers slowly turn into rock.

Metamorphic Rocks - These rocks have "morphed" into another kind of rock which was once igneous or sedimentary. The rocks are under tremendous pressure, which fosters heat build up, and this causes them to change. If you examine metamorphic rock samples closely, you'll discover how flattened some of the grains in the rock are.

EARTH'S MANY LAYERS



The **Lithosphere** (from lithos for "stone") is the Earth's outermost layer of rigid rock. It includes the continents, ocean floors and the uppermost mantle. It is fractured into a mosaic of gigantic plates that slowly move - separating, shearing, compressing and under-thrusting one another.

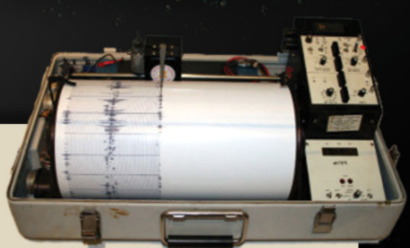
The **Asthenosphere** (from asthenes for "weak") underlies the lithosphere. Heat and extreme pressure make it deformable and perhaps partially molten. It can flow to relieve stress. As it moves, the overlying plates of the lithosphere move with it, setting continents, oceans and life in motion.

The **Mantle** is the thick layer of hot, solid rock between the crust and the molten iron core. The mantle makes up the bulk of the Earth, accounting for two-thirds of its mass. The mantle starts about 30 kilometers down and is about 2900 kilometers thick.

The Earth's **Outer Core** extends to a depth of around 3000 miles beneath the surface. It is believed that this outer core is made up of super-heated liquid molten lava. This lava is believed to be mostly iron, and nickel.

The **Inner Core** extends another 900 miles inward towards the center of the Earth. It is believed that this inner core is a solid ball of mostly iron, and nickel. Scientists once believed that the inner core was possibly a single, solid object; maybe even a single crystal of iron. But recent evidence has found that it has detailed structures, and even has an inner, inner core.

Seismograph Studies...

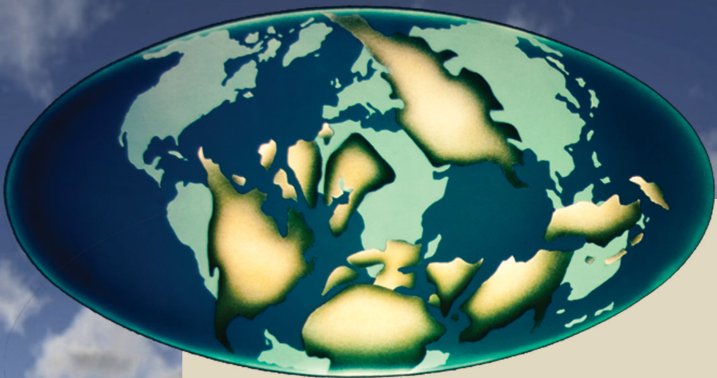


The deepest holes drilled into the Earth have but scratched its surface. Only sensitive instruments can tell us about the Earth's interior.

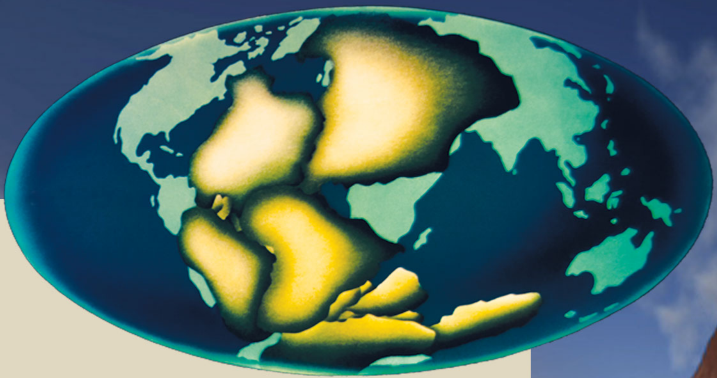
From laboratory experiments, scientists have learned that earthquake shock waves change as they encounter fluids and solids of different densities inside the Earth. Analyses of earthquake shock waves using a worldwide network of seismographs have revealed that the Earth is a concentrically layered planet, containing a solid inner core, a molten outer core, a partially molten mantle and a solid crust.

The Earth became a layered planet early in its history. Then it was largely molten because radioactive heat generated more rapidly than it could flow away. Iron and nickel melted and sank to form a central core; lighter materials floated upward and cooled to become the mantle and crust.

CONTINENTAL DRIFT

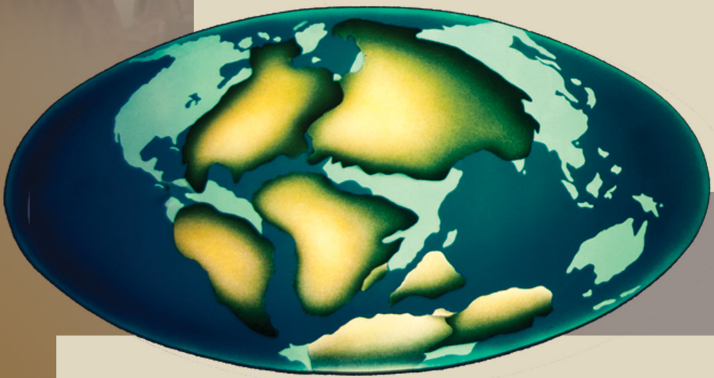


300 MILLION YEARS BC

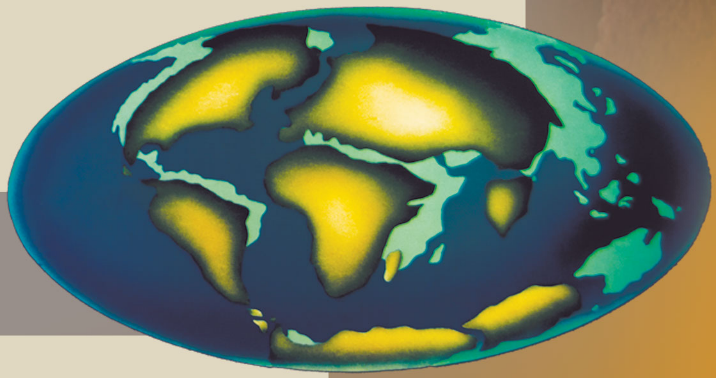


200 MILLION YEARS BC

For all of recorded geologic time, crustal plates have been in motion. Over the last 300 million years they have moved from a consolidated supercontinent called Pangaea to their present independent positions. This movement has been substantiated by evidence from physical geology, fossils and paleomagnetics.



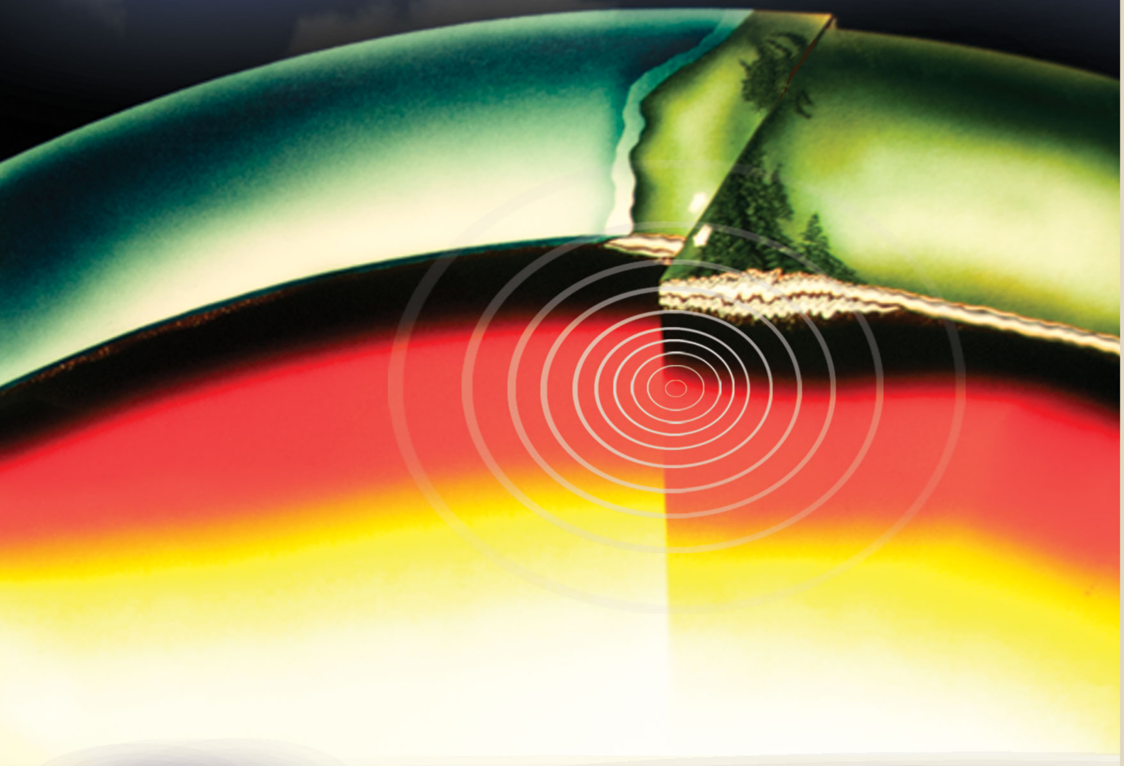
100 MILLION YEARS BC



45 MILLION YEARS BC

In 1915, the German geologist and meteorologist **Alfred Wegener** first proposed the theory of continental drift, which states that parts of the Earth's crust slowly drift atop a liquid core. The fossil record supports and gives credence to the theories of continental drift and plate tectonics. Wegener hypothesized that there was a gigantic supercontinent 200 million years ago, which he named Pangaea, meaning "All-earth". Pangaea started to break up into two smaller supercontinents, called Laurasia and Gondwanaland, during the Jurassic period. By the end of the Cretaceous period, the continents were separating into land masses that look like our modern-day continents.

EARTHQUAKES



The Earth's face changes its expressions through time. These surface changes are caused by movements among crustal plates driven by internal radioactive heat.

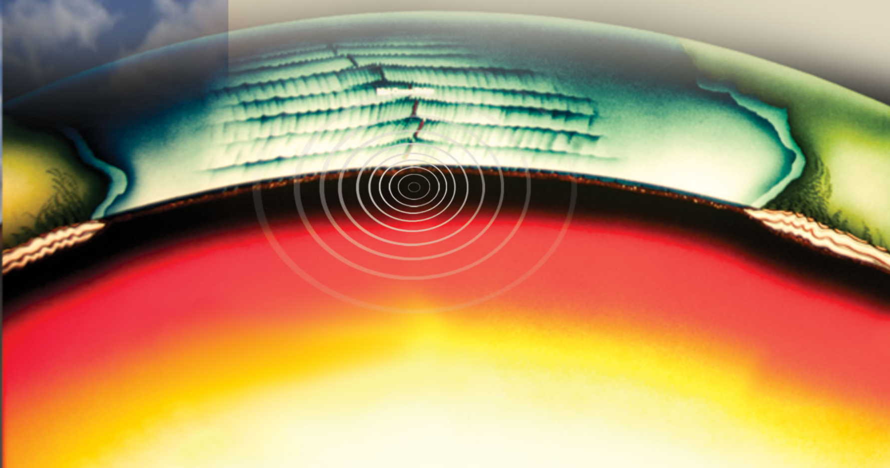
When the Earth's crustal plates collide, separate or slide by one another, the planet's surface changes. Sometimes, however, immense pressure escalates along these Fault Zones. This dangerous energy can suddenly release in an earthquake. Like a ripple in a pond, the surge of energy sends ripples through the ground with devastating effect. Seismologists are trying to understand earthquake phenomena in an attempt to give ample warning to the inhabitants of the potentially affected area.

SIGNIFICANT EARTHQUAKES

Jan. 23, 1556 Shansi, China 830,000 deaths Magnitude 8
July 27, 1976 Tangshan, China 255,000 deaths Magnitude 7.5
Aug. 9, 1138 Aleppo, Syria 230,000 deaths Magnitude n.a.
Dec. 26, 2004 Off west coast of northern Sumatra 225,000+ deaths Magnitude 9
Jan. 12, 2010 Haiti 222,570 deaths Magnitude 7.0
Dec. 22, 8562 Damghan, Iran 200,000 deaths Magnitude n.a.
May 22, 1927 Near Xining, Tsinghai, China 200,000 deaths Magnitude 7.9
Dec. 16, 1920 Gansu, China 200,000 deaths Magnitude 7.8
March 23, 893 Ardabil, Iran 150,000 deaths Magnitude n.a.
Sept. 1, 1923 Kwanto, Japan 143,000 deaths Magnitude 7.9

TSUNAMI

The colossal force of an earthquake underwater can sometimes send a wall of water racing toward the shore. The destructive power of these waves can ravage shorelines and flood miles inland, destroying everything in their path. Fortunately Tsunami Warning Centers detect ocean-based earthquakes early, often giving advanced warning to communities within the path of the wave.

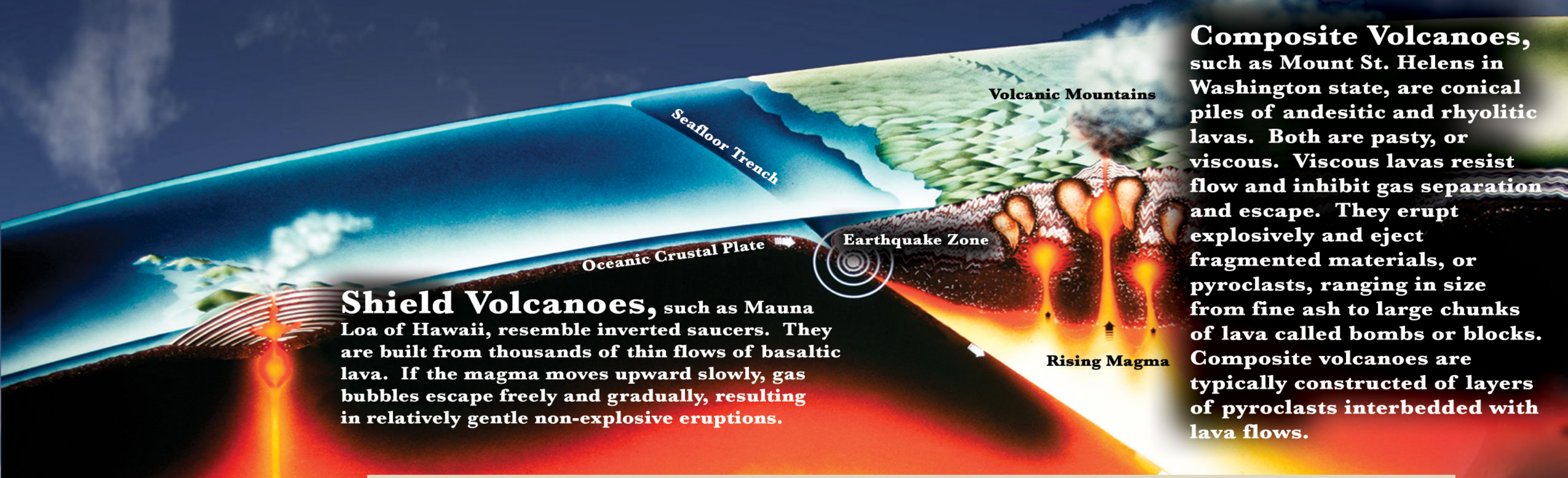


SIGNIFICANT TSUNAMIS

On December 26, 2004, an earthquake released close to 23,000 Hiroshima-type atomic bombs amount of energy from beneath the Earth's surface. This unleashed a series of killer waves across the Indian Ocean that traveled as fast as a jet airliner. The 9.0 magnitude earthquake was the largest in 40 years and the tsunami it generated traveled as much as 3,000 miles to Africa.

The largest Tsunami ever recorded occurred on July 9, 1958 in Lituya, Alaska. An earthquake measuring 8.3 on the Richer scale shook loose 40 million cubit yards of dirt and glacier from a mountainside, resulting in a tsunami which reached the height of 1,720 feet or 40 feet short of a third of a mile. It was twice the height of the Eiffel Tower!

VOLCANOES AND MOUNTAINS

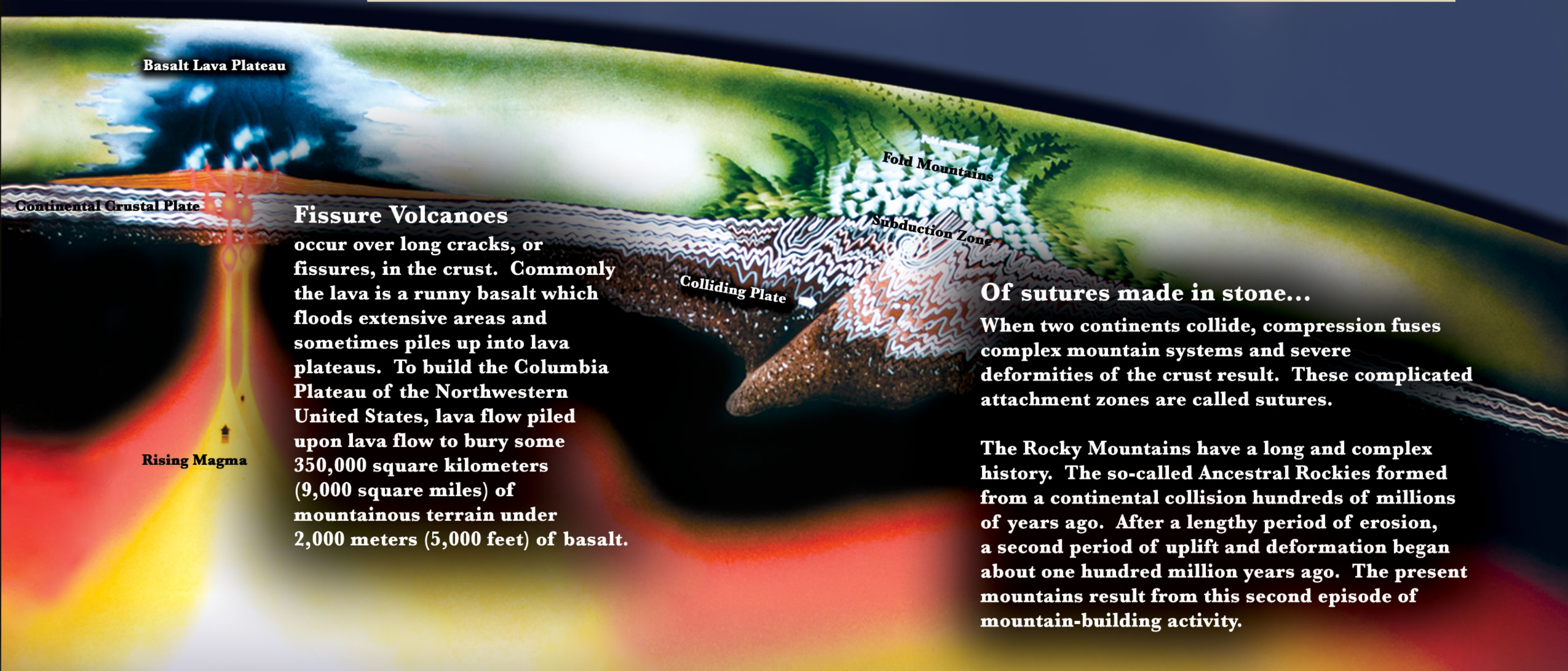


Composite Volcanoes, such as Mount St. Helens in Washington state, are conical piles of andesitic and rhyolitic lavas. Both are pasty, or viscous. Viscous lavas resist flow and inhibit gas separation and escape. They erupt explosively and eject fragmented materials, or pyroclasts, ranging in size from fine ash to large chunks of lava called bombs or blocks. Composite volcanoes are typically constructed of layers of pyroclasts interbedded with lava flows.

Shield Volcanoes, such as Mauna Loa of Hawaii, resemble inverted saucers. They are built from thousands of thin flows of basaltic lava. If the magma moves upward slowly, gas bubbles escape freely and gradually, resulting in relatively gentle non-explosive eruptions.

From a human point of view volcanoes can be devastating. From a geologic point of view, they are stunning surface-building processes. For thousands of years people have dwelt in clusters around volcanoes, for there they have found rich soils. Indeed volcanoes and life on Earth are inexorably interwoven.

When the Earth was young, volcanoes riddled its surface, venting vast quantities of water vapor and carbon dioxide into the atmosphere. Condensing as rain, the water vapor supplied the oceans with water, the medium that cradled life. The carbon dioxide nurtured green plants. The varied shapes of volcanoes are caused by the kind of lava they erupt. Some are gentle, others explosive.



Fissure Volcanoes occur over long cracks, or fissures, in the crust. Commonly the lava is a runny basalt which floods extensive areas and sometimes piles up into lava plateaus. To build the Columbia Plateau of the Northwestern United States, lava flow piled upon lava flow to bury some 350,000 square kilometers (9,000 square miles) of mountainous terrain under 2,000 meters (5,000 feet) of basalt.

Of sutures made in stone…

When two continents collide, compression fuses complex mountain systems and severe deformities of the crust result. These complicated attachment zones are called sutures.

The Rocky Mountains have a long and complex history. The so-called Ancestral Rockies formed from a continental collision hundreds of millions of years ago. After a lengthy period of erosion, a second period of uplift and deformation began about one hundred million years ago. The present mountains result from this second episode of mountain-building activity.

The Earth's folded linear mountain systems are the products of plates engaged in encounters that severely compress their colliding boundaries. The slow but powerful impact of continental plates exerts immense pressures that fold and thrust rocks up into towering peaks. The geologically young and growing Alps and Himalayas were born of such upheavals; the Alps from the repeated collisions of the African and Eurasian Plates, and the Himalayas from the northward advance of India against central Asia. The Himalayan uplift continues as India grinds northward a few centimeters each year.

The Andes Mountains on the rumpled west coast of South America formed when the ocean-carrying Nazca Plate was overridden by the continental South American Plate. The continuing decent of the Nazca Plate creates extensive zones of compression, volcanoes and earthquakes.

EARTH'S CRUSTAL PLATES

Most of the Earth's volcanoes, earthquakes and great linear mountain systems occur in narrow zones that girdle the planet. These zones reveal the geologically active boundaries of the plates that pave the Earth's surface.

The "ring of fire," rimming the Pacific Ocean, is the most important of these zones. Its seafloor trenches, active and dormant volcanoes and destructive earthquakes trace areas where plates are descending into the Earth's interior.

Activity 1: Mineral Identification

Suggested Grade level
K-4, 5-8, 9-12

Purpose

To teach the student to identify minerals by observing and testing the physical properties of each mineral.

Instructions

1. Set up mineral stations for each mineral the students are to identify. If necessary, some stations may have two minerals to identify.

2. Each station should be equipped with one each of the following items:
   * Glass plate
   * Penny
   * Streak plate (white unglazed porcelain)
   * Magnet
   * Water
   * Balance Scale
   * Graduated cylinder (for specific gravity test)
   * Steel Nail

3. Divide students into equal groups. Have the number of student groups match the number of mineral stations.

4. Distribute a Mineral Worksheet (p.17) and Mineral Background sheet to each student. Have students read the Mineral Background sheet.

5. Assign each group to a mineral station and have students move to their assigned station to begin testing. Have the students perform the physical property tests listed on the Mineral Background sheet. Have students record the test results on the Mineral Worksheet.

6. Rotate the student groups through each of the work stations, performing the tests at each station. Allow 5 to 10 minutes per mineral per station.

7. Hand out Mineral Identification Sheets. (These sheets will be prepared by the teacher depending on the minerals available to use in the class. The sheets should include the name of the minerals and their physical properties.)

8. Have students compare their test results with the Mineral Identification Sheet. Can the students correctly name each of the minerals using their test results? Write the name of the mineral on the Mineral Worksheet.

ACTIVITY 2: Cupcake Core Sampling

Suggested Grade level
K-4, 5-8

This activity is ideal for a small group of students, a youth group, or a parent-child activity.

Purpose

Trying to "see" what is beneath the surface of the Earth is one of the jobs of a geologist. Rather than digging up vast tracts of land to expose an oil field or to find some coal-bearing strata, core samples can be taken and analyzed to determine the likely composition of the Earth's interior. In this activity, students model core sampling techniques to find out what sort of layers are in a cupcake.

Materials

* Cupcake mix
* Plastic knife
* Drawing paper
* Frosting
* Food coloring
* Foil baking cups
* Toothpicks
* Plastic transparent straws

Directions

Prepare cupcakes according to package directions, but use at least three different colors of batter. Layer batter in colors in the muffin cups. Using foil baking cups and frosting will prevent the students from seeing the interior of the cupcakes, in the same way that a geologist can't see the interior of the Earth. (Tell the students that the frosting layer is equivalent to the soil.)

Provide each student with a cupcake, a straw, a toothpick, and a piece of paper. Ask the students to fold a piece of drawing paper into four sections and in one of the sections draw what they think the inside of the cupcake would look like. Ask the students how they might get more information about the cupcake without peeling the foil or cutting it open with a knife.

Someone may suggest using the straw to take a core sample. If not, show them how to push the straw into the cupcake and pull out a sample. Remember to use the straw like a drill, rotating it through the cupcake (straws can be cut to a length slightly longer than the depth of the cupcake.)

The students should make a second drawing of the cross section of their cupcake based on the information from three core samples. Each new drawing should be carefully labeled and placed in a different section of the recording paper.

Finally, the students should cut open the cupcakes with a knife to compare them to the drawings.

Hint — Keep relating what the students are doing to what real life geologists do. Nobody eats until the discussion is complete!

How did this activity help you to understand what geologists do? Can you think of other ways or reasons (other than looking for oil or coal) that we might learn something by drilling core samples? (Groundwater resources, for example, or deep-sea drilling in pale oceanography.)

Invite a petroleum or mining geologist into the classroom to discuss the analogy between what the students do in the coring simulation and what the scientist does in his or her job.

Activity 3: The Mountain Blows Its Top

A volcano is a vent in the surface of the Earth through which magma and gasses erupt. Volcanic eruptions are among the Earth's most powerful and destructive forces, but volcanoes are also creative. Volcanoes have shaped the Earth's landscape, as many of our mountains, islands, and plains have been built by volcanic eruptions.

Mount St. Helens was one of the most powerful volcanic eruptions in recent memory. The bulge that developed on the north flank of Mount St. Helens was evidence of changes occurring inside the volcano. Magma was moving closer to the surface and inflating, or deforming the side of the volcano.

A 5.1 magnitude earthquake on May 18, 1980 shook the volcano, including the bulge area. This shaking caused a sudden collapse of the volcano's north flank and triggered a large avalanche. The removal of this large mass of rock by the avalanche caused a sudden release of pressure inside the volcano and a violent eruption occurred.

Objective:
Students will observe fault movements on a model of the earth's surface.

Time Needed:
1 or 2 Class periods

Suggested Grade level 5-8

Materials Needed:

- 1,500 ml beaker
- Damp sand
- Several small balloons
- Rubber bands
- Bunsen burner or hot plate
- Straight pin
- A bottle of soda water
- Basin or bowl

Instructions

1. Put about ½ inch of damp sand in the bottom of the beaker and level the surface of the sand. Partially inflate a balloon, secure it with a rubber band, and place the balloon on top of the sand in the beaker. Cover the balloon with sand to a depth of about 1 ½ inches. Level the surface of the sand.
2. Explain that inflation caused a bulge to develop on the north side of Mount St. Helens. The inflated balloon represents the magma rising within Mount St. Helens and the sand represents the surface of the Volcano.
3. Place the beaker on the Bunsen burner or the hot plate. Heat the beaker until the balloon begins to expand (the surface of the sand should bulge).
4. Observe the changes in the shape of the surface of the sand. What happens to the "land" as the "magma chamber" expands?
5. Compare a soda bottle to a magma chamber. When soda is opened it fizzes because the gasses are escaping. Shake a soda bottle and open it (in a bowl or basin). The soda will "erupt" when the cap is suddenly removed. When the avalanche was triggered on Mount St. Helens the "cap" was taken off allowing the volcanic gasses to erupt.

Activity 4: Chocolate Rock Cycle

How sweet is this activity? It's an introduction to the rock cycle using chocolate! Chocolate can be ground into small particles (weathered), heated, cooled, and compressed — just like rocks. Unlike rocks, chocolate can undergo these processes safely and at reasonable temperatures.

Use your chocolate to create "sedimentary," "metamorphic," and "igneous" chocolate. And at the end of it all, make a tasty treat!

Suggested Grade level
3-8

Materials

* Blocks of dark and white chocolate
* Aluminum foil and/or aluminum foil cupcake holders
* Hot water and a container to hold it
* A plastic knife or another simple scraping device

Procedure

First, make "sedimentary" chocolate:

1. Scrape some small shavings from your chocolate blocks.

2. Gather these scrapings onto a piece of aluminum foil and press down on them. You might fold the aluminum foil and then press on the chocolate shavings. You could even stand on enclosed foil packages.

3. Observe the joined-together bunch of chocolate scrapings in the foil, which is now similar to sedimentary rock.

Second, make "igneous" chocolate:

1. Place a small pile of chocolate chunks from your original blocks into aluminum foil or a cupcake holder.

2. Float this concoction on medium hot water.

3. Watch as the heat from the water transfers to the foil and chocolate, which should start to melt.

4. Remove the foil when the chocolate is soft to the touch (for safety, use the plastic knife, not fingers).

5. Let the chocolate cool. The partially melted and cooled chocolate is now similar to igneous rock.

Third, make "metamorphic" chocolate:

1. Place a small pile of sedimentary and igneous chocolate into your aluminum foil or cupcake holder.

2. Float this concoction on very hot water.

3. Watch as the heat transfers from the water to the foil and melting chocolate. Allow the chocolate to melt until a smooth liquid forms.

4. Carefully remove the molten chocolate and let it cool, still contained in aluminum. Your melted and cooled chocolate is now similar to metamorphic rock.

5. Discuss: The "chocolate cycle" is designed to mirror the rock cycle. The rock cycle is a continuing process that has occurred throughout geological time. One type of rock can become another type over time. Very little rock on the surface of the earth has remained fixed in its original rock type. Most rocks have undergone several changes of the rock cycle!

Activity 5: Spongy Continents

Your students will learn the dynamic processes of continental drift watching sponges subduct, diverge, and slide past one another.

Suggested Grade level 1-6

Materials:

* Thin sponges
* Permanent marker
* Large aluminum pan

Dampen several large thin sponges. You may want to draw lines on the side of the sponge with a permanent marker to show layering within the earth.

Gently move two sponges around to demonstrate how the plates under our earth move around. Bump the two sponges gently into one another.

What is happening now to our plates? What would happen if the two sponges were pushed harder? What do we call the force that is building as the sponges push against one another? These plates can move different ways when they bump against one another.

Demonstrate how one may move under the other.

When this happens, how do the plates move? What kind of change on the surface of the earth could that cause? A crack caused by the earth breaking is called a fault. Another way these plates can move is to bend.

Bend one of the sponges by pressing on opposite ends of the sponge.

When this occurs what changes may be noticed at the surface of the earth?

Demonstrate two sponges getting stuck on each other and then the pressure built up forcefully moving them in a sideways movement.

What could occur on the earth's surface when this happens? Sometimes the pressure actually folds the plate over onto itself. What would happen at the earth's surface during this event?

Students should be asked to draw pictures of the plates or sponge in their science notebooks after each demonstration. They should write several sentences describing what occurred in the demonstration and what could be the result on the earth's surface. Place the sponges in a science center so that the children can recreate these demonstrations themselves.

Student Activity Handout

Mineral Worksheet

Sample #	Color	Streak	Feel	Luster	Magnetic Attraction	Hardness	Specific Gravity	Mineral Name?
Example	yellow/gold	greenish-black	smooth	metallic	no	6-6.5	5	Pyrite

Mineral Background Sheet

The following is a description of some of the Physical Properties that are used to identify minerals:

Luster

Does it shine? How much?

* Glassy/vitreous (Shines like glass)
* Earthy/chalky (Dull)
* Metallic (Looks like metal)
* Waxy/silky/pearly (Has a muted shine)

Fracture

Does the mineral show regular surfaces or planes?

Or, does the mineral have an irregular, broken surface?

Magnetic Attraction

Was the mineral attracted to a magnet? Yes / No

Color

What is the dominant color of the mineral?

Streak

When you scratched the mineral across the streak plate (the porcelain), what color was the streak?

Feel

What was the texture of the mineral? Was it:

* Gritty or sandy?
* Powdery or chalky?
* Smooth like glass?
* Smooth and sticky like wax?
* Sharp like metal?

Hardness

Mohs Scale of Hardness	
1 (softest)	Feels soapy or greasy
2	Scratched by fingernail (hardness = 2.5)
3	Scratched by penny
4	Can scratch a penny
5	Scratched by steel nail (hardness = 5.5)
6	Can scratch steel
7-10 (hardest)	Can scratch glass

Specific Gravity

This property is the weight of the mineral relative to the weight of an equal volume of water. Minerals with a high specific gravity feel heavy for their size.

National Science Education Standards

The lessons included in this Dinosaur Passage To Pangaea Educator's Guide address the following National Education Standards:

LEVELS K-4	LEVELS 5-8	LEVELS 9-12
SCIENCE AS INQUIRY STANDARDS		
Abilities necessary to do scientific inquiry Understanding about scientific inquiry	Abilities necessary to do scientific inquiry Understanding about scientific inquiry	Abilities necessary to do scientific inquiry Understanding about scientific inquiry
PHYSICAL SCIENCE STANDARDS		
Properties of objects and materials Light, heat, electricity and magnetism	Properties and changes of properties in matter Motions and forces Transfer of energy	Structure and properties of matter Chemical reactions Motions and forces Conservation of energy and increase in disorder Interactions of energy and matter
EARTH AND SPACE SCIENCE STANDARDS		
Properties of earth materials Changes in earth	Structure of the earth system Earth's history	Energy in the earth system Geochemical cycles Origin and evolution of the earth system
SCIENCE AND TECHNOLOGY STANDARDS		
Abilities to distinguish between natural objects and objects made by humans Understanding about science and design	Understanding about science and technology	Understanding about science and technology

CONTACT INFORMATION

DINOSAUR PASSAGE TO PANGAEA

DEPARTED 22 JUNE

For more information or to locate a theater near you playing this film, please visit:

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TANDEM MOTION PICTURE STUDIOS

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