CLIL MODULE:
EARTHQUAKES AND VOLCANOES

Prof.ssa Elena Tibaldi
Istituto Sant'Anna
AS 2013-2014

CLIL MODULE OBJECTIVES

Content (Science):

- Understand how and why earthquakes form
- Describe what happens at three different plate boundaries
- Explain how tsunamis form
- Describe the structure of volcanoes
- Describe the geographic distribution of earthquakes and volcanoes

Communication (Language):

- Develop new vocabulary related to earthquakes and volcanoes
- Use newly acquired vocabulary in context
- Study multiple meaning words
- Recognize word origin

Cognition (Cognitive skills):

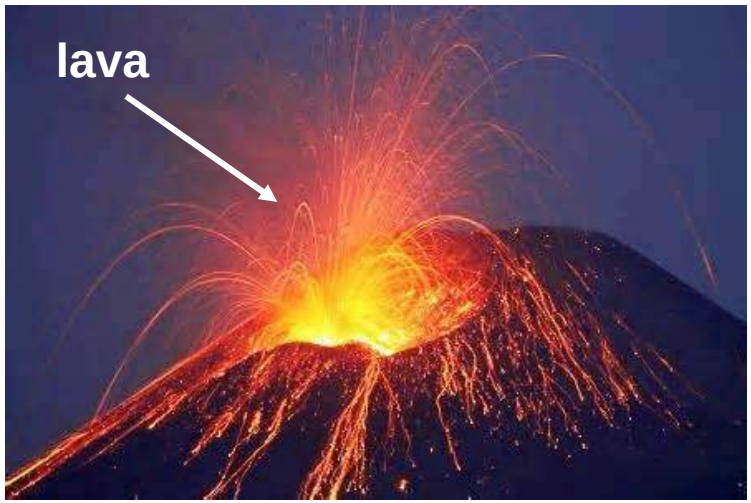
- Interpret drawings and pictures
- Interpret a landscape and the geological structures

Culture:

- Be aware of seismic and volcanic risk in Italy
- Be aware of safety precaution in case of natural event

(1) BRAINSTORMING ACTIVITY: WHAT DO YOU KNOW ABOUT NATURAL DISASTERS?

Look at the following pictures: describe them and try to identify the causes of the natural disaters.



(2) READ THE FOLLOWING PASSAGE AND...

Earth's crust is the **layer of rock** closest to the **Earth's surface**. The crust is divided into a number of blocks of rock, called **plates**, that cover the planet. An **earthquake** is a **sudden**, violent shaking in Earth's crust. It happens when two of these plates, under great pressure, move past each other along a **fault**. The violent shaking is caused by **seismic waves** that travel through the planet. These waves can knock down building and bridges. The place inside the Earth where an earthquake starts is called **focus.** The **epicenter** is the place on the Earth's surface directly above the focus.

A volcano forms at an opening, or **vent**, in the crust near the **edges of plates**. A **volcanic eruption** occurs when the plates move apart or when one plate is pushed under the other. Water vapour, particles, gases and magma pour out onto the surface. Volcanoes form new land. Gases and particle from the volcanoes may affect the weather.

(Gateway to Science, Collins)

.... (3) BUILD YOUR OWN GLOSSARY

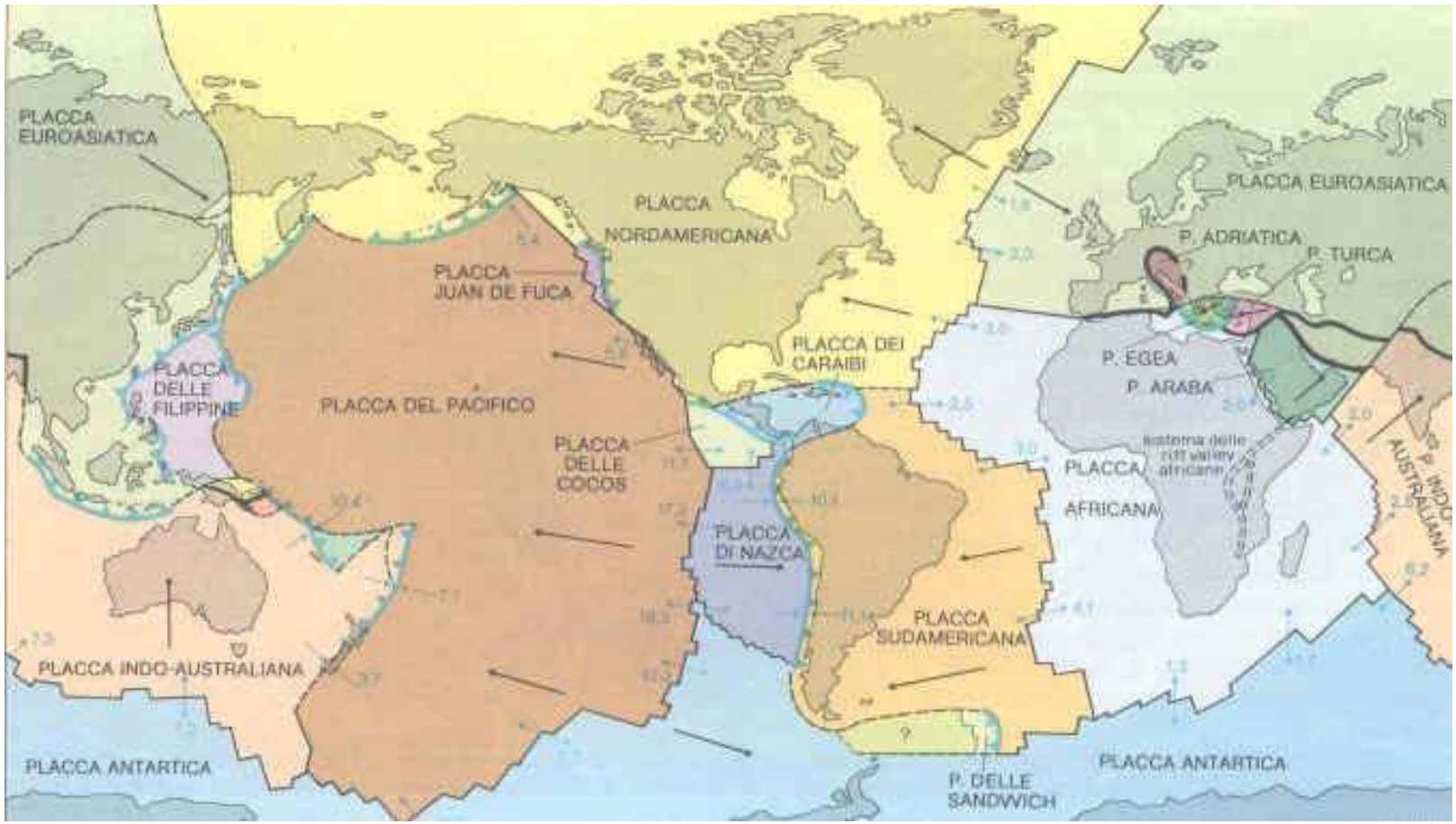
Complete the following table, writing the translation of the terms.
You can personalize the table by adding other terms that you don't know yet and finding out the correct translation using a dictionary.

English term	Italian term
Earth's crust	
Layer of rock	
Earth's surface	
Plates	Placche tettoniche
Earthquake	
Sudden	
Fault	Faglia
Seismic waves	
Focus	Ipocentro
Epicenter	
Vent	Camino vulcanico

English term	Italian term
Edges of plates	Margini di placca
Volcanic eruption	
Oceanic ridge	Dorsale oceanica
Oceanic trench	Fossa oceanica

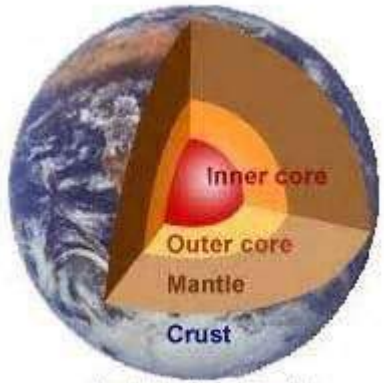
(4) THE SURFACE OF THE EARTH

Earth's crust is the layer of rock closest to the Earth's surface. The crust is divided into a number of blocks of rock, called **plates**, that cover the planet.
Earth's plates float on the mantle.
Plate tectonics is the result of the motion of Earth's plates and represents the explanation for the continental drift.



(5) STRUCTURE OF THE EARTH

Look at the picture. Then read the sentences and check the correct section.



Inside the Earth

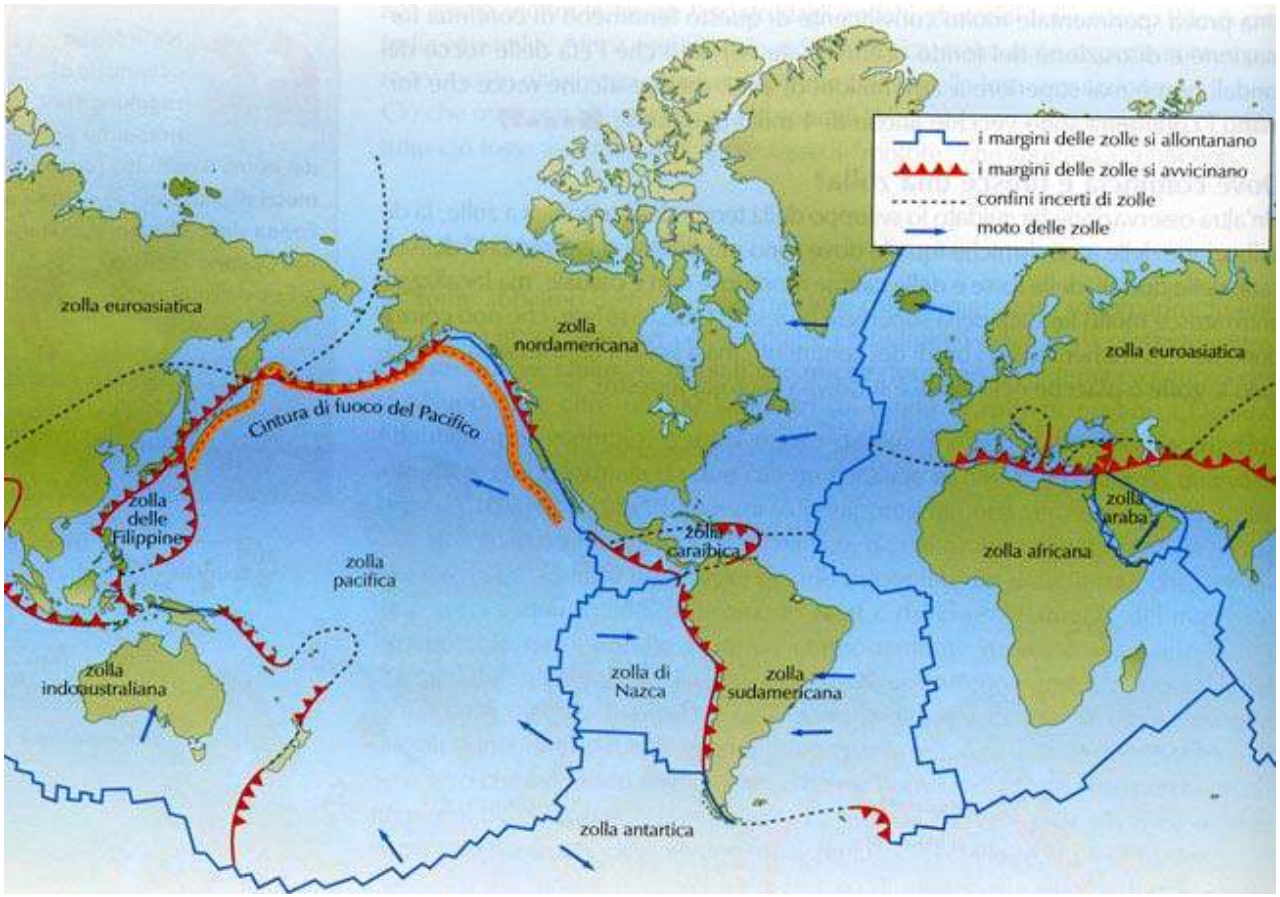
Sentences	CRUST	MANTLE	CORE
1) It can be as thin as 3 km under the oceans			
2) It is the hottest part of the Earth.			
3) It may be 70 km in thickness under the continent			
4) It moves about as fast as fingernails grow.			
5) The rock here is so hot that it is in a plastic state.			
6) Temperatures are greater than 4000°C.			
7) The outer part of this layer consists of solid rock, mostly basalt and granite.			
8) This part is made up of iron and nickel.			
9) It is liquid in the outer part and solid in the inner part			
10) Tectonic plates float on it.			

(Geography - K. Kelly, Macmillan; modified)

(6) PLATE BOUNDARIES AND MOVEMENTS

- Plates boundaries are places where two plates meet. These bondaries can be on a continent or beneath the ocean.

- There are three types of movement at the plate boundaries:

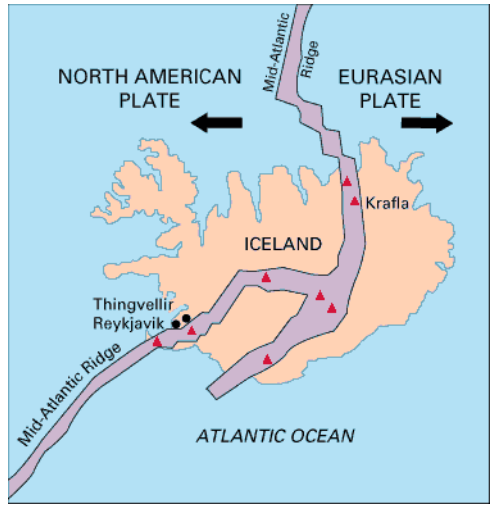


A) Divergent boundary

B) Convergent boundary

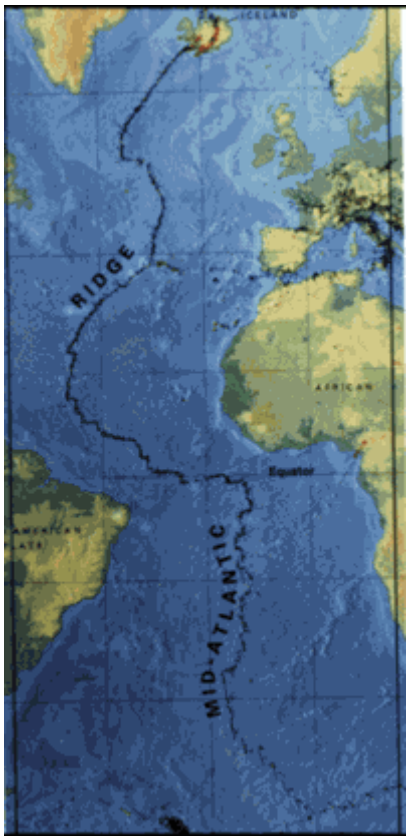
C) Transform boundary

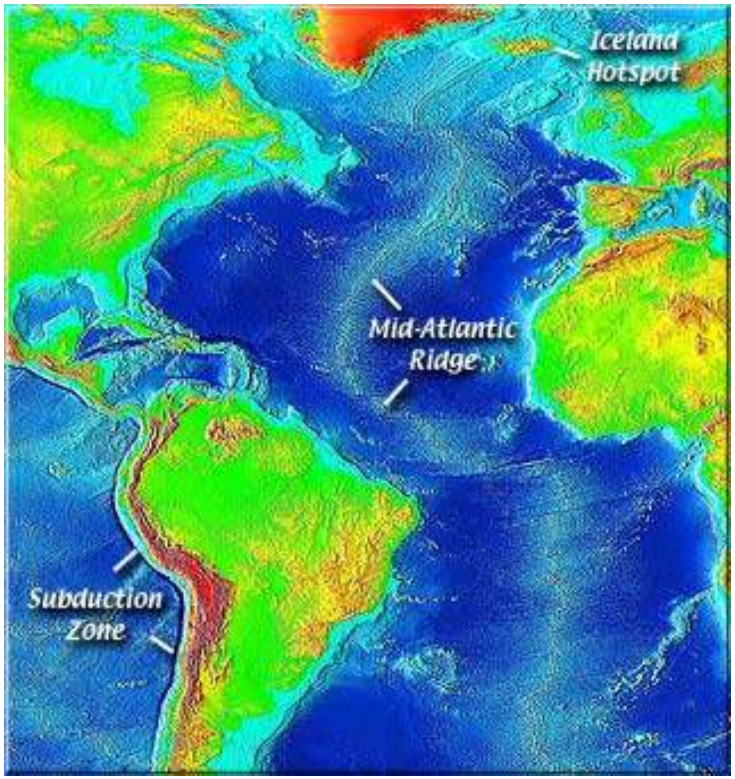
(A) DIVERGENT PLATE BOUNDARIES: when two plates move apart



MID-ATLANTIC RIDGE:
An example of oceanic ridge

Mid-Atlantic Ridge is an underwater mountain chain where plates move apart. New crust forms at the ridge and continents slowly move apart

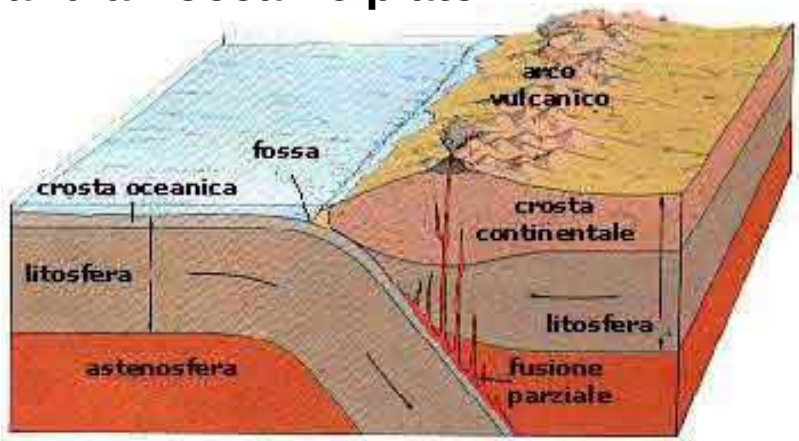




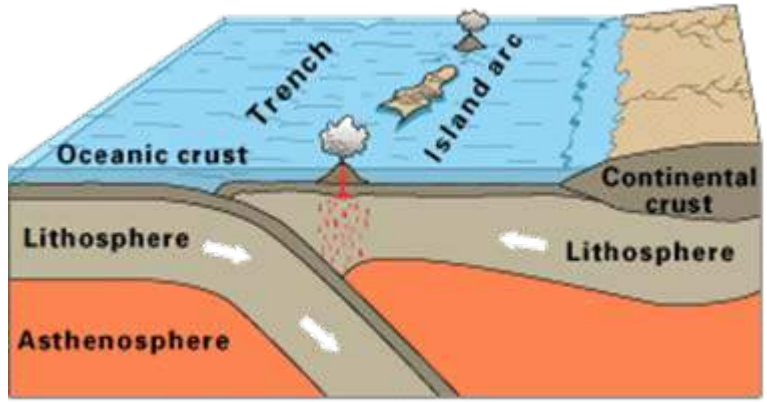
Rock outcrop in Iceland, a visible surface feature of the Mid-Atlantic Ridge, the easternmost edge of the North American plate. It is a popular destination for tourists in Iceland.

(B) CONVERGENT PLATE BOUNDARIES:
when two plates come together

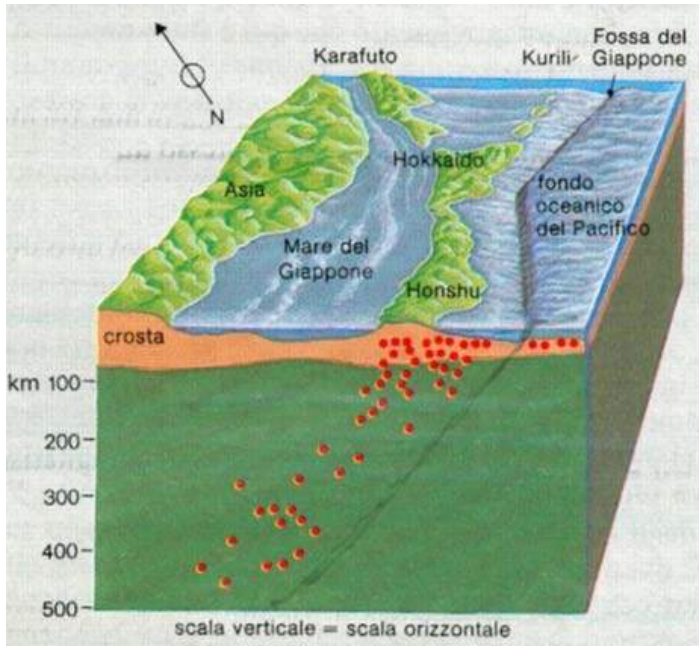
a continental and an oceanic plate



two oceanic plates

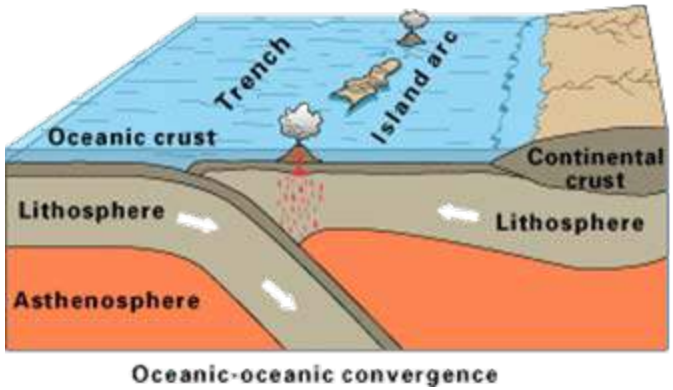


Oceanic-oceanic convergence



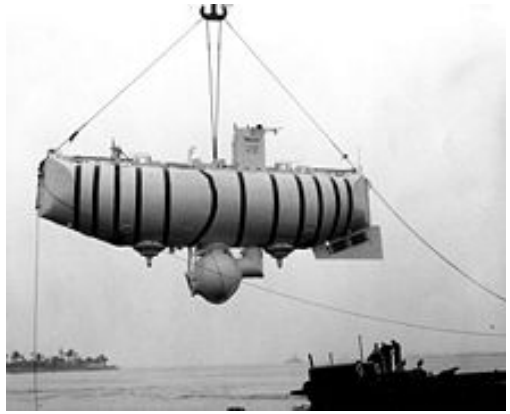
MARIANAS TRENCH: An example of oceanic trench

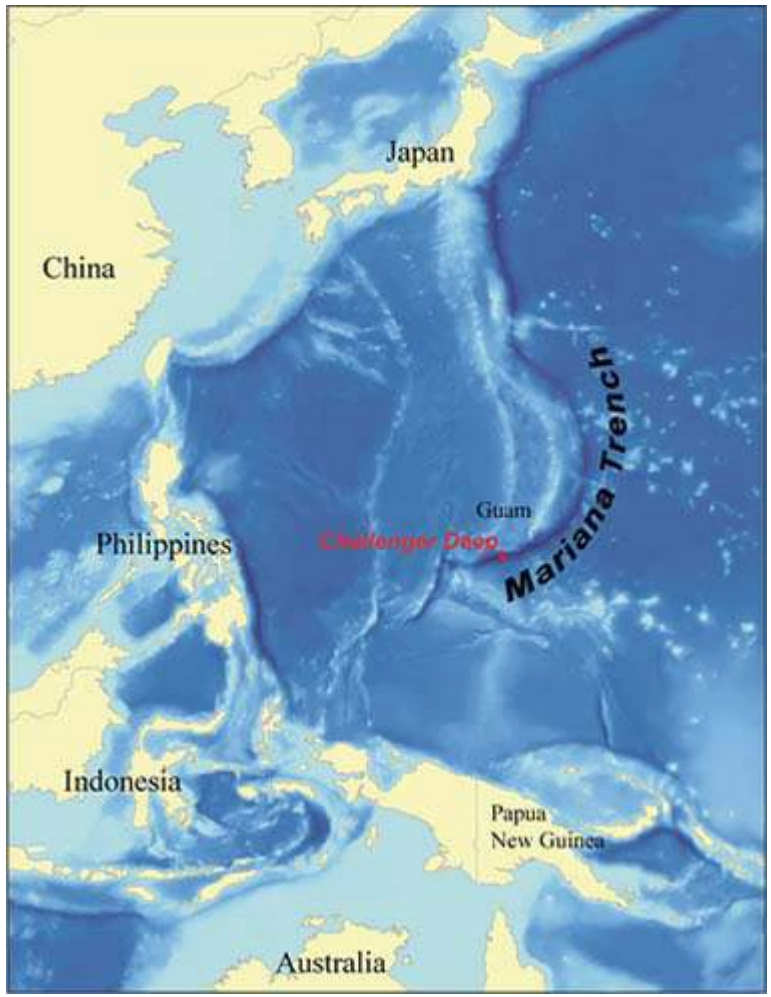
The **Mariana Trench** or **Marianas Trench** is the deepest part of the world's oceans. It is located in the Western Pacific Ocean, to the east of the Mariana Islands. The trench is about 2,550 kilometres long but has an average width of only 69 kilometres. It reaches a maximum-known depth of 10.911 km



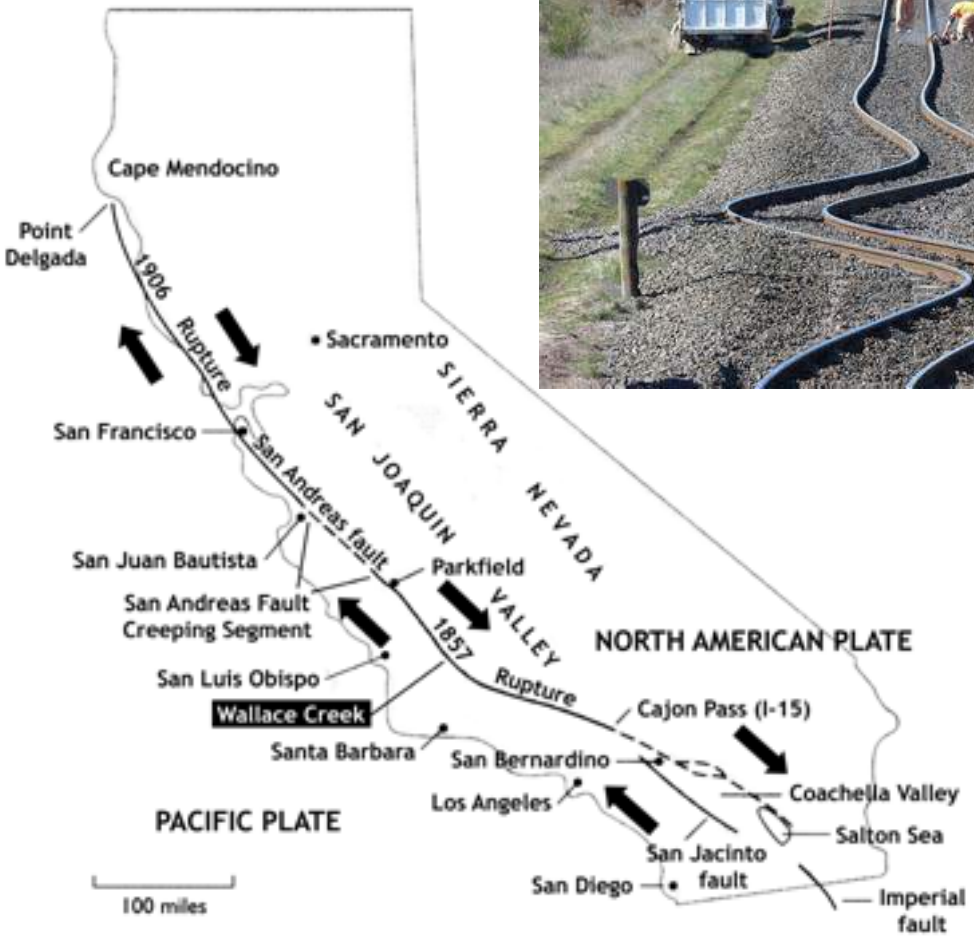
Oceanic-oceanic convergence

The *Bathyscaphe Trieste* (designed by Auguste Piccard) was the first manned vehicle to reach the bottom of the Marianas Trench in 1959.





(C) TRANSFORM PLATE BOUNDARIES: when plates slide past each other



San Andreas fault

SAN FRANCISCO: WAITING FOR THE “BIG ONE”

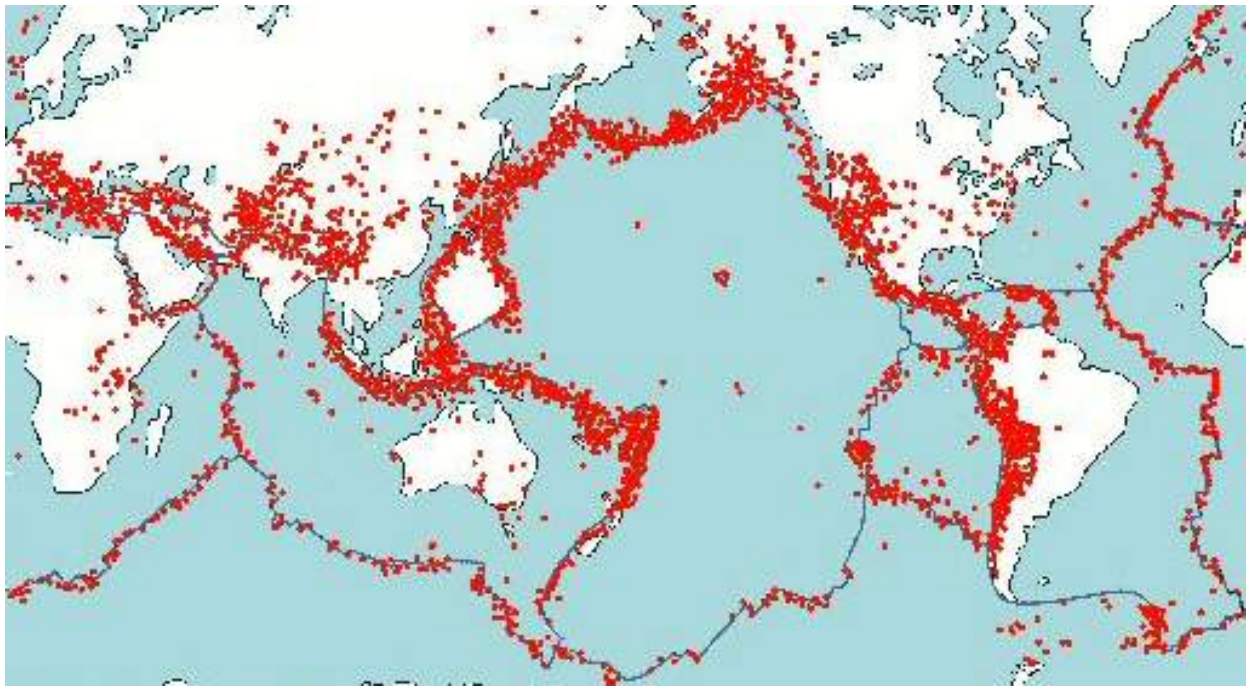
San Francisco (1906)

San Francisco (1989)

7) WHERE DO EARTHQUAKES HAPPEN?

Most earthquakes result when plates move over, under or past each other. Earthquake occurs when the pressure on the rocks at plate boudaries builds up. This happens in different ways. Plates can move apart or diverge. As the rock pull apart, magma rises from below. Plates can come together or converge. The rocks are pushed from two different directions. This makes them bend and break. Earthquakes can also happen when two plates move past one another.

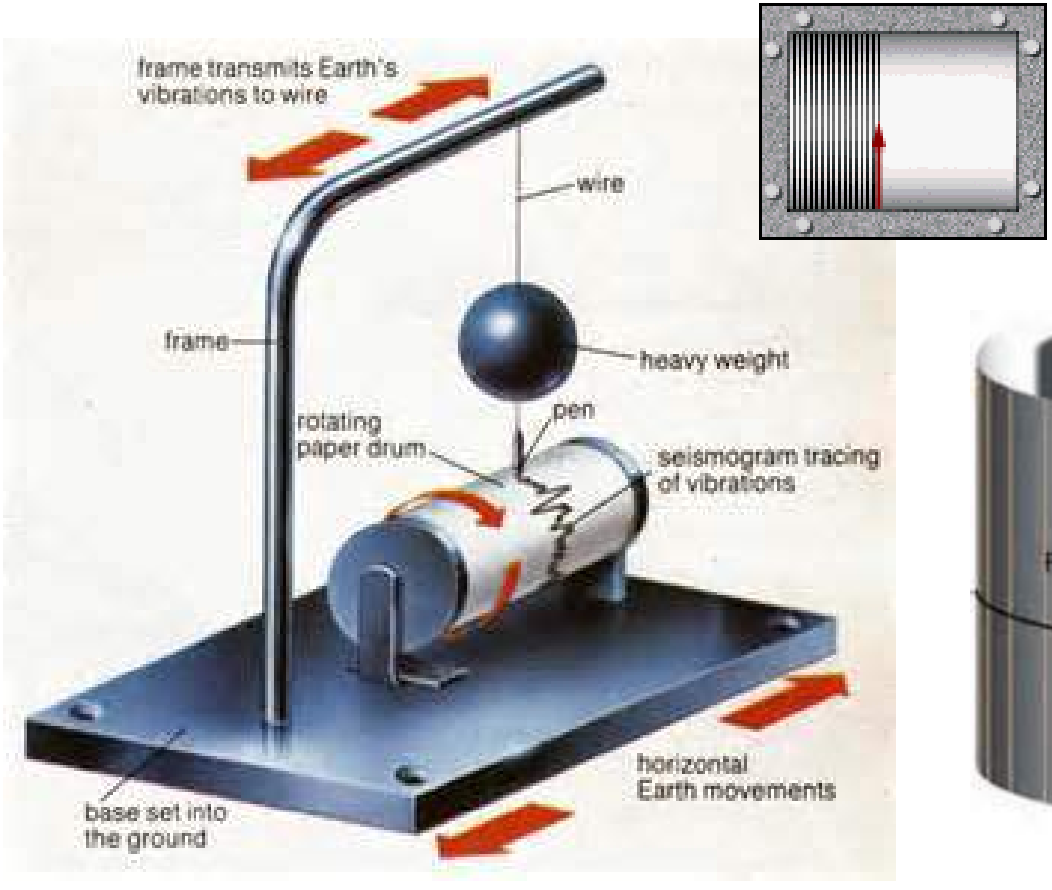
(Gateway to Science, Collins)

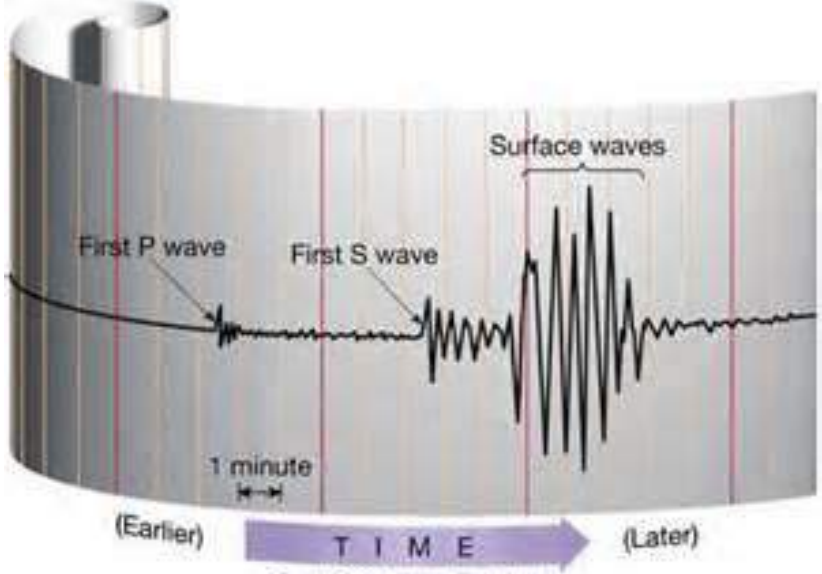


Global view of JRC support to natural disasters (earthquakes)
http://ec.europa.eu/dgs/jrc/index.cfm?id=5060#

(8) SEISMOGRAPH AND SEISMOGRAM

A **seismograph** is the device that scientists use to measure earthquakes. The goal of a seismograph is to accurately record the motion of the ground during a quake.

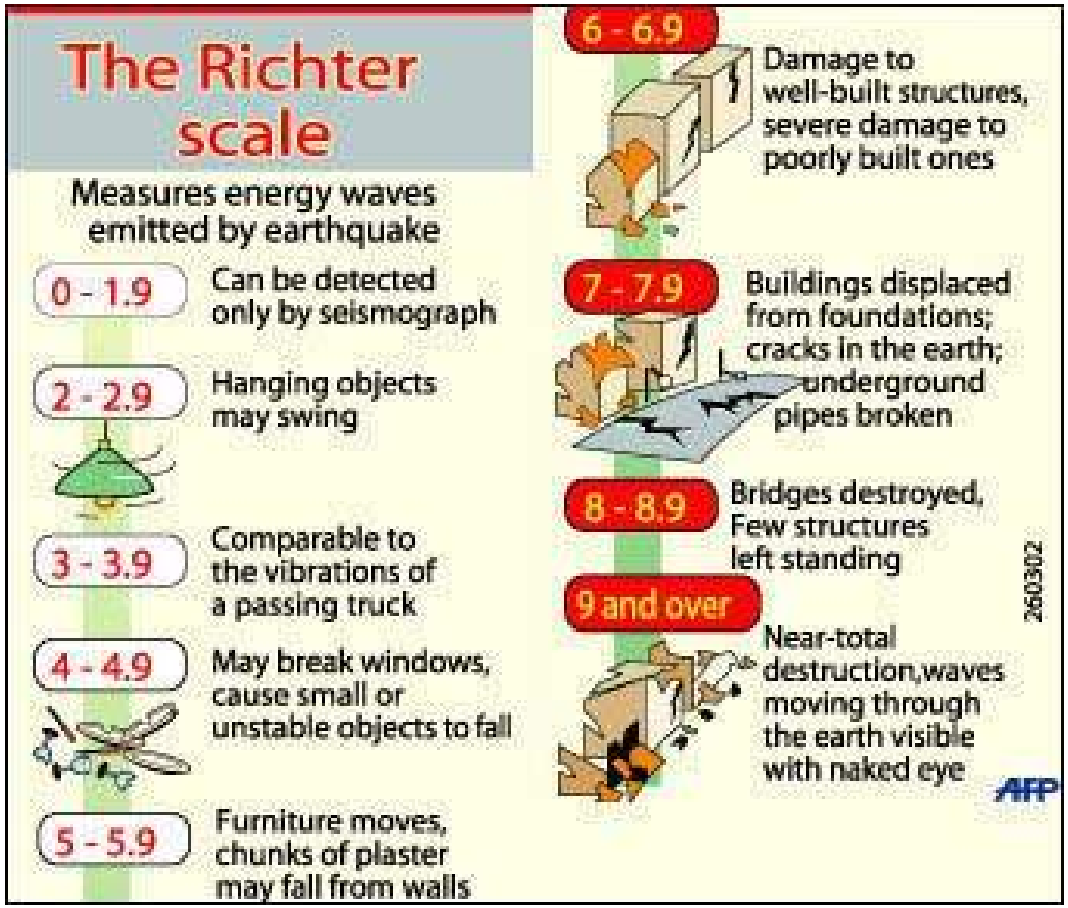




(9) RICHTER AND MERCALLI SCALE

THE RICHTER SCALE

- Developed by American Charles Richter in 1935 to measure the size of earthquakes
- Numbers 1 to 10 relate to the energy that the quake releases
- Those of magnitude 2 are not felt. A magnitude 5 quake can cause major damage. Above 8 and the effects can be spread over hundreds of miles
- On the Richter Scale, each step is a 30-fold increase in energy. So a magnitude 9 quake is 800,000 times bigger than a 5



Modified Mercalli Scale

I	Only felt by sensitive instruments
II	Felt by few persons at rest, especially on upper floors, delicate suspended objects may swing
III	Felt indoors, but may not be recognized as earthquake, vibrations like large passing truck
IV	Felt indoors by many, some outdoors, may awaken some sleeping persons; dishes, windows, doors may move, cars rock.
V	Felt by most; some windows, dishes break; tall objects may fall.
VI	Felt by by all, falling plaster and chimneys, light damage but some fear.
VII	Very noticeable, damage to weaker buildings on fill; driving automobiles notice.
VIII	Walls, monuments, chimneys, bookcases fall; liquifaction; driving is difficult
IX	Buildings shifted off foundations, cracked and twisted; ground is cracked and underground pipes are broken.
X	Most structures severely damaged to destroyed; ground is cracked, rails are bent, landslides on steep slopes
XI	Few structures standing; bridges and roads severely damaged or destroyed, large fissures in ground
XII	Total damage; can see the earthquake wave move through the ground; gravity overcome and objects thrown into the air

(10) SEQUENCE OF EVENTS IN AN EARTHQUAKE

Put the sentences in the correct order:

 Buildings may sway and eventually collapse if the force is strong enough.

 Earthquakes tend to happen where plates collide or slide past each other.

 The colliding or sliding plates cause such a great compression below the surface that rocks bend and then crack suddenly.

 The shock waves may cause the Earth's surface to tremble or "quake" for several seconds.

 The earthquake is usually strongest at the epicentre, which is the surface area directly above the focus.

 This is the place where the cracks occur.

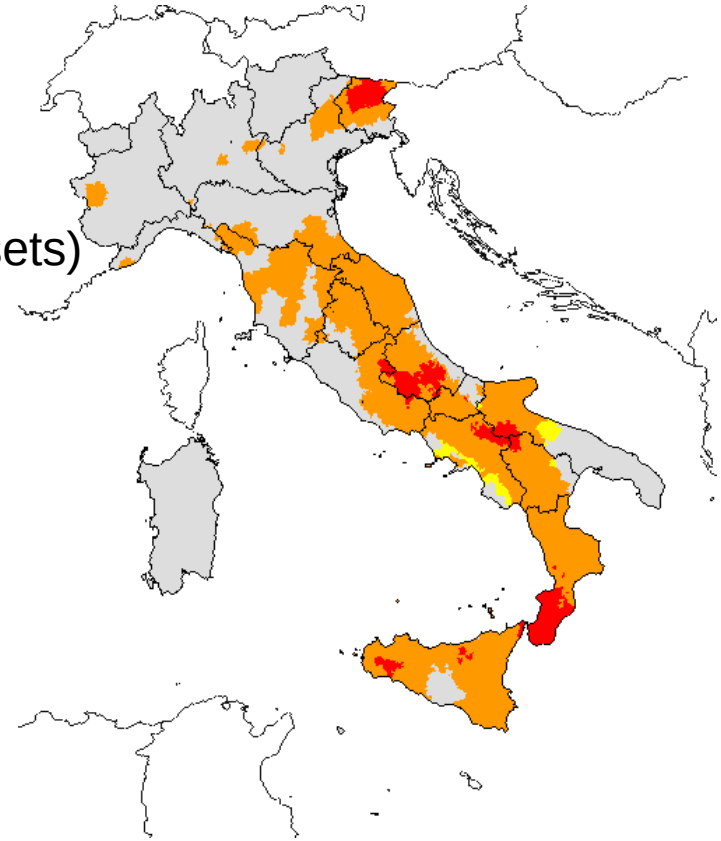
 When this happens, shock waves spread out from the focus

(Geography – K. Kelly, Macmillan)

(11) SEISMIC HAZARD IN ITALY

Seismic hazard is defined as the probability in a given area and in a certain interval of time of an earthquake occurring that exceeds a certain threshold of magnitude.

Italy has a medium-high seismic hazard (due to the frequency and intensity of phenomena), very high vulnerability (due to the fragility of building, infrastructural, industrial, production and service assets) and an extremely high exposure (due to population density and its historical, artistic and monumental heritage that is one of its kind in the world).



L'Aquila, April 6, 2009

Italy therefore has a high seismic risk, in terms of victims, damage to buildings and direct and indirect costs expected after an earthquake.

(12) SAFETY PRECAUTIONS DURING EARTHQUAKES

Look at the pictures and write a short sentence to indicate what you should or shouldn't do during an earthquake.

1

……

……

2

……

……

3

……

……

4

……

……

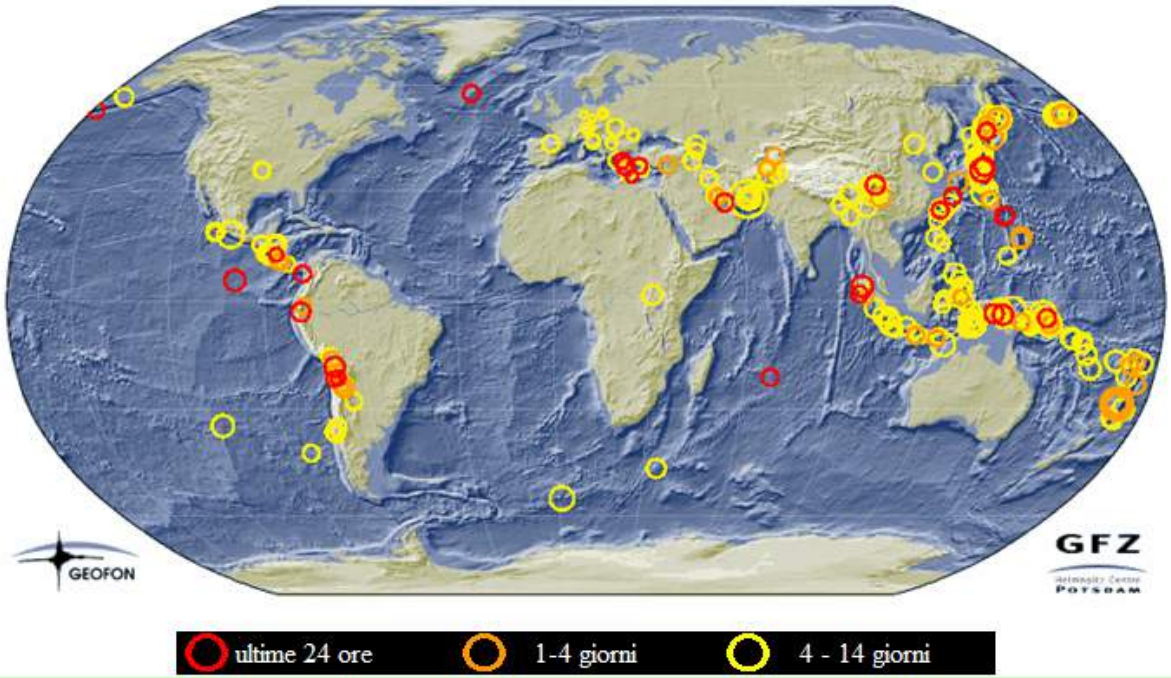
ULTIME NEWS

Notizie Terremoti

- Forte Scossa Di Terremoto In Giappone: Magnitudo 5. 7 A Nord Di Tokyo
- Terremoto Oggi Piemonte, Scossa In Provincia Di Alessandria
- Terremoto Al Largo Delle Eolie: Scossa Di Magnitudo 2. 4 In Mattinata
- Terremoto Ecuador Oggi, Forte Scossa Vicino Cuenca
- Terremoto Oggi Sicilia, Lieve Scossa In Mare
- Una Mappa 3d Della Città Di Heracleion
- Terremoto In Abruzzo Durante La Notte. (29 / 04)
- Terremoto Grecia, Intensa

Terremoti in tempo reale nel mondo

entra nella pagina degli ultimi terremoti



http://meteoterremoti.altervista.org/

(13) SURFACE WAVES AND TSUNAMIS

1) Read the following passage:

Most waves on a lake or an ocean occur when wind energy moves over the surface.
The energy that causes the tsunami comes from an earthquake on the seafloor.
All of the water above the epicentre is affected. A wave forms.
It doesn't seem large at first, but the energy is great.
When the water hits the shore, it crashes over the land.

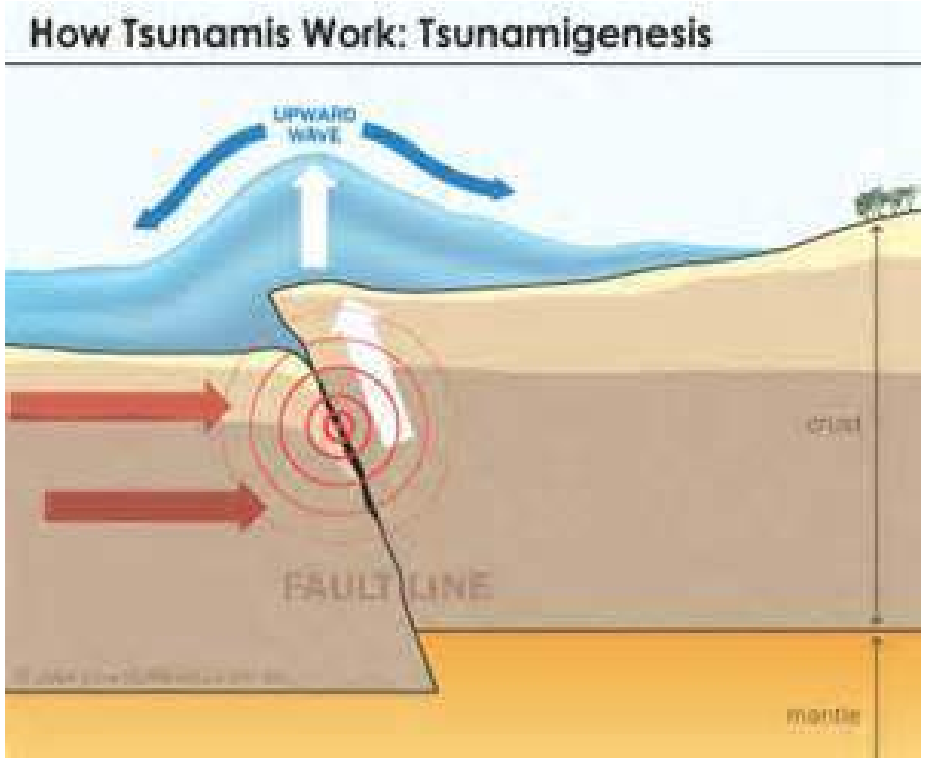
(Gateway to Science, Collins)

2) Think and discuss.

- Why tsunami doesn't seem large at first?
- How can be tsunami detected?
- What should you do in case of tsunami?

3) Find out information on:

- Which are the area in the world which are more at risk of tsunami?
- how tsunamis are detected in different part of the world.
- Recent tsunamis.



LET'S PLAY WITH WORDS

What is the origin and the meaning of the term "tsunami"?

The word tsunami comes from two Japanese words:
- The word **tsu** means "harbor"
- The word **nami** means "wave".

A **tsunami** is a huge wave tha is most damaging when it reaches a harbor or shore

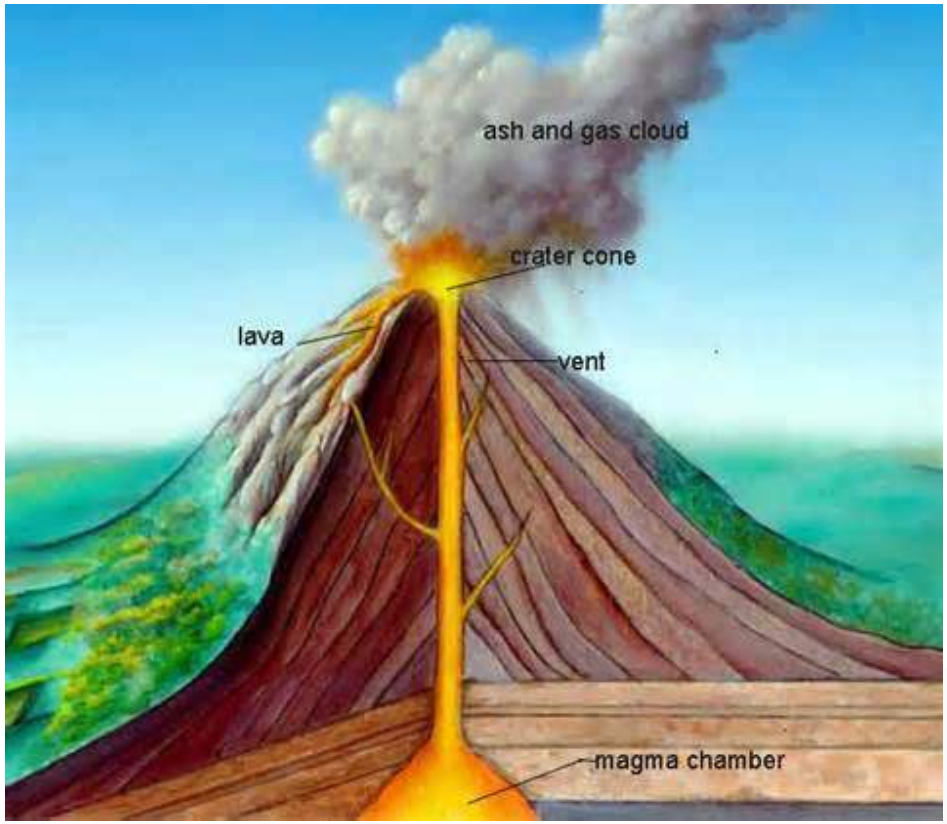
(Gateway to Science, Collins)

(14) WHERE DO VOLCANOES FORM?

Volcanoes often form at the boundaries between plates. They occur when the plates pull apart and magma flows up from below through cracks (divergent boundaries). Volcanoes can also form when plates come together (convergent plates). One plate moves under the other. The rock gets very hot and becomes magma. The magma rises, forming a volcano.

(Gateway to Science, Collins)

(15) VOLCANO: A SMALL GLOSSARY



TERM	TRANSLATION
Ash	
Crater cone	
Gas cloud	
Vent	
Magma chamber	

magma	Melted rocks and vapour; inside the Earth; in crust and mantle
lava	Melted rocks; solidify outside the Earth

www.youtube.com/watch?v=HgcTRHPiO68

Video eruzione vulcano Islandese Eyjafjöll

(16) ACTIVITY: FOLD MOUNTAINS AND VOLCANOES

Complete the following sentences with these words:

Pressure – buckle – eruption – folded – colliding – wells up – sinks – collision – surface – crust – melts

1) The Earth's plates are frequently..... with each other.
2) The collision of the Earth's plates leads to intense..... along their zones of contact.
3) The pressure from plate..... causes the rock layers of the.....to fold.
4) When rock layers....., this forces them upwards to create fold mountains chains.
5) When one plate is forced under another plate it..... down into the intensely hot mantle and .....

(Geography – K. Kelly, Macmillan)

6) Melted rock is lighter than solid rock, so some of it will rise upwards to the ..... Through the buckled and ..... rock layers.

7) The melted rock ..... to erupt violently at the surface, creating some of the most dangerous volcanoes on Earth.

8) An example of such an ..... Was at Mount St Helens in the Rocky Mountains in 1980 which killed 57 people.

Mount St Helens

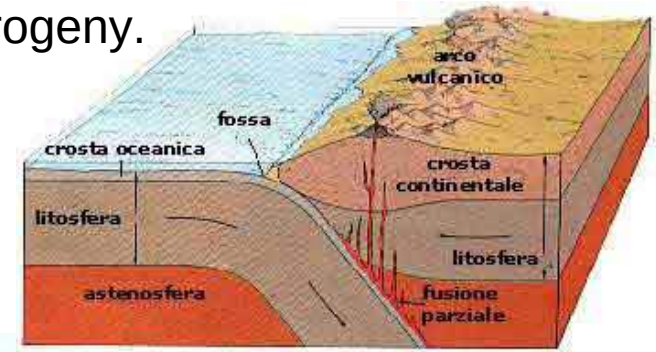
(Geography K. Kelly, Macmillan)

(17) MOUNT ACONCAGUA: THE HIGHEST VOLCANO IN THE WORLD

Mt Aconcagua is the highest volcano in the world. It reaches 6959m. It is located in the Andes Mountains between Chile and Argentina.

The mountain was created by the subduction of the Nazca Plate beneath the South American plate during the geologically recent Andean orogeny.

It is not an active volcano.



(18) ACTIVITY: THE RESTLESS EARTH

Match these words with the correct paragraph.

Plates – continental drift – folding – earthquakes – mid ocean ridges – volcanic mountains – the Pacific Ring of Fire

1) _____→ These can occur where the plates collide or slide past each other and compression and cracking of rock causes shock waves to spread from the focus. When these waves reach the surface, the ground trembles, causing great damage to life and property.

1) _____→ this phenomenon can occur where plate boudaries collide and compression causes parts of the Earth's crust to become raised and buckled into mountains.

1) _____→ these are formed where plates collide and magma reaches the surface violently through a vent. Layers of ash and lava gradually form a volcanic cone, which will have a crater at its summit.

(Geography – K. Kelly, Macmillan)

1) _____ → these can be formed where plate boundaries separate beneath the oceans. Magma makes its way to the surface along cracks to form raised formations. Some higher parts may protrude above the surface of the ocean in the form of volcanic islands.

5) _____→ The layers on the surface of the Earth's crust which make up our continents and the floors of our oceans.

6) _____→ This is the world's largest earthquake and volcanic zone.

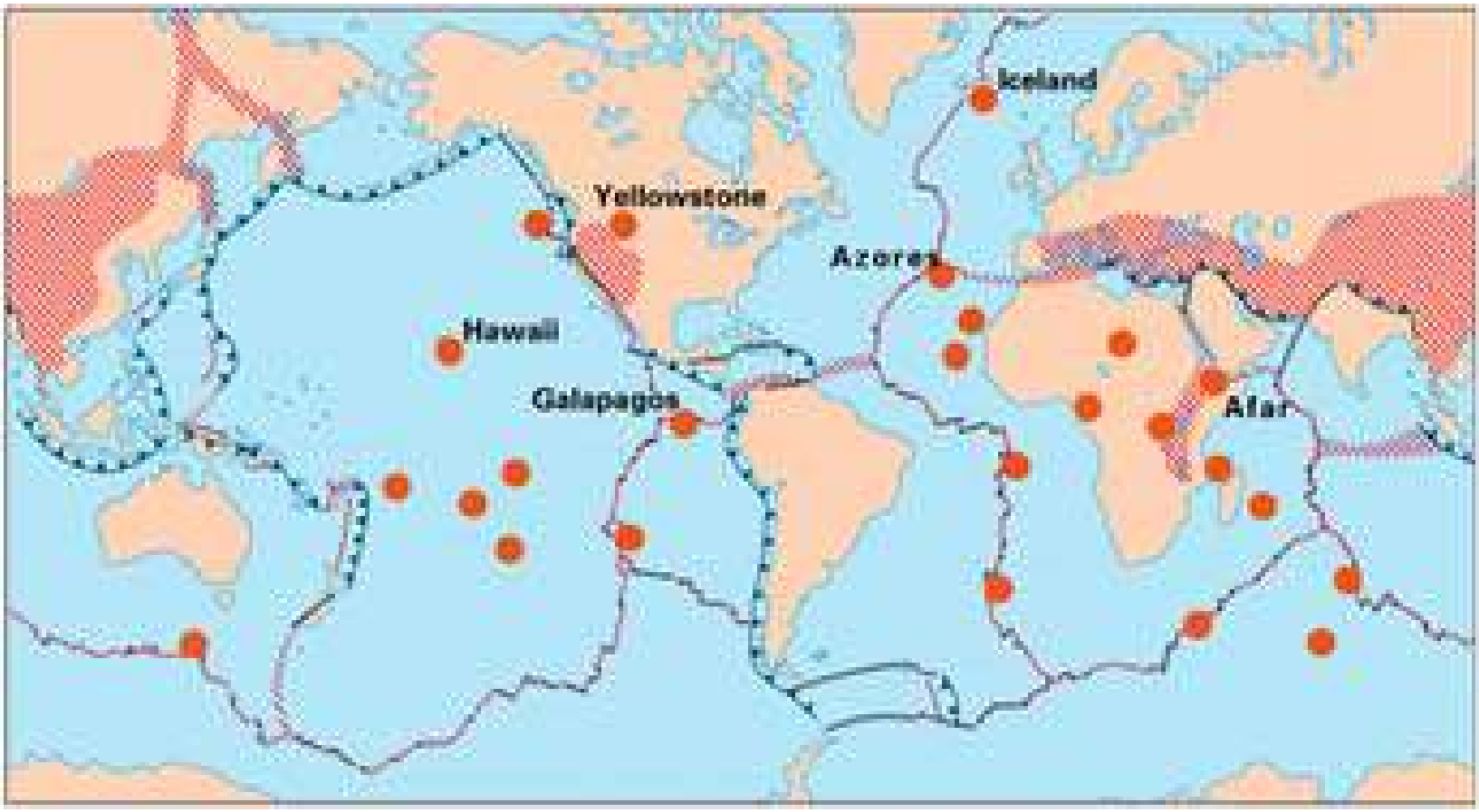
7) _____→ The process by which convection currents in the mantle below the Earth's surface cause the plates to move slowly and also cause the boudaries of plates to collide with and separate from each other.

(Geography K. Kelly, Macmillan)

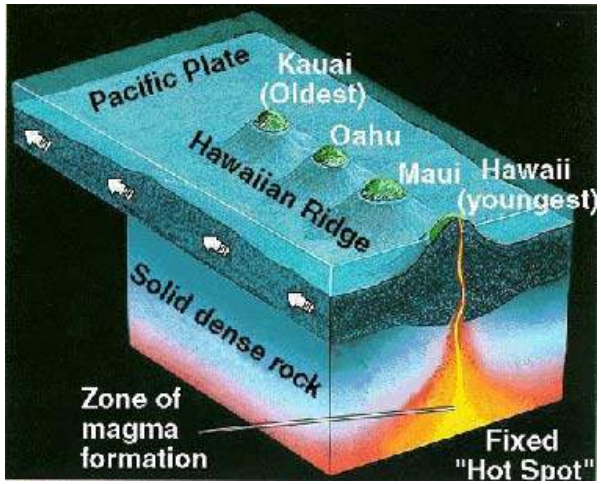
(19) VOLCANOES AND HOT SPOTS

The mantle is the layer of the Earth under the crust. Some areas of the mantle are hotter than others. Volcanoes can form at these hot spots. As the plates move, the volcanoes form an island chain. The Hawaiian Islands are on a hot spot.

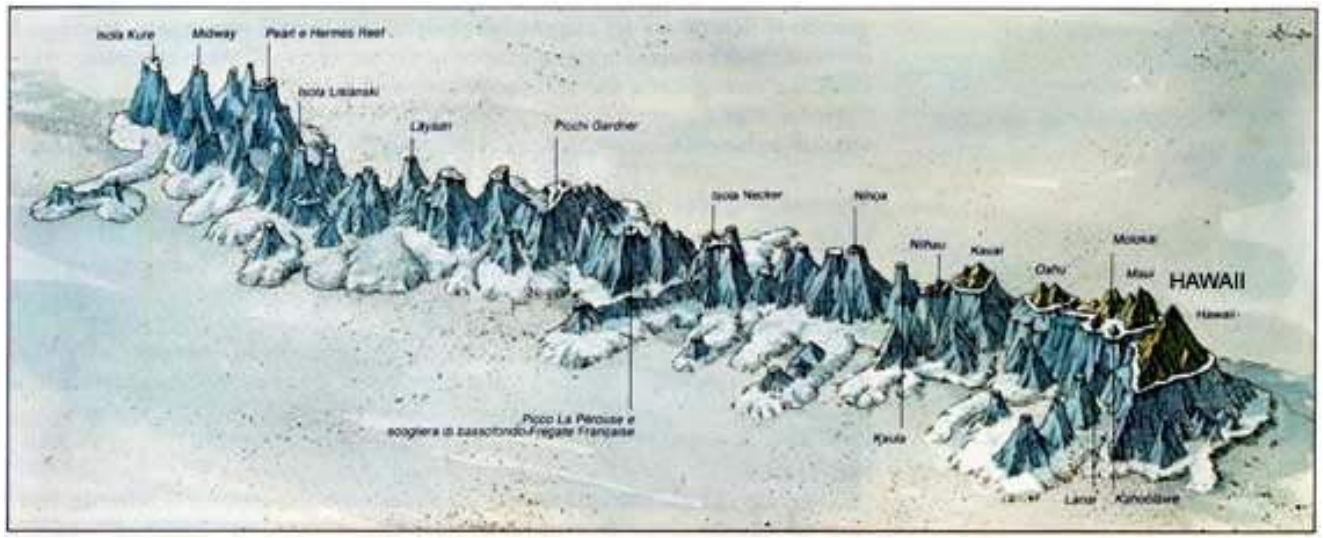
(Gateway to Science, Collins)



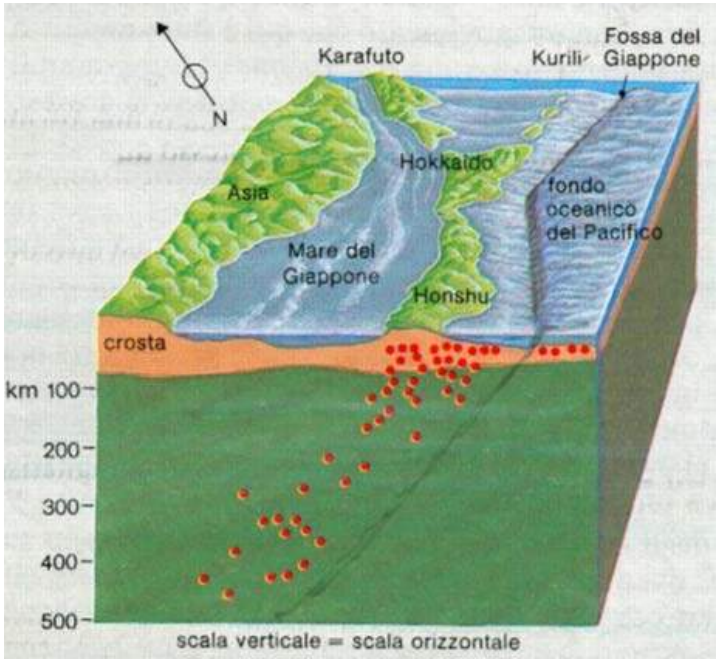
THE HAWAIIAN ISLANDS:
A CHAIN OF VOLCANOES ON A HOT SPOT



http://www.nationalgeographic.it/ambiente/2012/12/09/foto/kilauea_hawaii_lava_raggiunge_costa_oceano-1409829/2/#media

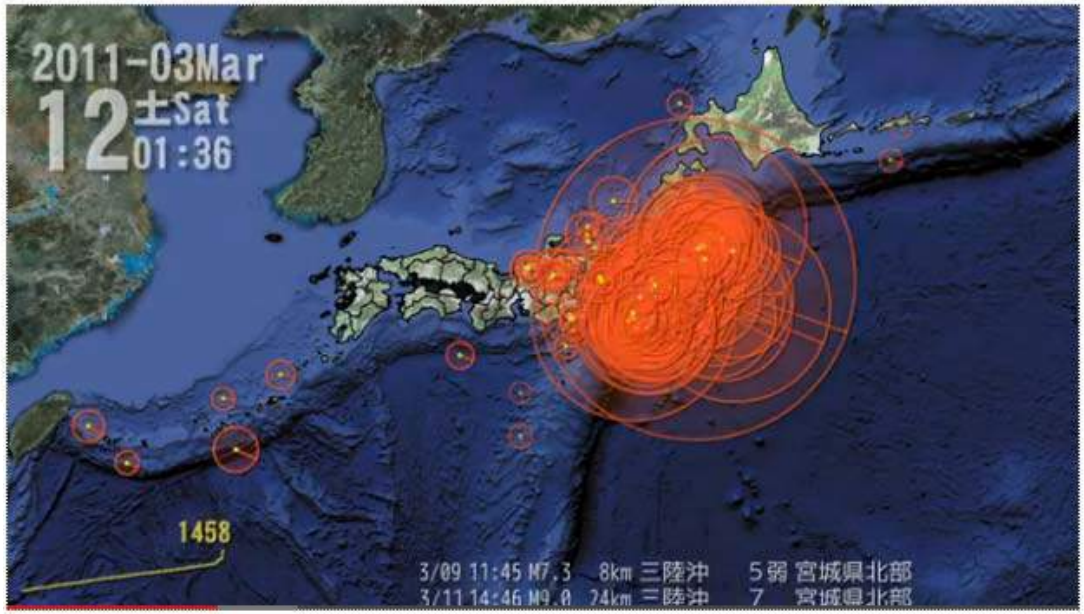


(20) JAPAN: LAND OF EARTHQUAKES AND VOLCANOES



www.focus.it/ambiente/natura/il-drammatico-video-del-terremoto-in-giappone-del-2011_C7.aspx

Japan, March 11, 2011



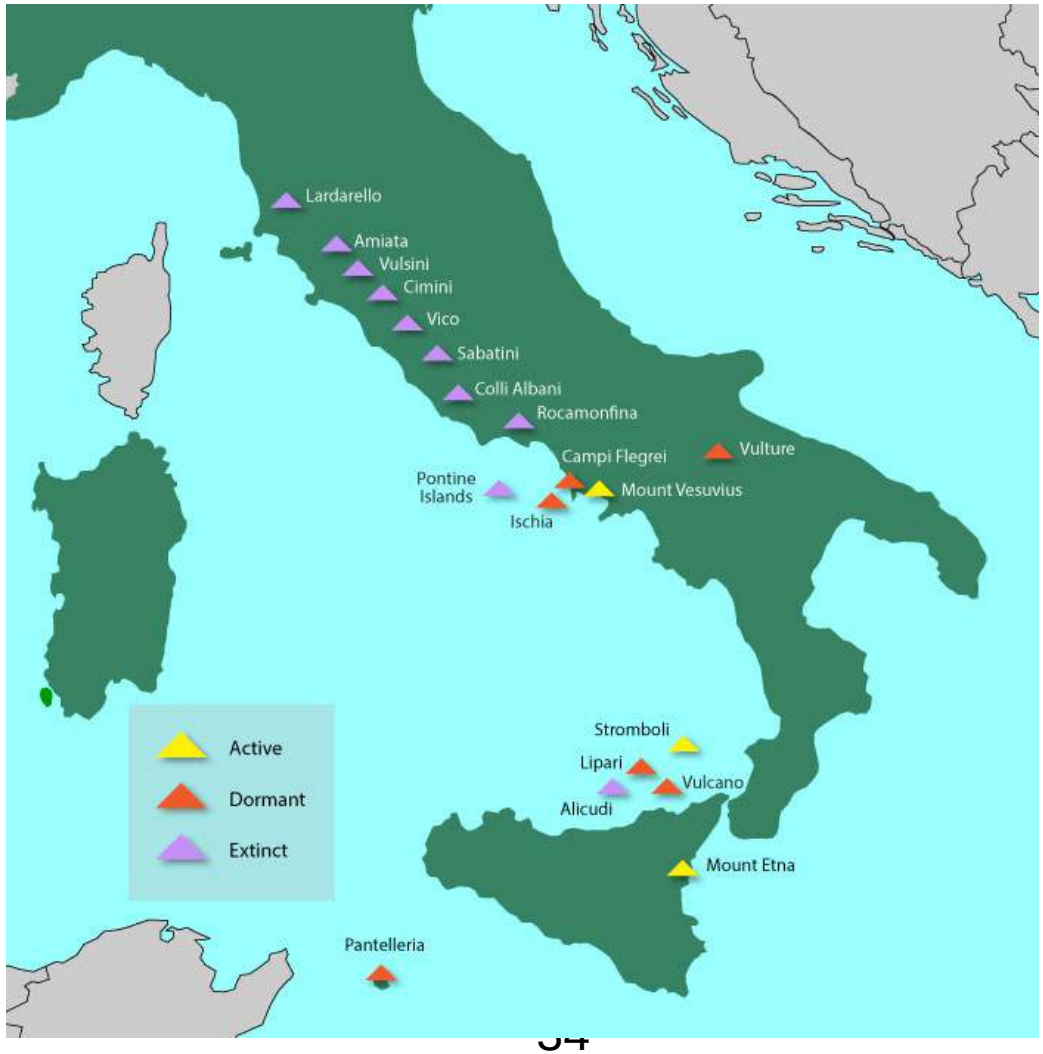
In questo video vengono mostrati su una mappa i terremoti con magnitudo superiore a 4,5 M avvenuti in Giappone e nelle zone limitrofe da gennaio 2011. È impressionante vedere e sentire, poco dopo il minuto 1,47, la scossa dell'11 (Magnitudo 9,03) che ha provocato lo tsunami, seguito da una serie di scosse fortissime e concentrate che hanno devastato e distrutto il Giappone. La rappresentazione grafica e sonora è di grande impatto: le dimensioni dei segnaposti e dei suoni ad essi associati crescono al variare dell'intensità delle scosse e aiuta a farsi un'idea della potenza rilasciata in occasione del sisma.

http://tg24.sky.it/tg24/mondo/2011/03/15/giappone_terremoto_tsunami_video_paura_distruzione_day_after.html

(21) VOLCANOES IN ITALY

The country's volcanism is due chiefly to the presence of the plate boundary between the Eurasian Plate and the African Plate.

Three main clusters of volcanism exist: a line of volcanic centres running northwest along the central part of the Italian mainland (Campanian volcanic arc); a cluster in the northeast of Sicily; and another cluster around the Mediterranean island of Pantelleria.



(22) ACTIVITY: ADVANTAGES AND DISADVATAGES OF VOLCANOES

Match the beginning (1-6) with the end of the sentences (a-f)

Beginnings:

1) New land is
2) Coffee beans are
3) Hot springs called geysers, heated by magma near the Earth's surface, are
4) Dormant and extinct volcanoes are
5) Villages and town are often
6) Giant tidal waves called tsunamis can be

Endings:

a) Created by erupting volcanoes in the sea floor. They can kill thousands of people, expecially in low-lying places such as deltas, e.g. Bangladesh
b) Created for farming and living space, e.g. Iceland
c) Devastated by landslides and mud-lows when snow capped volcanic mountains erupt
d) Grown in the mineral rich lava soils around volcanoes, e.g. in Colombia and in the Andes Mountains in South America
e) Used to heat glasshouses for food production in Iceland
f) Visited by thousands of people each year, e.g. Mount Vesuvius near Naples.

1	2	3	4	5	6

(Geography K. Kelly, Macmillan)

(23) TASK-BASED ACTIVITY

Choose one among these three activities:

1) Write down a text (or produce a powerpoint presentation) on recent event concerning:
a) Earthquakes

b) Volcanic eruptions

c) Tsunami

2) Write down a text (or produce a powerpoint presentation) about seismic or volcanic risk in Italy.

3) Produce a powerpoint pointing out the safety precaution to help people in the event of an earthquake or a tsunami.