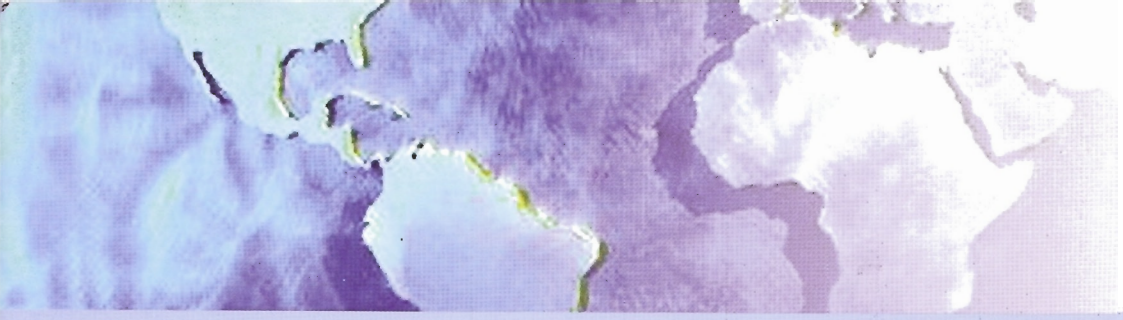

TSUNAMI

Teacher's Guide

For 4th to 6th Grades

International Strategy
ISDR
for Disaster Reduction

UNESCO

INTERNATIONAL TSUNAMI INFORMATION CENTRE HONOLULU

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ASIAN DISASTER REDUCTION CENTER

TSUNAMI

FOR 4th to 6th GRADES

The Project of "Education for Disaster Preparedness in Primary School"
is funded through the UN Flash Appeal initiative "Evaluation and Strengthening
of Early Warning Systems in countries affected
by the 26 December 2004 Tsunami"
a multi-donor, multi-partner initiative coordinated by UN/ISDR
and supported by generous contributions from the Governments of
Japan, Germany, Finland, Netherlands, Norway and Sweden and the European
Commission Humanitarian Aid Office.

ISBN 974-269-5814

PREFACE

The Indian Ocean Tsunami disaster that occurred on December 26, 2004 caused the loss of thousands of lives and massive destruction. The serious damage alerted the Office of the Basic Education Commission (OBEC) to emphasize the importance of providing the curriculum knowledge about tsunami and other natural disasters for schools. Therefore we have initiated a project on Disaster Preparedness in Primary School in conjunction with the Asian Disaster Reduction Center (ADRC), Japan and the Department of Disaster Prevention and Mitigation (DDPM), Ministry of Interior, Thailand.

The purpose of the project is to provide knowledge and capacity building for teachers and students in primary schools in case they encounter tsunami or other natural disasters in the future. A text book "Tsunami for 4th - 6th Grades" and its "Teacher's Guide" have been developed as a tool to achieve the project's objective.

Regarding the Teacher's Guide, the contents are deliberated to lead the teachers into an effective approach of how they will manage classroom activities. It provides teacher's basic information about the scientific knowledge of the earth, the mechanism of earthquake and tsunami, tsunami warning systems, self knowledge and management when a tsunami is approaching, emergency evacuation drills, including a short story from student experience of the tragedy.

The book was tested in Phra Rat Chatan Tab Lamu School, Tai Muang District, Pang-nga Province and Ban Ka Lim School, Kratoo District, Phuket Provice. After the pilot classes were conducted, we invited a number of relevant officials from the Ministry of Natural Resources and Environment as well as the experts in the Ministry of Education to review and approve the book. This procedure enabled us to adjust the book's content for the best practical use in classrooms.

We hope the Teacher's Guide will assist teachers with valuable materials to teach tsunami and other natural disasters in their classes. Finally, we would like to thank to all those who dedicated their time and energy to complete this book.

The Office of the Basic Education Commission

INTRODUCTION

The overall objective of the "Tsunami for 4th - 6th Grades" and "Tsunami Teacher's Guide" is to give students and their teachers the opportunity to gain accurate knowledge about tsunami and other natural disasters from both scientific explanation and practical implementation.

The teacher's guide is provided to accompany the student's textbook. The guide provides teachers with an effective approach of how to conduct classroom activities as well as offering basic scientific knowledge of the earth, the cause of an earthquake and a tsunami, and self management including preparedness when a tsunami approaches or other natural disasters.

The teacher's guide consists of six components that provide the basic instructions on how to conduct classes. They are,

- purpose; key issues of the topics to achieve
- materials; items to help student understanding
- guidance; the process of conducting a class
- timeline; a standard timeframe of the topic
- teacher's data; further information for teacher
- image; complementary pictures or photos

As every teacher knows, classroom management is vital when working with students and the key to manage classes effectively is to teach varied and balanced lessons which are purposeful, relevant and meaningful. It also should present an appropriate degree of challenges.

To accomplish these key elements of managing classes, the following steps will help teachers to prepare for their classes.

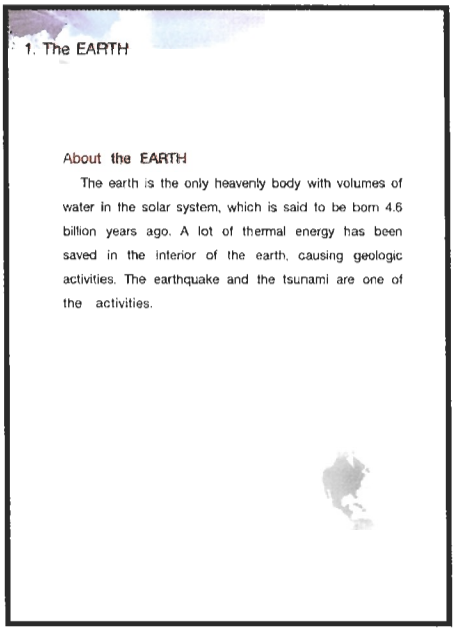
<Steps>

1. Read the teacher's guide by yourself this will help you plan a schedule and to choose the materials which you might like to use for class activities.
2. Explain to the students the objectives of the textbook and activities they will challenge in the class.
3. Form teams or groups before doing the activities if specified.
4. Read the textbook with the students in order to provide the introduction that raises students' motivation and interest.
5. Discuss with the students prior and after completion of the activities.

To educate students successfully, teachers should go beyond just transferring knowledge about the cause of earthquake and tsunami and self management in the event of an approaching tsunami and other natural disasters. Teachers are required to provide the practical skills that will enable students to take appropriate actions. Lastly, teacher's self improvement is strongly recommended to make their classes more effective and attractive. Consequently, disaster education in school contributes to long-term disaster risk reduction as well as knowledge dissemination widely to communities where they live.

Table of Contents

1. The Earth


1. The EARTH

About the EARTH

The earth is the only heavenly body with volumes of water in the solar system, which is said to be born 4.6 billion years ago. A lot of thermal energy has been saved in the interior of the earth, causing geologic activities. The earthquake and the tsunami are one of the activities.

Purpose

Chapter 1. provides a timeline of the creation of the galaxy, solar system and the earth. It 's important to acquire background knowledge about the generation of the earth before learning about tsunami and earthquake. Using the calendar, you can teach the history of the earth. This method is called a "cosmic calendar."

Materials

- Calendar

Guidance

1. Teach the time outline of the earth
2. Ask questions by using a calendar

   (For example, the day when space generated is assumed January 1, present is 23:59:59, December 31....Q1: When did the earth generated? Q2: When was the dinosaur born? Q3: When was the human born?)

   Answer and explanation

1. The Earth

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～10	Lecture	Lecture
2	10～20	quiz	Discussion
3	20～30	Answer and explanation	Answer

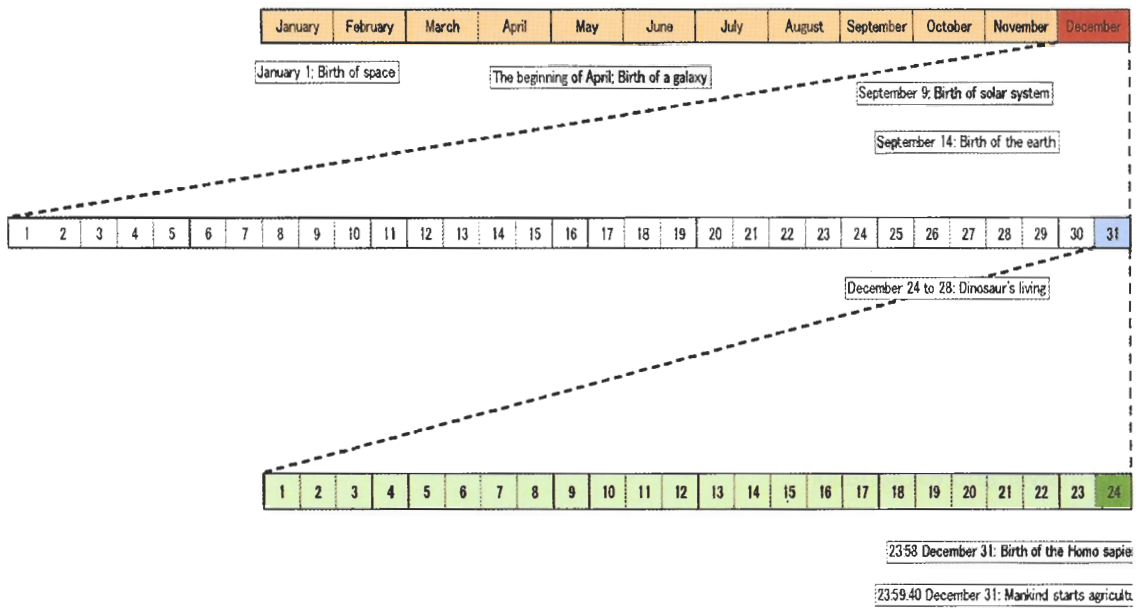
Teacher's data

Cosmic calendar: Show the timeline from the beginning to present using the calendar

- Beginning of April: Birth of a galaxy
- September 9: Birth of the solar system
- September 14: Birth of the earth
- December 24 to 28: First Dinosaurs appear
- 23:58 December 31: Birth of the Homo sapiens
- 23:59:40 December 31: Homo sapiens start (humans) agriculture

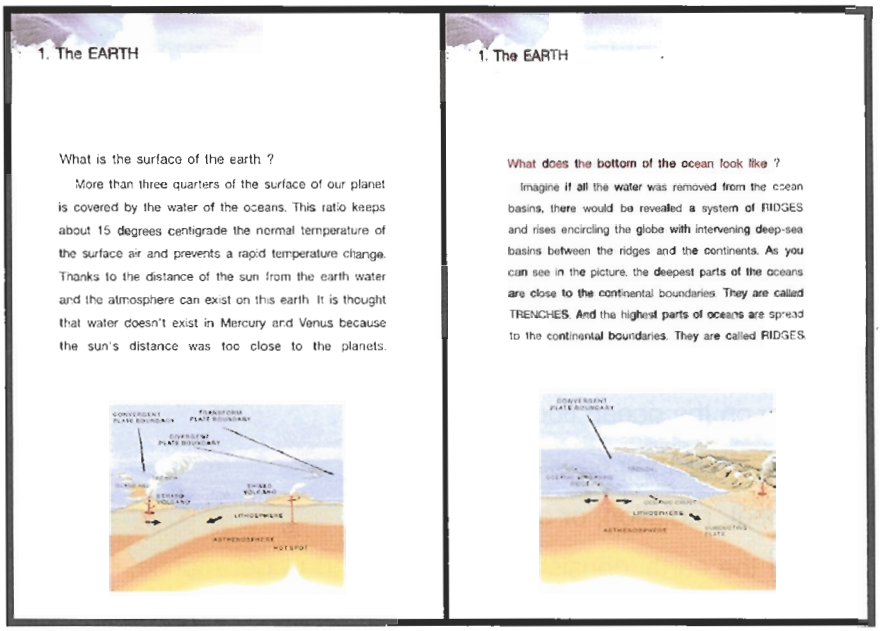
(http://school.discovery.com/schooladventures/universe/itsawesome/cosmiccalendar/page2.html)

Image



(Original)

1. The Earth



1. The EARTH

What is the surface of the earth ?

More than three quarters of the surface of our planet is covered by the water of the oceans. This ratio keeps about 15 degrees centigrade the normal temperature of the surface air and prevents a rapid temperature change. Thanks to the distance of the sun from the earth water and the atmosphere can exist on this earth. It is thought that water doesn't exist in Mercury and Venus because the sun's distance was too close to the planets.

1. The EARTH

What does the bottom of the ocean look like ?

Imagine if all the water was removed from the ocean basins, there would be revealed a system of RIDGES and rises encircling the globe with intervening deep-sea basins between the ridges and the continents. As you can see in the picture, the deepest parts of the oceans are close to the continental boundaries. They are called TRENCHES. And the highest parts of oceans are spread to the continental boundaries. They are called RIDGES.

Purpose

In these two pages, students will be able to learn about the surface of the world. At the end of the lecture, students will study the geographical features in Thailand by using the map of Southeast Asia.

Materials

- Southeast Asia Map (initially focus around Thailand, then move to other countries)

Guidance

1. Lecture about the timeline of the earth
2. Distribute the Southeast Asia Map to the students. They will learn the geographical features in Thailand using the map.

1. The Earth

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～15	Lecture	Lecture
2	15～30	Discussion	Discussion

Teacher's data

Ridge: a long narrow elevation on the ocean floor

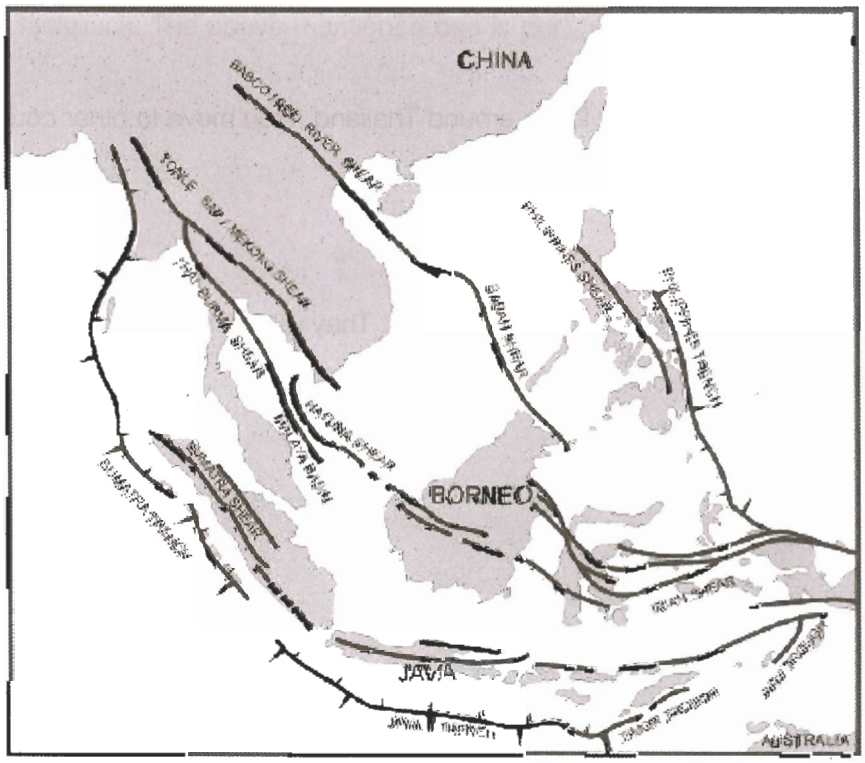
Trench: a long, steep-sided valley on the ocean floor

Hot spot: an area of intense heat, radiation, or activity

Lithosphere: the outer layer of the earth, consists of the crust and upper mantle, approximately 100 km thick.

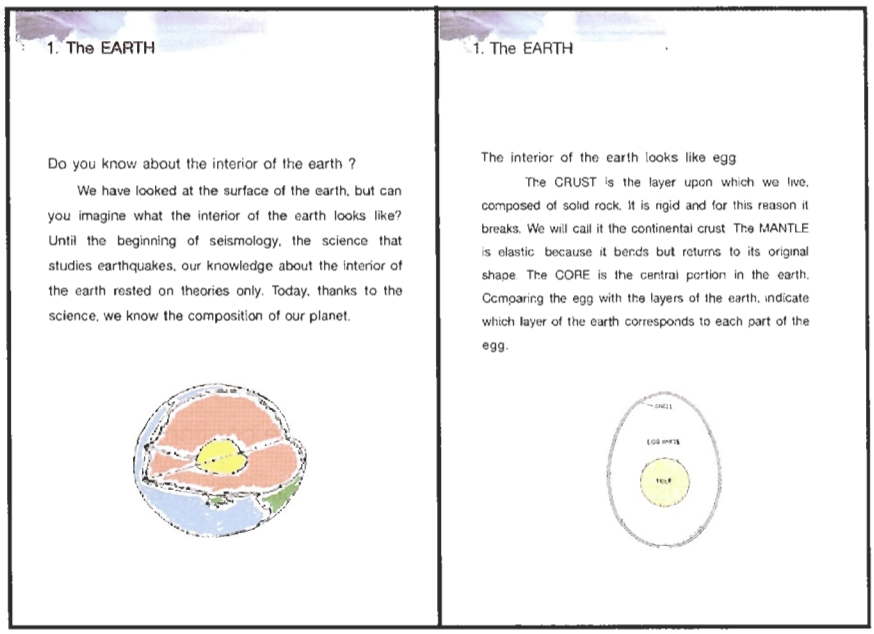
Asthenosphere: a zone of the earth's mantle that lies beneath the lithosphere and consists of several hundreds of kilometers of deformable rocks.

Image



(http://www.earthevolution.org/Abstracts/21_Storetvedt_et_al.pdf)

1. The Earth



1. The EARTH

Do you know about the interior of the earth ?

We have looked at the surface of the earth, but can you imagine what the interior of the earth looks like? Until the beginning of seismology, the science that studies earthquakes, our knowledge about the interior of the earth rested on theories only. Today, thanks to the science, we know the composition of our planet.

1. The EARTH

The interior of the earth looks like egg

The CRUST is the layer upon which we live, composed of solid rock. It is rigid and for this reason it breaks. We will call it the continental crust. The MANTLE is elastic because it bends but returns to its original shape. The CORE is the central portion in the earth. Comparing the egg with the layers of the earth, indicate which layer of the earth corresponds to each part of the egg.

Purpose

In these two pages, students will be able to learn about the interior of earth. There are two key points. First, the crust is where we live, which is really thin. The second point is the interior of the earth is extremely hot and molten (liquid). You will teach the interior features of the earth by using a boiled egg.

Materials

- Boiled egg
- Knife

Guidance

1. Teach about the interior layers of the earth.
2. Teach the interior of earth by comparing the layers of the boiled egg.

1. The Earth

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～10	Lecture	Lecture
2	10～20	Lecture (by using boiled egg)	Observation

Teacher's data

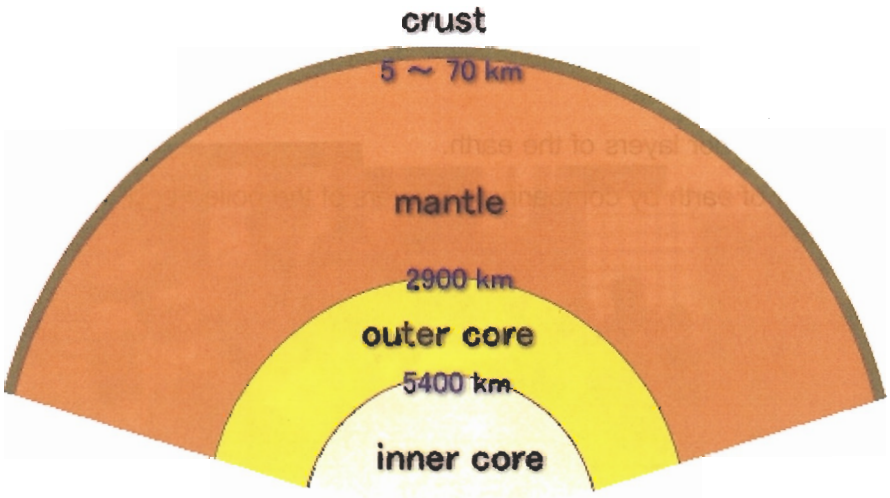
The outermost layer of the Earth is the crust. This comprises the continents and ocean basins. The crust has a variable thickness, being 35-70 km thick in the continents and 5-10 km thick in the ocean basins. The crust is composed mainly of alumino-silicates.

The next layer is the mantle, which is composed mainly of ferro-magnesium silicates. It is about 2900 km thick, and is separated into the upper and lower mantle. This is where most of the internal heat of the Earth is located. Large convective cells in the mantle circulate heat and may drive plate tectonic processes.

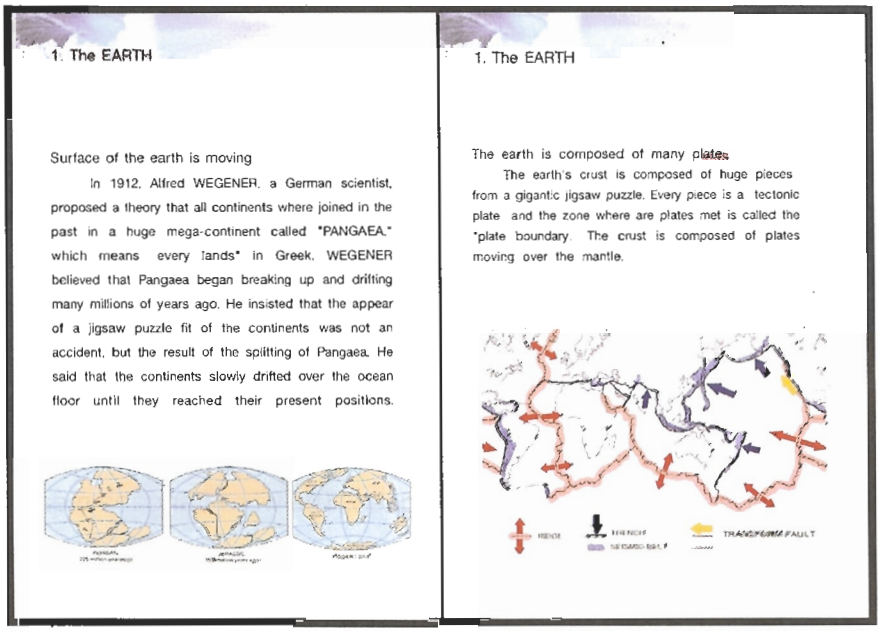
The last layer is the core, which is separated into the liquid outer core and the solid inner core. The outer core is 2300 km thick and the inner core is 1200 km thick. The outer core is composed mainly of a nickel-iron alloy, while the inner core is almost entirely composed of iron. Earth's magnetic field is believed to be controlled by the liquid outer core.

(http://scign.jpl.nasa.gov/learn/plate1.htm)

Image



1. The Earth



Purpose

In these two pages, the student will be able to identify the Plate Tectonic Theory of WEGENER. It is important to understand that the continentals of around the world are constantly in motion.

Materials

- World map (It is enough in copied.)
- PANGAEA map
- Scissors
- Glue

Guidance

1. Teach the Theory of Plate Tectonics
2. Obtain copies of the world map.Cut out the oceans and the continents depicted in the PANGAEA map. Combine the pieces together to form PANGAEA .
3. Conduct discussion about the Theory of Plate Tectonics.

1. The Earth

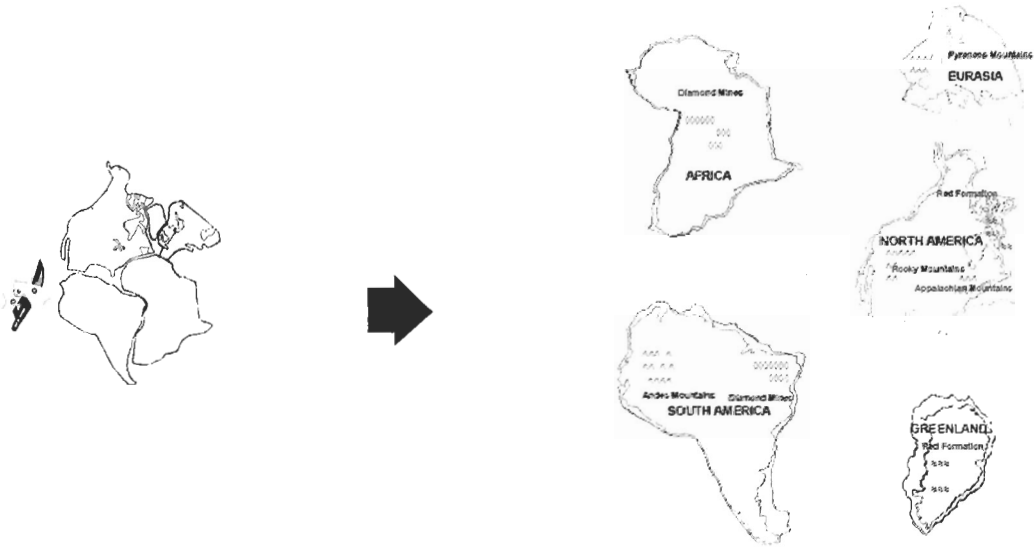
Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～10	Lecture	Lecture
2	10～30	Experiment	Experiment
3	30～40	Discussion	Discussion

Teacher's data

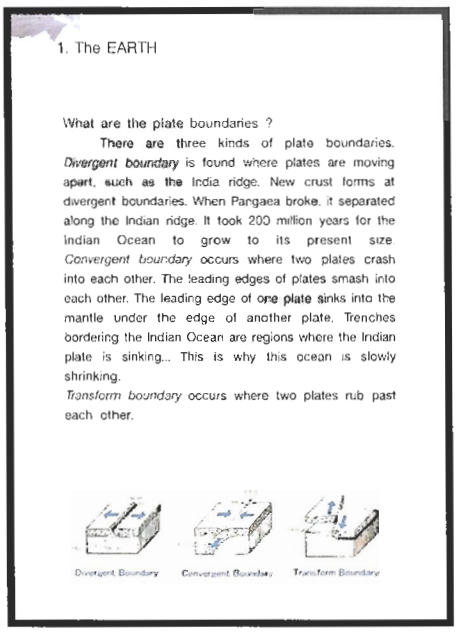
The Pangaea theory is one that states that all present continents were once joined together and collectively known as a 'super continent' called a Pangaea. The word Pangaea means 'all lands' in Greek, defining the formation of continents over 200 millions years ago before it split up. These split-up pieces drifted slowly apart and became the way they are today. Even until now, the shape of the Earth surface is still changing, and there will be continued movement, as long as the mantle underneath the Earth's crust gets heated and convection currents in the magma keeps dragging the plates. The Pangaea theory was treated with much skepticism when it was first raised. But since then, there have been much evidence to support this theory.

Image



(http://www.ocean-institute.org/edu_programs/materials/P/PDF/PDF_FG/IES_A3.pdf)

1. The Earth



1. The EARTH

What are the plate boundaries ?

There are three kinds of plate boundaries. *Divergent boundary* is found where plates are moving apart, such as the India ridge. New crust forms at divergent boundaries. When Pangaea broke, it separated along the Indian ridge. It took 200 million years for the Indian Ocean to grow to its present size. *Convergent boundary* occurs where two plates crash into each other. The leading edges of plates smash into each other. The leading edge of one plate sinks into the mantle under the edge of another plate. Trenches bordering the Indian Ocean are regions where the Indian plate is sinking... This is why this ocean is slowly shrinking.

Transform boundary occurs where two plates rub past each other.

Divergent Boundary Convergent Boundary Transform Boundary

Purpose

In this section, there is no experiment. You teach about the plate boundaries that are Convergent Boundaries, Divergent Boundaries, and Transform Boundaries. This content may be difficult for students. So please explain this section slowly.

Materials

(None) Only lecture

Guidance

1. Lecture about the plate boundaries

1. The Earth

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0～20	Lecture	Lecture

Teacher's data

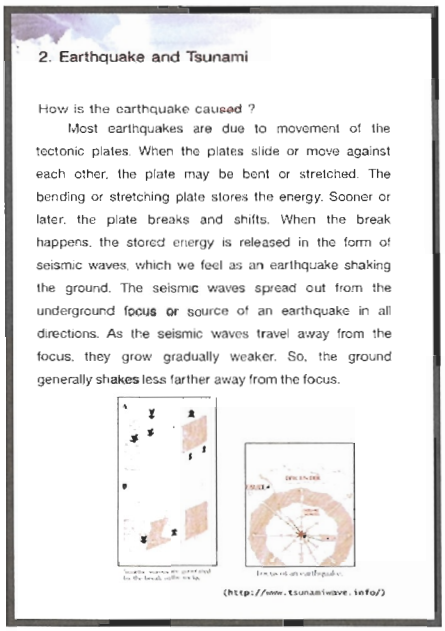
[Convergent Boundaries] Places where plates crash or crunch together are called convergent boundaries. Plates only move a few centimeters each year, about the rate of fingermail growth, so collisions are very slow and last millions of years. Even though plate collisions take a long time, lots of interesting things happen. For example, in the drawing above, an oceanic plate has crashed into a continental plate. Colliding is like looking at a single frame in a slow-motion movie of two cars crashing into each other. Just as the front ends of cars fold and bend in a collision, so do the "front ends" of colliding plates. The edge of the continental plate in the drawing has folded into a huge mountain range, while the edge of the oceanic plate has bent downward and dug deep into the Earth. A trench has formed at the bend. All that folding and bending makes rock in both plates suddenly break and slip, causing earthquakes. As the edge of the oceanic plate digs into Earth's hot interior, some of the rock in it melts. The melted rock rises up through the continental plate, causing more earthquakes on its way up, and forming volcanic eruptions where it finally reaches the surface.
[Divergent Boundaries] Places where plates are coming apart are called divergent boundaries. When Earth's brittle surface layer (the lithosphere) is pulled apart, it typically breaks along parallel faults that tilt slightly outward from each other. As the plates separate along the boundary, the block between the faults cracks and drops down into the soft plastic interior (the Asthenosphere). The sinking of the block forms a central valley called a rift. Magma (liquid rock) seeps upward to fill the cracks. In this way, new crust is formed along the boundary. Earthquakes occur along the faults, and volcanoes form where the magma reaches the surface.
[Transform Boundaries] Places where plates slide past each other are called transform boundaries. Since the plates on either side of a transform boundary are merely sliding past each other and not tearing or crunching each other, transform boundaries lack the spectacular features found at convergent and divergent boundaries. Instead, transform boundaries are marked in some places by linear valleys along the boundary where rock has been ground up by the sliding. In other places, transform boundaries are marked by features like stream beds that have been split in half and the two halves have moved in opposite directions.

(http://www.cotf.edu/ete/modules/msese/earthsysflr/plates1.html)

Image

(None) Only lecture

2. Earthquake and Tsunami



2. Earthquake and Tsunami

How is the earthquake caused ?

Most earthquakes are due to movement of the tectonic plates. When the plates slide or move against each other, the plate may be bent or stretched. The bending or stretching plate stores the energy. Sooner or later, the plate breaks and shifts. When the break happens, the stored energy is released in the form of seismic waves, which we feel as an earthquake shaking the ground. The seismic waves spread out from the underground **focus or** source of an earthquake in all directions. As the seismic waves travel away from the focus, they grow gradually weaker. So, the ground generally shakes less farther away from the focus.

(http://www.tsunamiwave.info/)

Purpose

First page in the chapter 2 shows the causes of an earthquake. Students will able to learn about the mechanism of the earthquake occurrence. It is important to identify that most tsunamis are caused by earthquakes. Moreover, tsunamis can also be generated by underwater landslides,volcanic eruptions, and meterorite strike into the ocean because massive amounts of water can be displaced.

Materials

(None) Only lecture

Guidance

1. lecture

2. Earthquake and Tsunami

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～15	Lecture	Lecture

Teacher's data

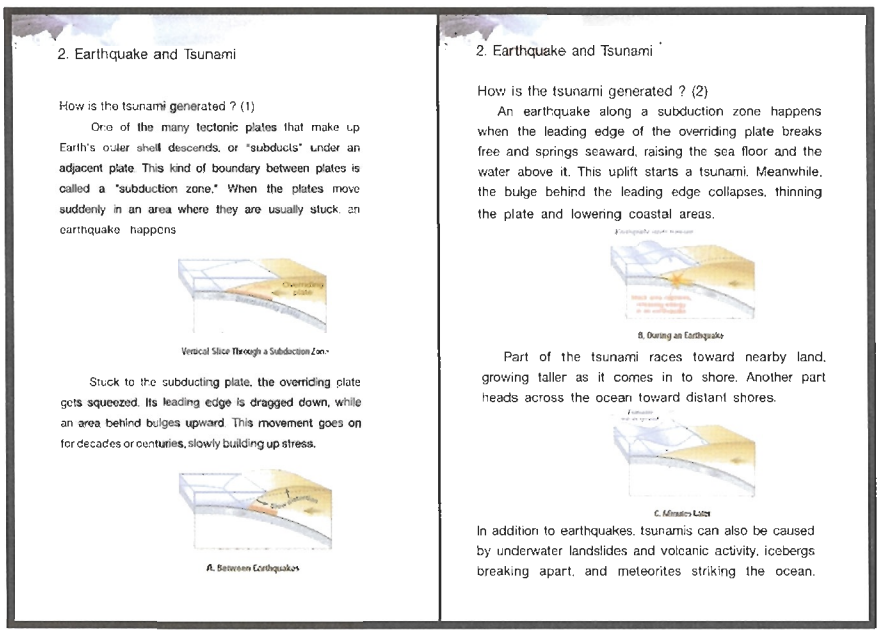
An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates. Ground shaking from earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths and injuries and extensive property damage.

(http://www.fema.gov/pdf/hazards/earthquakes/nehrp/earthquake_backgrounder.pdf)

Image

(None) Only lecture

2. Earthquake and Tsunami



2. Earthquake and Tsunami

How is the tsunami generated ? (1)

One of the many tectonic plates that make up Earth's outer shell descends, or "subducts" under an adjacent plate. This kind of boundary between plates is called a "subduction zone." When the plates move suddenly in an area where they are usually stuck, an earthquake happens.

Vertical Slice Through a Subduction Zone

Stuck to the subducting plate, the overriding plate gets squeezed. Its leading edge is dragged down, while an area behind bulges upward. This movement goes on for decades or centuries, slowly building up stress.

A. Between Earthquakes

2. Earthquake and Tsunami

How is the tsunami generated ? (2)

An earthquake along a subduction zone happens when the leading edge of the overriding plate breaks free and springs seaward, raising the sea floor and the water above it. This uplift starts a tsunami. Meanwhile, the bulge behind the leading edge collapses, thinning the plate and lowering coastal areas.

B. During an Earthquake

Part of the tsunami races toward nearby land, growing taller as it comes in to shore. Another part heads across the ocean toward distant shores.

C. Minutes Later

In addition to earthquakes, tsunamis can also be caused by underwater landslides and volcanic activity, icebergs breaking apart, and meteorites striking the ocean.

Purpose

In these two pages the students will be able to learn about mechanism of the tsunami by using experiment tool. It is a very effective method which takes sometime. It is very important to summarize the proper sequence of events that generate a tsunami 1) Plate tectonic movements cause earthquakes. 2) A large earthquake along a coastline may or may not cause tsunami.

Materials

- Box
- Board
- Plastic sheet
- Piece of wood
- Brick

Guidance

1. Lecture about mechanism of tsunami generation.
2. Experiment
   - Like the picture, put the board in the box. And cover the plastic sheet on the board.
   - Pour the water in the box (a depth of 5 cm). And float the piece of wood on the water.
   - Lift lightly the plastic sheet side of A, keep the movement of water and wood under observation.
   - Make various shore models by using bricks!
3. Discussion

2. Earthquake and Tsunami

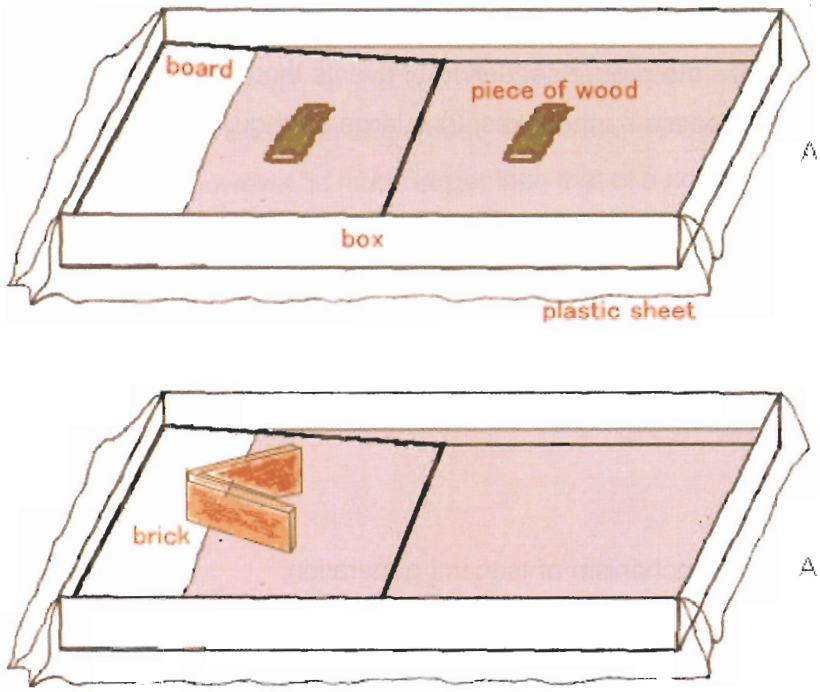
Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～15	Lecture	Lecture
2	15～45	Experiment	Experiment
3	45～60	Discussion	Discussion

Teacher's data

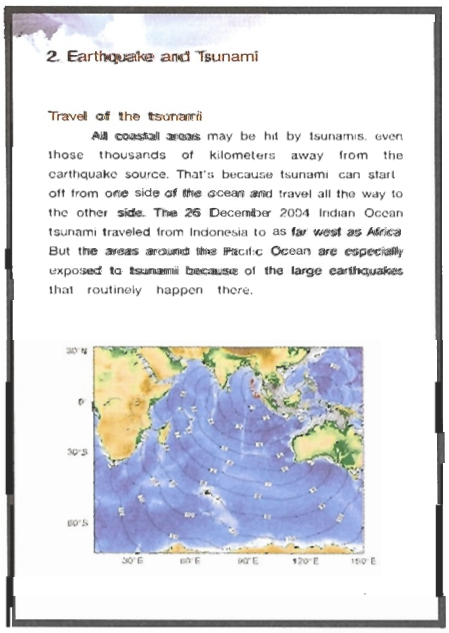
(None) Only experiment

Image



(http://www.ricen.hokkaido-c.ed.jp/240chigaku_jikken/24013earthquake/jisin13.htm)

2. Earthquake and Tsunami



Purpose

This page shows the how a tsunami spreads across the ocean. It is important to identify the that earthquakes and therefore tsunamis are unpredictable. Earthquakes and tsunamis can suddenly strike people. You introduce two cases. One is about the 2004 Sumatra Earthquake and Indian Ocean Tsunami. The other is about the 1960 Chilean Tsunami that crossed the Pacific Ocean

Materials

Guidance

1. Lecture (2004 Sumatra Earthquake and Indian Ocean.)
2. Lecture (1960 Chilean Tsunami)

2. Earthquake and Tsunami

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～15	Lecture	Lecture
2	15～30	Lecture	Lecture

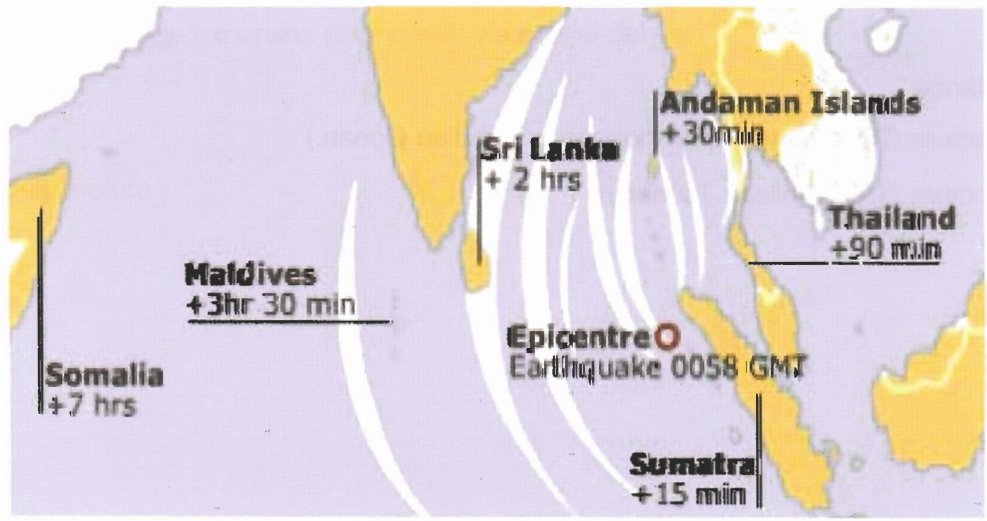
Teacher's data

[2004 Sumatra Earthquake and Indian Ocean Tsunami] On 26 December 2004 the biggest earthquake for the past 40 years (magnitude 9.3) occurred between the Australian and Eurasian plates in the Indian Ocean. The quake triggered a tsunami a series of large waves - that spread thousands of kilometers over several hours. The earthquake caused the sea floor to rupture along the fault line, causing a giant wave which traveled and carved a path of destruction across the 4500 km-wide Indian Ocean over a period of seven hours.

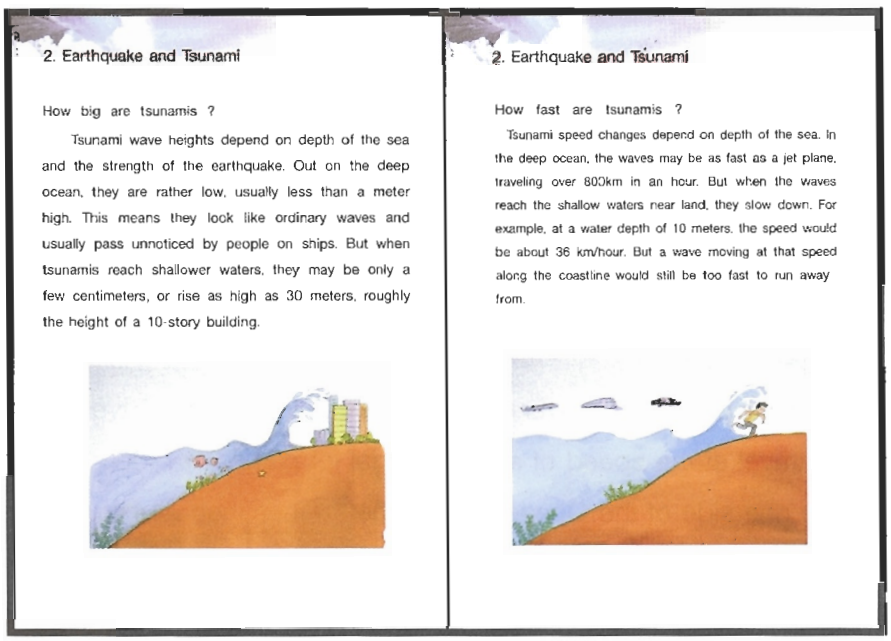
[1960 Chilean Tsunami] 1960 Chilean Tsunami was a result of the largest earthquake ever measured (magnitude 9.5). This quake occurred along the coast of Chile on May 22, 1960. In Chile, the earthquake and the tsunami that followed took more than 2,000 lives and caused property damage estimated at $550 million (1960 U.S. dollars). From Chile the tsunami radiated outward, killing 61 people in Hawaii and 122 in Japan. The 1960 Chile earthquake ruptured a fault zone along which a slab of sea floor is descending, or "subducting," beneath the adjacent South American Continent. Such "subduction zones" are formed where two of the tectonic plates that make up the Earth's outer shell meet. Earthquakes occur when the fault ruptures, suddenly releasing built-up energy. During the 1960 Chile earthquake, the western margin of the South American Plate abruptly moved as much as 60 feet relative to the subducting Nazca Plate, in an area 600 miles long and more than 100 miles wide.

(http://www.usgs.gov/)

Image



2. Earthquake and Tsunami



2. Earthquake and Tsunami

How big are tsunamis ?

Tsunami wave heights depend on depth of the sea and the strength of the earthquake. Out on the deep ocean, they are rather low, usually less than a meter high. This means they look like ordinary waves and usually pass unnoticed by people on ships. But when tsunamis reach shallower waters, they may be only a few centimeters, or rise as high as 30 meters, roughly the height of a 10-story building.

2. Earthquake and Tsunami

How fast are tsunamis ?

Tsunami speed changes depend on depth of the sea. In the deep ocean, the waves may be as fast as a jet plane, traveling over 800km in an hour. But when the waves reach the shallow waters near land, they slow down. For example, at a water depth of 10 meters, the speed would be about 36 km/hour. But a wave moving at that speed along the coastline would still be too fast to run away from.

Purpose

These two pages show the height and speed of a tsunami. The explanation of data in detail may be difficult for students. Please teach in simpler terms by using the pictures.

Materials

Guidance

1. Lecture (about tsunami speed)
2. Lecture (about tsunami height)

2. Earthquake and Tsunami

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～15	Lecture	Lecture
2	15～30	Lecture	Lecture

Teacher's data

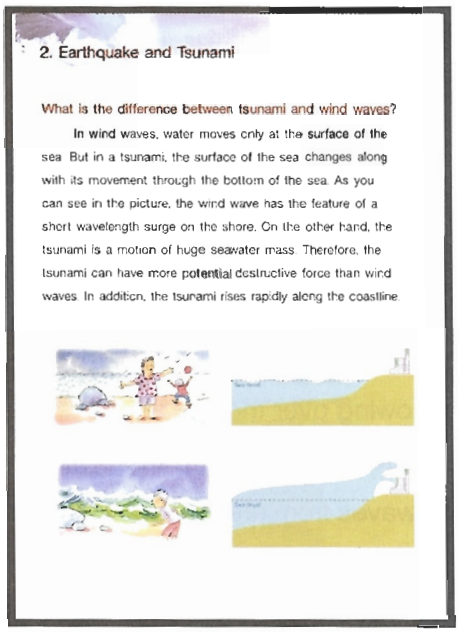
[How fast?] Where the ocean depth is deep, over 6,000 m, unnoticed tsunami waves at the surface of the ocean can travel at the speed of a commercial jet plane, over 800 km per hour. They can move from one side of the Ocean to the other in less than 24 hours. This great speed makes it important to be aware of the tsunami as soon as it is generated. Scientists can predict when a tsunami will arrive at various places by knowing the source mechanism characteristics of the earthquake that generated the tsunami, and the characteristics of the seafloor along the paths to those places. Tsunamis travel much slower in shallower coastal waters where their wave heights begin to increase dramatically.

[How big?] Offshore and coastal features can determine the size and impact of tsunami waves. Reefs, bays, entrances to rivers, undersea features and the slope of the beach all help to modify the tsunami as it attacks the coastline. When the tsunami reaches the coast and moves inland, the water level can rise many meters. In extreme cases, water level has risen to more than 15 m for tsunamis of distant origin and over 30 m for tsunami waves generated near the epicenter. The first wave may not be the largest in the series of waves. One coastal community may see no damaging wave activity while in another nearby community destructive waves can be large and violent. The flooding can extend inland by 300 m or more, flooding large expanses of land with water and debris.

Image

(None) Only lecture

2. Earthquake and Tsunami



Purpose

In this page shows the difference between tsunami and wind waves. These two are different types of waves. You will teach the difference to the students by using photographs and pictures.

Materials

(None) Only lecture

Guidance

1. Lecture about wind waves
2. Lecture about tsunami waves

2. Earthquake and Tsunami

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～10	Lecture	Lecture
2	10～20	Lecture	Lecture

Teacher's data

The waves you see at the beach are generated by wind blowing over the sea surface. The size of these waves depends on the strength of the wind creating them and the distance over which it blows. Generally the distance between these waves from crest to crest, known as the wavelength, ranges from a couple of feet to perhaps a thousand feet. The speed of these waves as they travel across the ocean ranges from a few miles an hour up to sixty miles an hour in some instances.

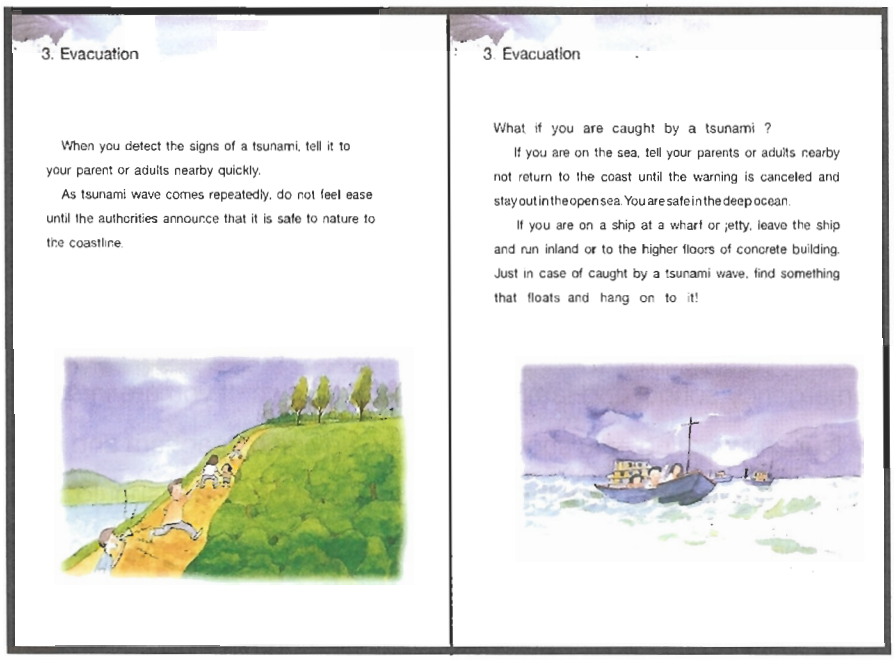
Tsunami waves resulting from physical mechanisms behave much differently than wind generated waves. The magnitude of the disturbance causing the tsunami is the primary factor influencing the size and strength of the waves. The height of the wave when it is generated is very small, usually less than a few feet. The distance between successive wave crests or the wavelength however, is much larger than that of a normal wave and may be hundreds of miles apart. Depending on the depth of the water in which the tsunami is traveling, it may attain speeds of up to 500 miles an hour.

(http://tsunamifury.org/facts/tsunami_comparison.htm)

Image

(None) Only lecture

3. Evacuation



Purpose

These two pages explain the signs that a tsunami is approaching. Your role is to teach about tsunami warning information.

Materials

(None) Only lecture

Guidance

1. Lecture about school and family emergency evacuation. Please emphasize the four caution notes.

3. Evacuation

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～30	Lecture	Lecture

Teacher's data

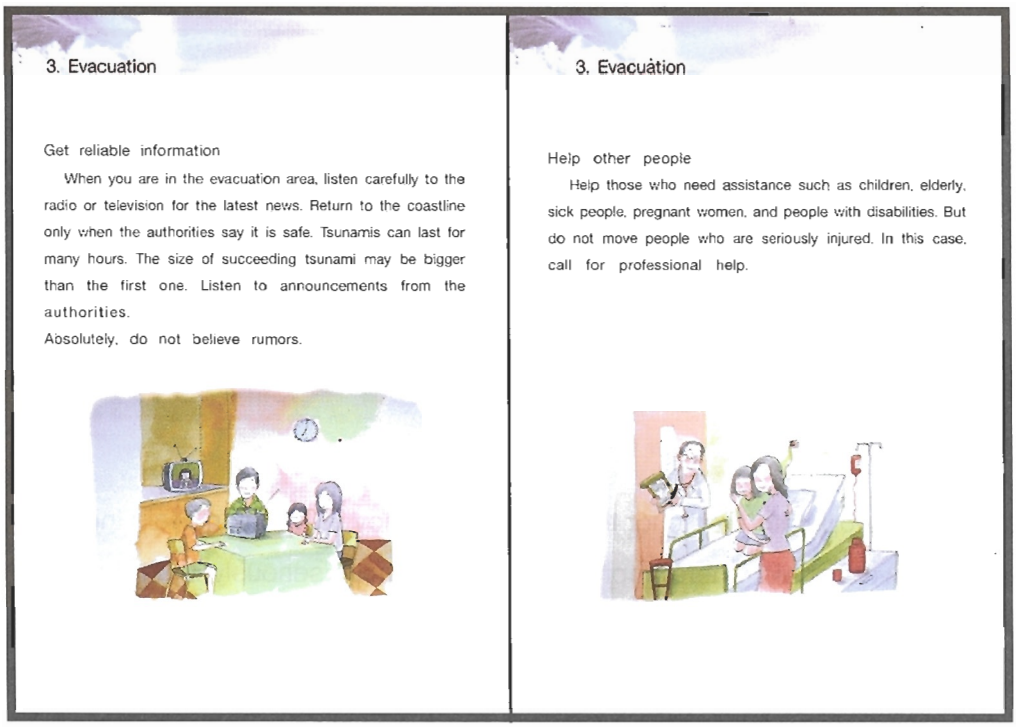
Detail information for emergency school and family tsunami evacuation. If you are in school and you hear there is a tsunami warning, you should follow the advice of teachers and other school personnel. If you are at home and hear there is a tsunami warning, you should make sure your entire family is aware of the warning. Your family should evacuate your house if you live in a tsunami evacuation zone. Move in an orderly, calm and safe manner to an identified evacuation site or to any safe place outside your evacuation zone. Follow the advice of local emergency and law enforcement authorities. If you are at the beach or near the ocean and you feel the earth shake, move immediately to higher ground, do not wait for a tsunami warning to be announced. Stay away from rivers and streams that lead to the ocean as you would stay away from the beach and ocean if there is a tsunami. A regional tsunami from a local earthquake could strike some areas before a tsunami warning can be announced.

(Sources: http://tsunamifury.org/tsunami_warning.htm)

Image

(None) Only lecture

3. Evacuation



3. Evacuation

Get reliable information

When you are in the evacuation area, listen carefully to the radio or television for the latest news. Return to the coastline only when the authorities say it is safe. Tsunamis can last for many hours. The size of succeeding tsunami may be bigger than the first one. Listen to announcements from the authorities.

Absolutely, do not believe rumors.

3. Evacuation

Help other people

Help those who need assistance such as children, elderly, sick people, pregnant women, and people with disabilities. But do not move people who are seriously injured. In this case, call for professional help.

Purpose

In these two pages, show the activity that should be conducted at an evacuation site. There are two important points. First is getting accurate information, second is helping each other.

Materials

(None) Only lecture

Guidance

1. Lecture about getting accurate information
2. Lecture about helping each other

3. Evacuation

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～15	Lecture	Lecture
2	15～30	Lecture	Lecture

Teacher's data

Stay tuned to a battery-operated radio for the latest emergency information. Help injured or trapped persons. Give first aid where appropriate. Do not move seriously injured persons unless they are in immediate danger of further injury. Call for help. Remember to help your neighbors who may require special assistance-infants, elderly people, and people with disabilities. Stay out of damaged buildings. Return home only when authorities say it is safe. Enter your home with caution. Use a flashlight when entering damaged buildings. Check for electrical shorts and live wires. Do not use appliances or lights until an electrician has checked the electrical system. Open windows and doors to help dry the building.

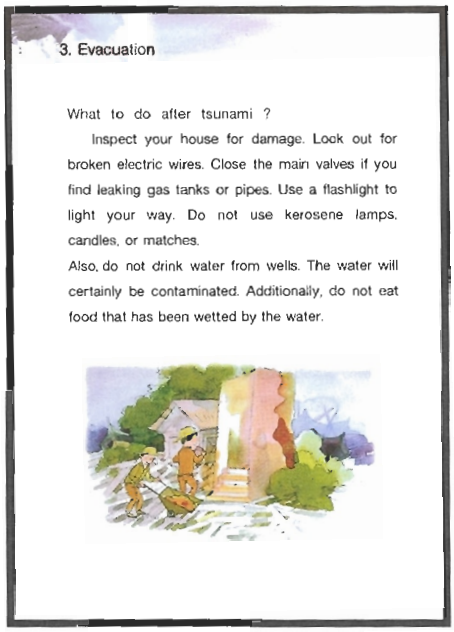
Shovel mud while it is still moist to give walls and floors an opportunity to dry. Check food supplies and test drinking water. Fresh food that has come in contact with flood waters may be contaminated and should be thrown out. Have tap water tested by the local health department.

(http://www.fema.gov/hazards/tsunamis/tsunamif.shtm)

Image

(None) Only lecture

3. Evacuation



3. Evacuation

What to do after tsunami ?

Inspect your house for damage. Look out for broken electric wires. Close the main valves if you find leaking gas tanks or pipes. Use a flashlight to light your way. Do not use kerosene lamps, candles, or matches.

Also, do not drink water from wells. The water will certainly be contaminated. Additionally, do not eat food that has been wetted by the water.

Purpose

This page shows the recovery activity after a destructive tsunami has struck the coastlines. It is not necessarily safe, even after returning home. It is important to act carefully.

Materials

(None) Only lecture

Guidance

1. Lecture (according to the kid's text)
2. Discussion: The feature of the house is different according to the region. You ask the students where are the danger spots at your house.

3. Evacuation

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～10	Lecture	Lecture
2	10～20	Discussion	Discussion

Teacher's data

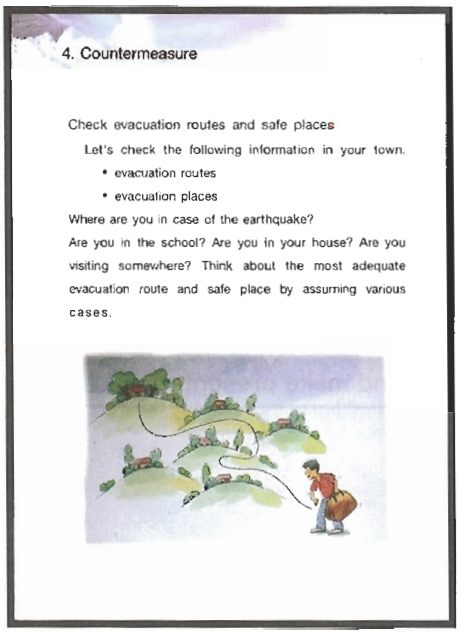
Note the following points;

- Gas leakages
- Leaks
- Crashed glasses
- Well water
- Unstable furniture
- Others

Image

(None) Only lecture

4. Countermeasure



4. Countermeasure

Check evacuation routes and safe places

Let's check the following information in your town.

- evacuation routes
- evacuation places

Where are you in case of the earthquake?

Are you in the school? Are you in your house? Are you visiting somewhere? Think about the most adequate evacuation route and safe place by assuming various cases.

Purpose

The first page in chapter 4 shows how to look for evacuation routes and evacuation sites. Though this preparedness activity takes a lot of time, it is very effective as the students identify the situation of a town in relation to disasters.

Materials

- Paper (As large as possible)
- Field note (Note when the outdoors acting)
- Camera (It is possible to print out within the day)
- Colored pencils
- Town map
- Scotch tape

Guidance

1. Learn about disasters
2. Know our town
3. Develop a map
4. Conduct group discussions and make presentation

4. Countermeasure

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～30	Lecture	Lecture
2	30～150	Know our town	Know our town
3	150～270	Develop a map	Develop a map
4	270～330	Conduct group discussions and make presentation	Conduct group discussions and make presentation

Teacher's data

1 Participants are given lectures on disasters in the local community and an introduction to the Town-Watching concept.

2. Each group walks around the streets in the local community, looking to identify both positive and negative features relating to disaster risk management activities. Group members make notes and take photograph.

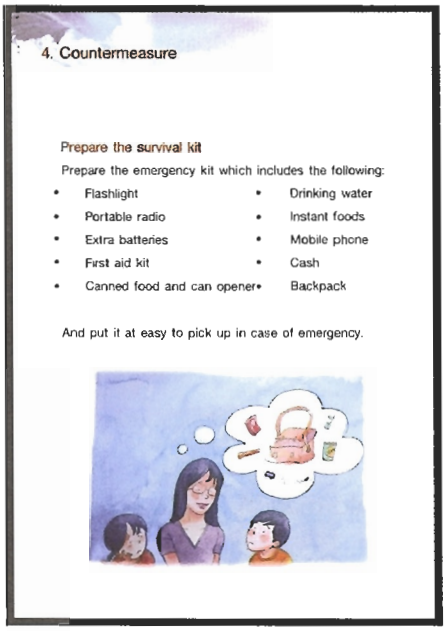
3. Group members create a community based hazard map, manually integrating their observa tions and findings on a large-scale base map.

4. Each group discussion such issues as about, "What are the potential problems?" "What are the possible preparedness actions?", and, "Who should be responsible for implementing particular preparedness actions?" Then, a representative of each group's discussions to present to an audience of all the other groups, so that all may share in each other's findings and suggestions.

Image

(http://www.sonpo.or.jp/action/release/news_bosaimap.html)

4. Countermeasure



Purpose

This page is a checklist of survival kit. The students will be able to identify survival kit items by using this page.

Materials

(None) Only lecture

Guidance

1. Lecture and distribute the answer sheet.
2. Discussion the contents of a survival kit. And question; why do you need it? Besides, what is necessary?

4. Countermeasure

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～10	Lecture	Lecture
2	10～20	Discussion	Discussion

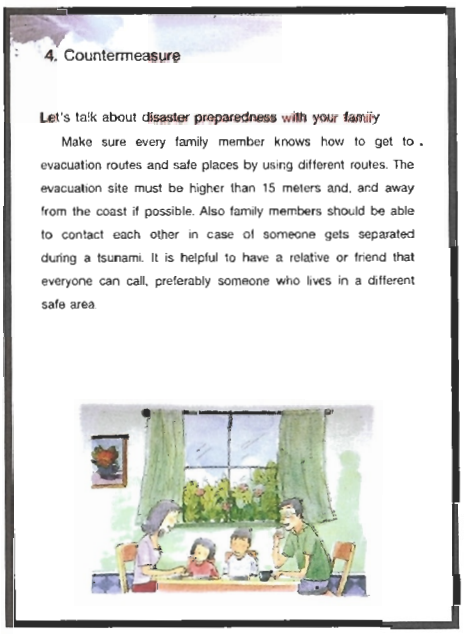
Teacher's data

- Flashlight : For night time use and dark location.
- Portable radio: It is effective to understand public information.
- Extra batteries: Maintaining the electric power
- First aid kit: It is effective to the immediate attention.
- Canned food and can opener: It notes it at the best-before date.
- Drinking water: It notes it at the best-before date.
- Instant foods: It notes it at the best-before date.
- Mobile phone: Effective contact method that ties family away
- Cash: It is possible to use it effectively at any time.
- Backpack: The above-mentioned one is put.

Image

(None) Only lecture

4. Countermeasure



4. Countermeasure

Let's talk about disaster preparedness with your family

Make sure every family member knows how to get to evacuation routes and safe places by using different routes. The evacuation site must be higher than 15 meters and, and away from the coast if possible. Also family members should be able to contact each other in case of someone gets separated during a tsunami. It is helpful to have a relative or friend that everyone can call, preferably someone who lives in a different safe area

Purpose

This page shows the importance of information sharing. Cooperation within school and the family is very useful for preparedness action. And you have to arrange the family's activities.

Materials

(None) Only lecture

Guidance

1. Lecture (at the school)
2. Discussion (at home with your family)
3. Discussion (at the school)

4. Countermeasure

4. Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	1st day	Lecture	Lecture
2	2nd day	Discussion	Discussion
3	3rd day	Discussion	Discussion

Teacher's data

1st day: Please bring the content of the lecture together.

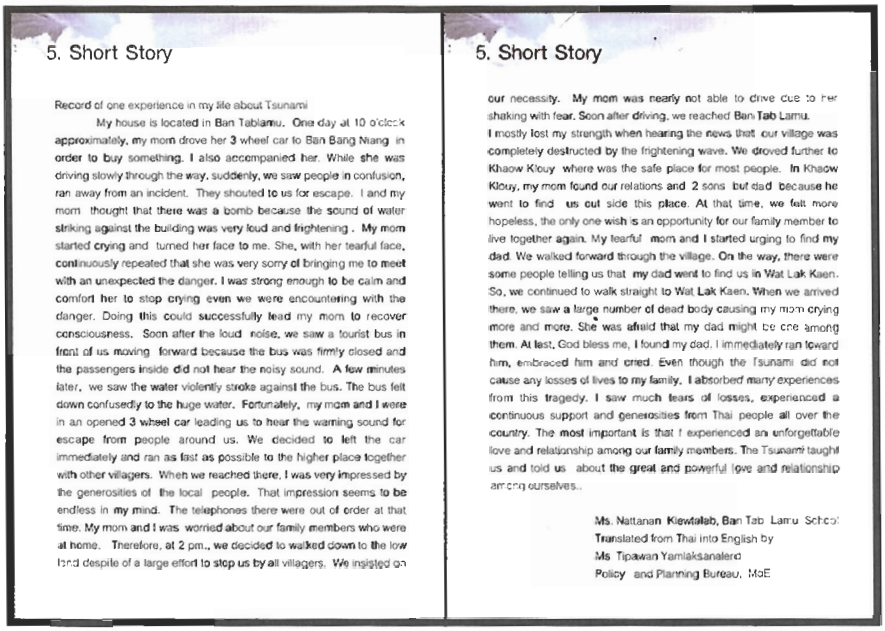
2nd day: The students will talk about disaster preparedness with family.

3rd day: the student will announce the content that discussed at home.

Image

(None) Only lecture

5. Short Story



5. Short Story

Record of one experience in my life about Tsunami

My house is located in Ban Tablamu. One day at 10 o'clock approximately, my mom drove her 3 wheel car to Ban Bang Niang in order to buy something. I also accompanied her. While she was driving slowly through the way, suddenly, we saw people in confusion, ran away from an incident. They shouted to us for escape. I and my mom thought that there was a bomb because the sound of water striking against the building was very loud and frightening. My mom started crying and turned her face to me. She, with her tearful face, continuously repeated that she was very sorry of bringing me to meet with an unexpected the danger. I was strong enough to be calm and comfort her to stop crying even we were encountering with the danger. Doing this could successfully lead my mom to recover consciousness. Soon after the loud noise, we saw a tourist bus in front of us moving forward because the bus was firmly closed and the passengers inside did not hear the noisy sound. A few minutes later, we saw the water violently stroke against the bus. The bus felt down confusedly to the huge water. Fortunately, my mom and I were in an opened 3 wheel car leading us to hear the warning sound for escape from people around us. We decided to left the car immediately and ran as fast as possible to the higher place together with other villagers. When we reached there, I was very impressed by the generosities of the local people. That impression seems to be endless in my mind. The telephones there were out of order at that time. My mom and I was worried about our family members who were at home. Therefore, at 2 pm., we decided to walked down to the low land despite of a large effort to stop us by all villagers. We insisted on

5. Short Story

our necessity. My mom was nearly not able to drive due to her shaking with fear. Soon after driving, we reached Ban Tab Lamu.

I mostly lost my strength when hearing the news that our village was completely destructed by the frightening wave. We droved further to Khaow Klouy where was the safe place for most people. In Khaow Klouy, my mom found our relations and 2 sons but dad because he went to find us out side this place. At that time, we felt more hopeless, the only one wish is an opportunity for our family member to live together again. My tearful mom and I started urging to find my dad. We walked forward through the village. On the way, there were some people telling us that my dad went to find us in Wat Lak Kaen. So, we continued to walk straight to Wat Lak Kaen. When we arrived there, we saw a large number of dead body causing my mom crying more and more. She was afraid that my dad might be one among them. At last, God bless me, I found my dad. I immediately ran toward him, embraced him and cried. Even though the Tsunami did not cause any losses of lives to my family, I absorbed many experiences from this tragedy. I saw much tears of losses, experienced a continuous support and generosities from Thai people all over the country. The most important is that I experienced an unforgettable love and relationship among our family members. The Tsunami taught us and told us about the great and powerful love and relationship among ourselves..

Ms. Nattanan Klewtalab, Ban Tab Lamu School
Translated from Thai into English by
Ms Tipawan Yamlaksanalerd
Policy and Planning Bureau, MoE

Purpose

This section share's student story experiences. However, this story is one example. If it is possible, you can gather the other story, speak to students, and show the real life severity and the hope for the disaster.

Materials

(None) Only introduction

Guidance

1. introduction the existing materials (experiment story)
2. discussion

5. Short Story

Timetable

Order of guidance	Time (min)	Activities	
		Teacher	Student
1	0 ～15	Lecture	Lecture
2	15～30	Discussion	Discussion

Teacher' s data

(None) Only introduction

Gather the experiment stories of the student that live in your region.

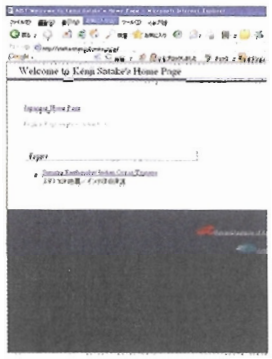
mage

(None) Only introdution

Reference sources of information

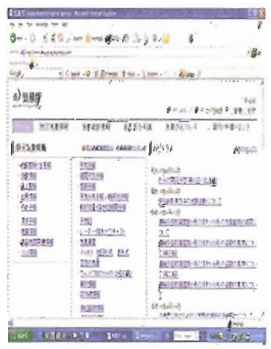
http:// www.disaster.go.th/html/ english/executives.html

http://staff.aist.go.jp/kenji.satake/



http://www.tsunamiwave.info/

http://www.jma.go./jp/jma/idexe.html



http://www.usgs.gov/

http://www.adrc.or.jp/

http://www.emd.wa.gov/info/

http://www.metho.Tokyo.jp/

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