

Earthquakes



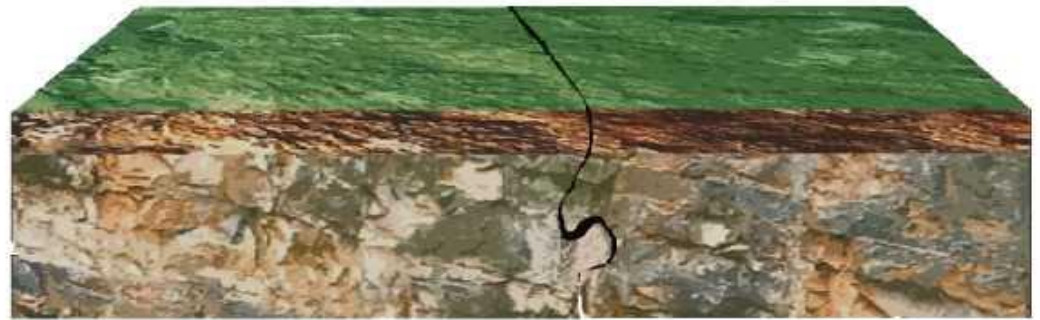
These icons indicate that teacher's notes or useful web addresses are available in the Notes Page.



This icon indicates the slide contains activities created in Flash. These activities are not editable.

For more detailed instructions, see the *Getting Started* presentation.

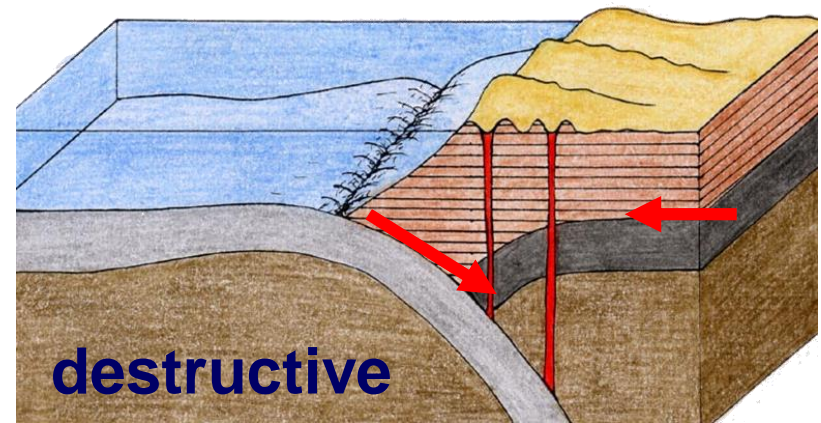
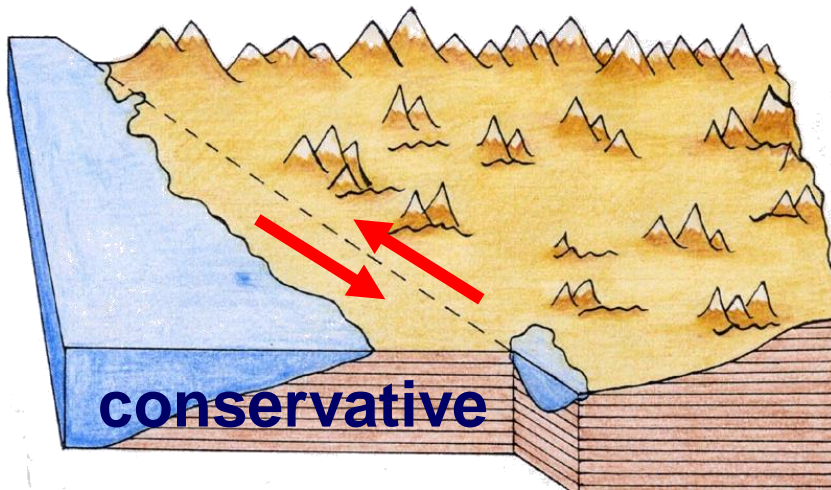
- **What are earthquakes and where do they occur?**
- What causes earthquakes?
- How are earthquakes measured?
- What is the difference between the epicentre and the focus?
- How can we limit the damage caused by earthquakes?
- What is a tsunami?



What are earthquakes?

Earthquakes are vibrations caused by earth movements at plate boundaries and at major fault lines (cracks in the earth's surface).

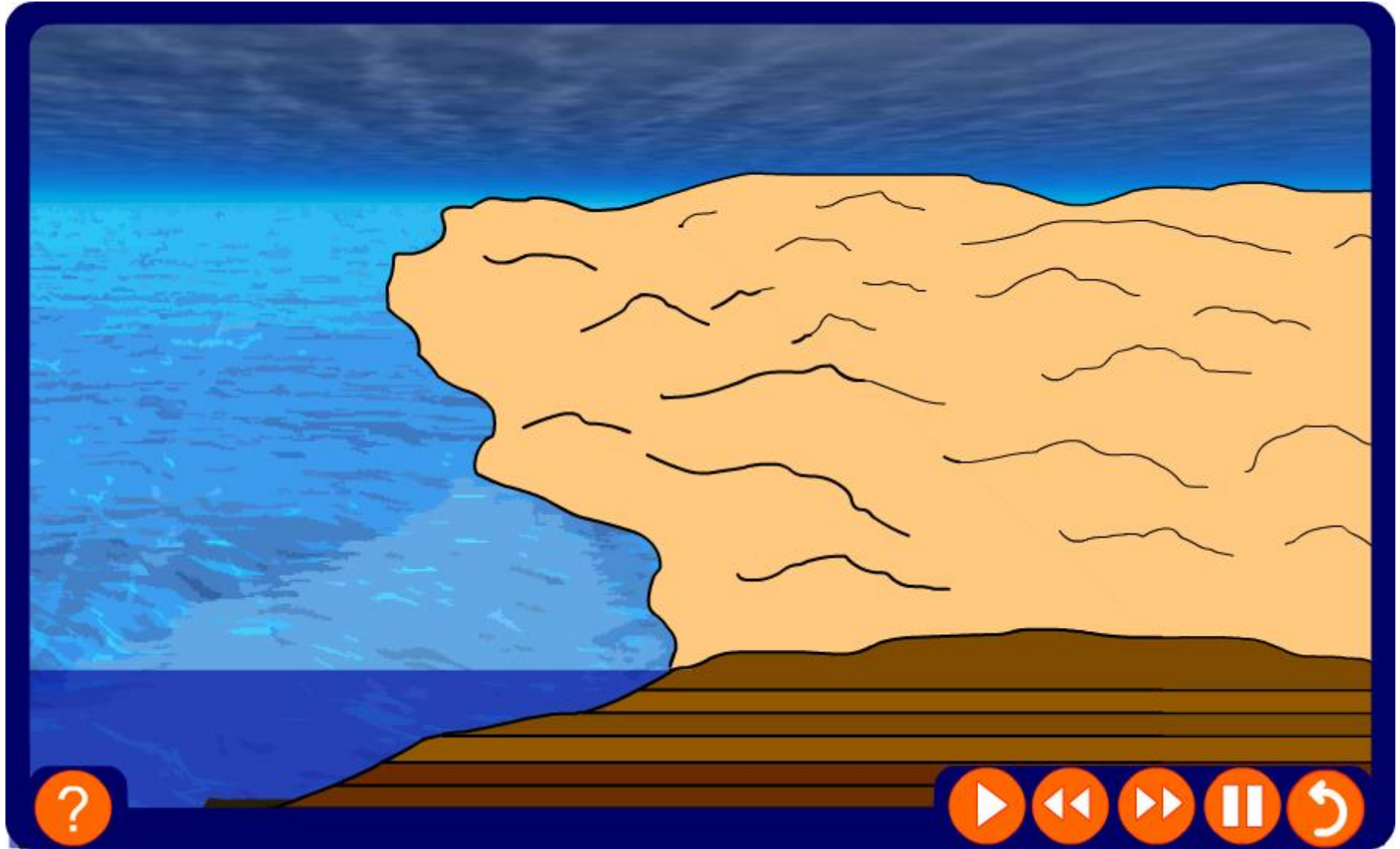
They can occur at all four major plate boundaries but the most severe earthquakes are normally found at **conservative** and **destructive** plate boundaries.



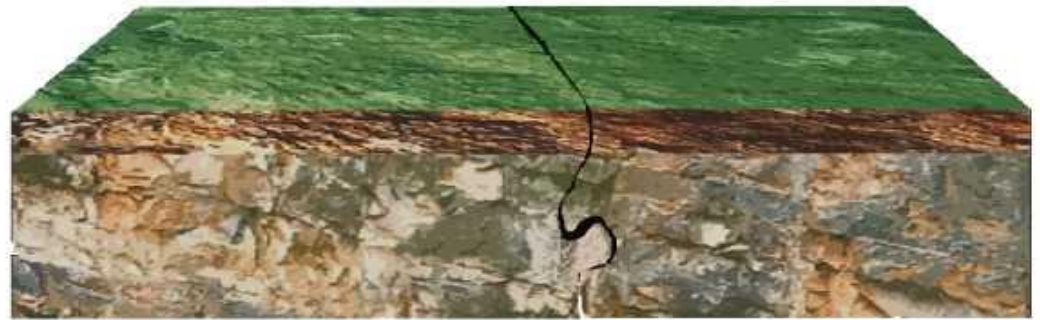
Destructive plate boundary



Conservative plate boundary

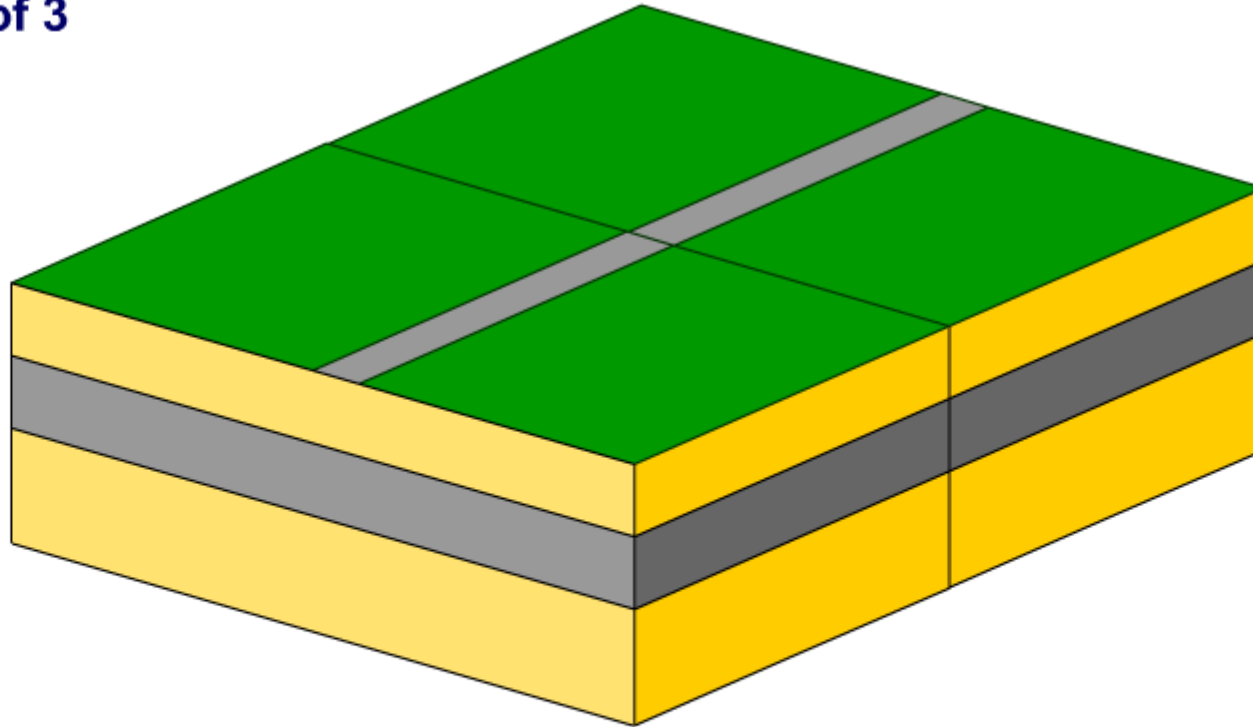


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Why do earthquakes happen?

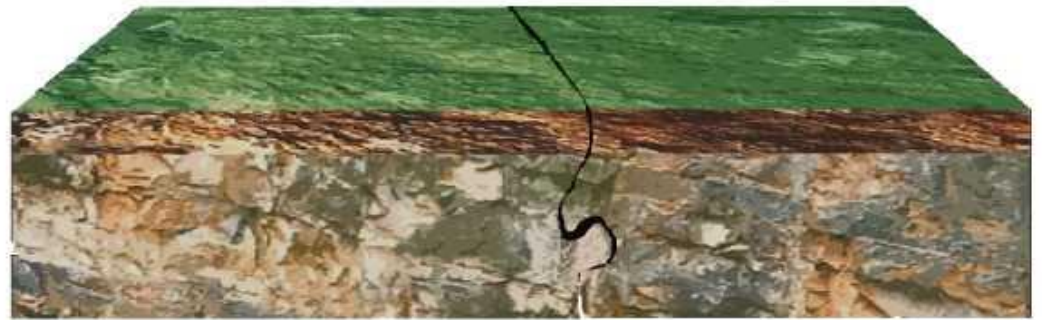
Stage 1 of 3



Two plates at a plate boundary cannot move past each other easily.



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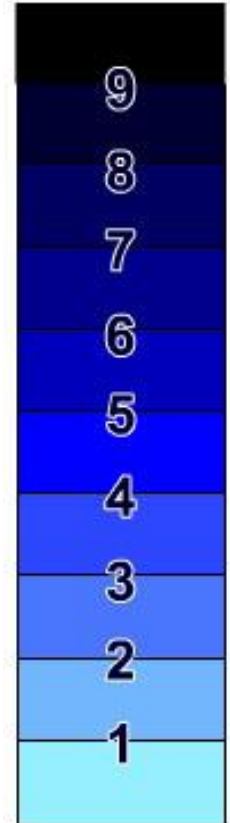
How can we measure earthquakes?

The Richter Scale

This measures the magnitude of a tremor (how powerful it is) using an instrument called a **seismograph**.

On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. Although the Richter Scale has no upper limit, the largest earthquake ever recorded was in 1960 in Chile. It measured **9.5** on the Richter Scale.

It is a **logarithmic** scale which means that a size '6' on the Richter Scale is 10 times larger than a size '5' and 100 times larger than a size '4'.



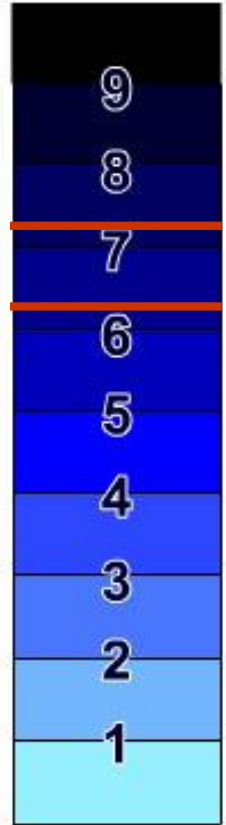
How can we measure earthquakes?

The Japanese earthquake in Kobe (September 1995) measured **7.2** on the Richter Scale.

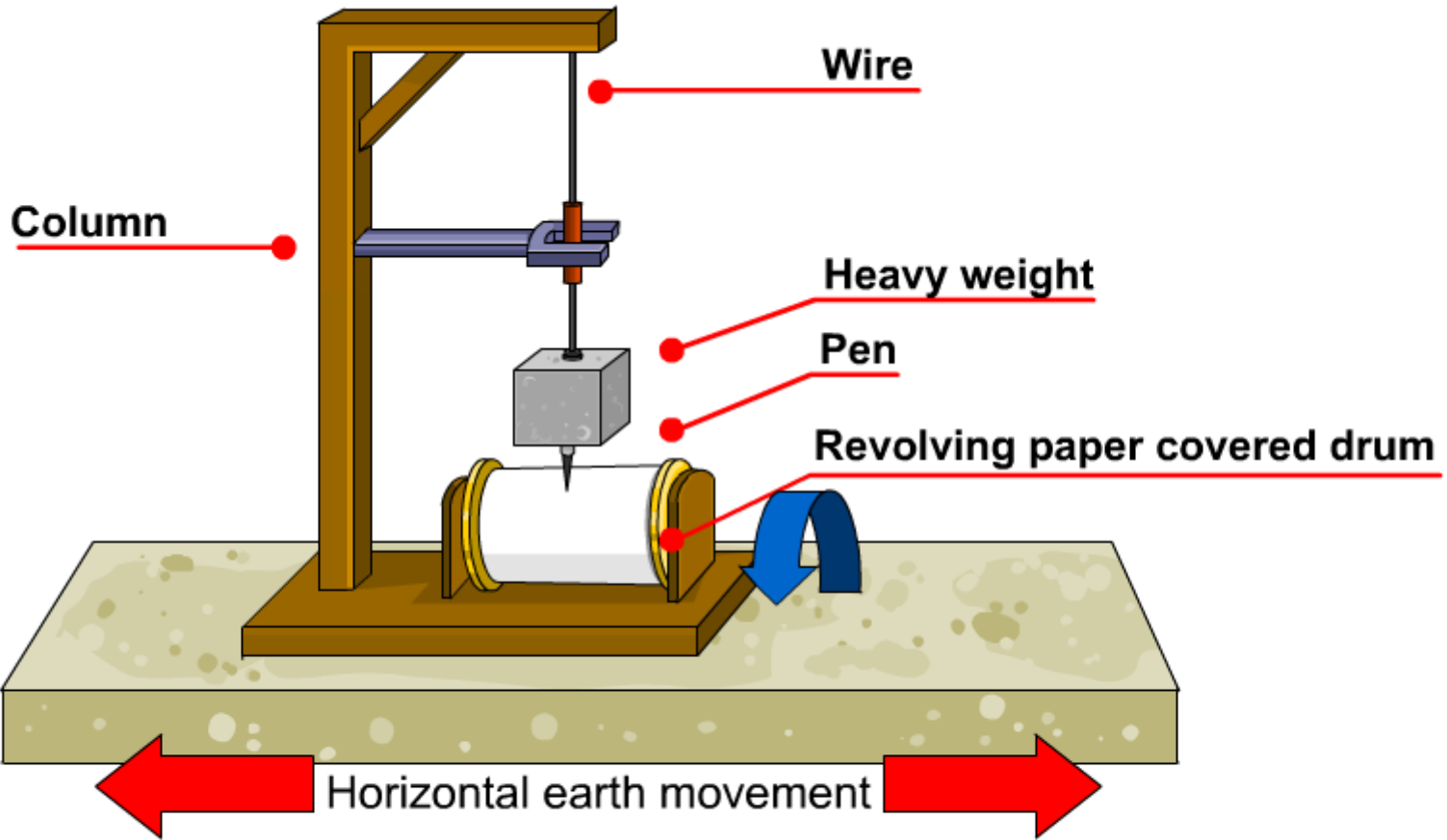
The Greek earthquake (June 1995) measured **6.2** on the Richter Scale.

How many times greater was the Japanese earthquake?

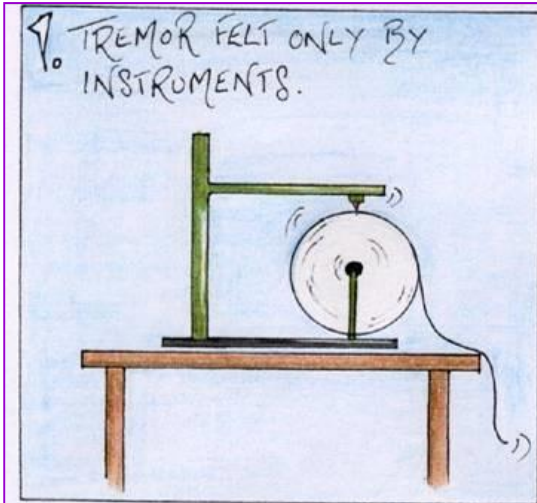
The Japanese earthquake was **10** times more powerful than the Greek earthquake.



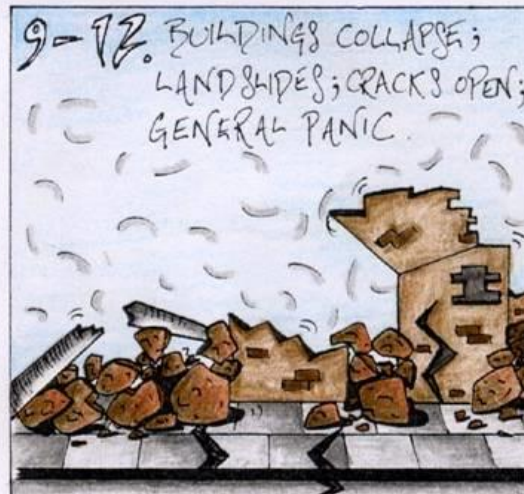
A seismograph



Mercalli Scale



MERCALLI SCALE



The **Mercalli scale** measures how much damage is caused by the earthquake based on **observations**.

It is measured on a scale between 1 and 12.

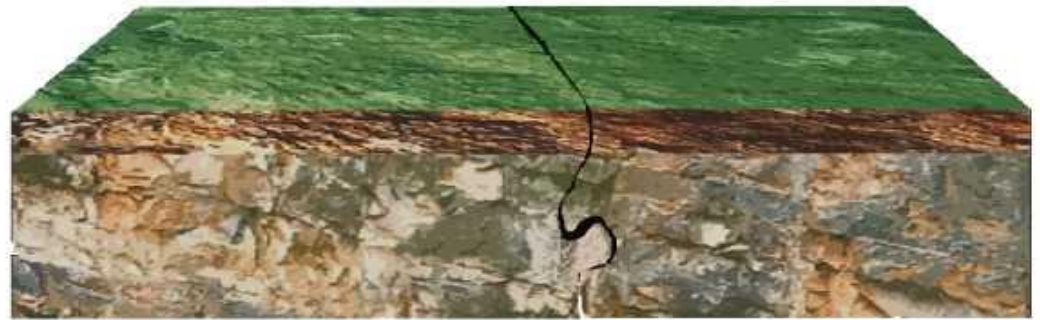


Design your own cartoon based on the Mercalli Scale descriptions below.

- | | |
|-------------|--|
| I | Felt by almost no one. |
| II | Felt by very few people. |
| III | Tremor noticed by many, but they often do not realise it is an earthquake. |
| IV | Felt indoors by many. Feels like a truck has struck the building. |
| V | Felt by everyone; many people are awakened. Swaying trees and poles may be observed. |
| VI | Felt by all; many people run outdoors. Furniture is moved. |
| VII | Everyone runs outdoors. Poorly built structures considerably damaged. Slight damage elsewhere. |
| VIII | Specially designed structures damaged slightly, others collapse. |
| IX | All buildings considerably damaged, many shift off foundations. Noticeable cracks in the ground. |
| X | Many structures destroyed. Ground badly cracked. |
| XI | Almost all structures fall. Bridges wrecked. |
| XII | Total destruction. Waves seen on ground surfaces. |



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- How can we limit the damage caused by earthquakes?
- What is a tsunami?

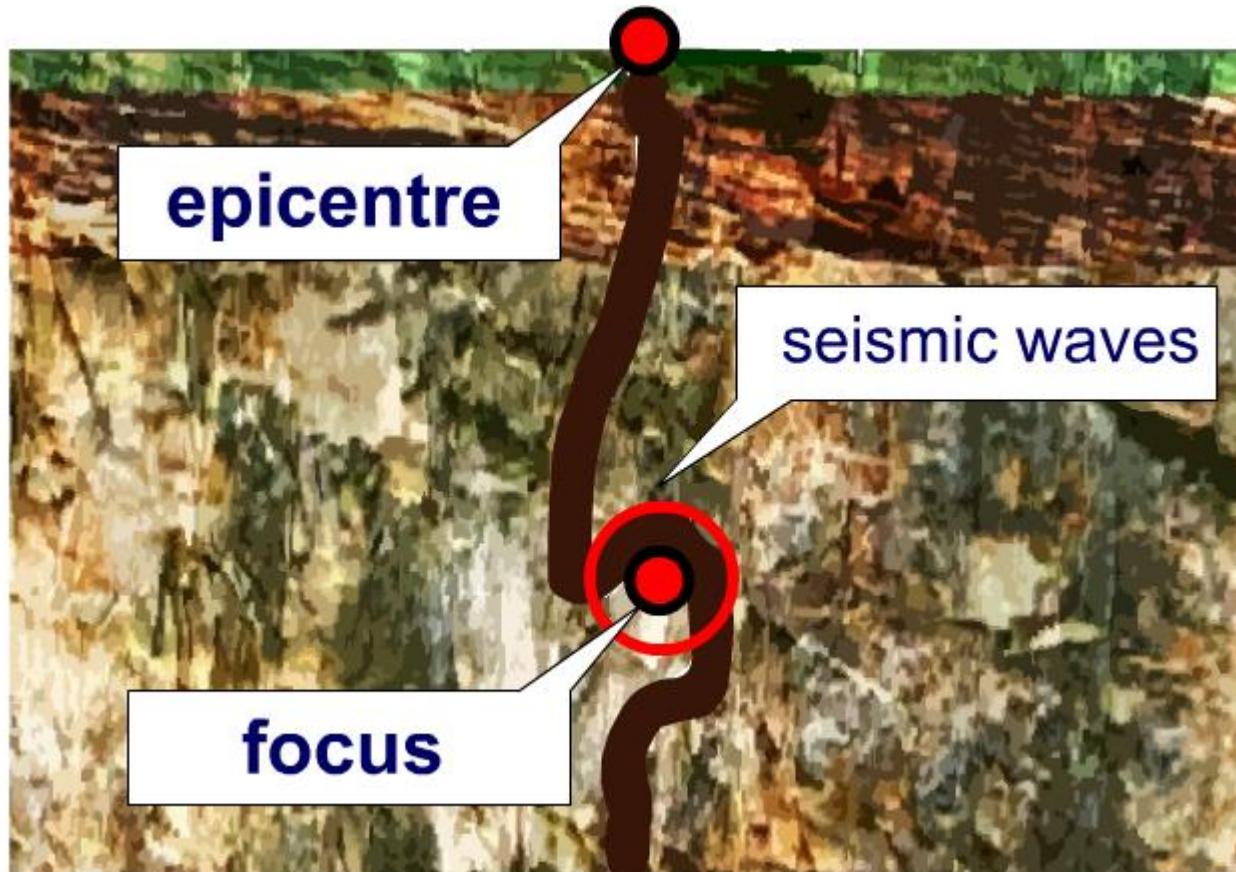


Epicentre and focus

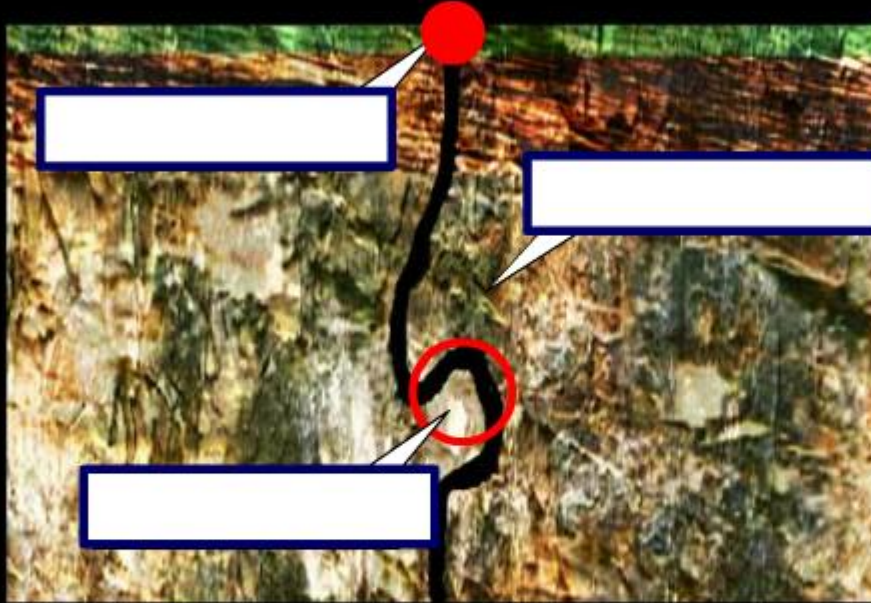
The **focus** is the point at which the rock moves.

Seismic waves start at the focus.

The **epicentre** is directly above the focus on the earth's surface.



Epicentre and focus



epicentre

seismic waves

focus



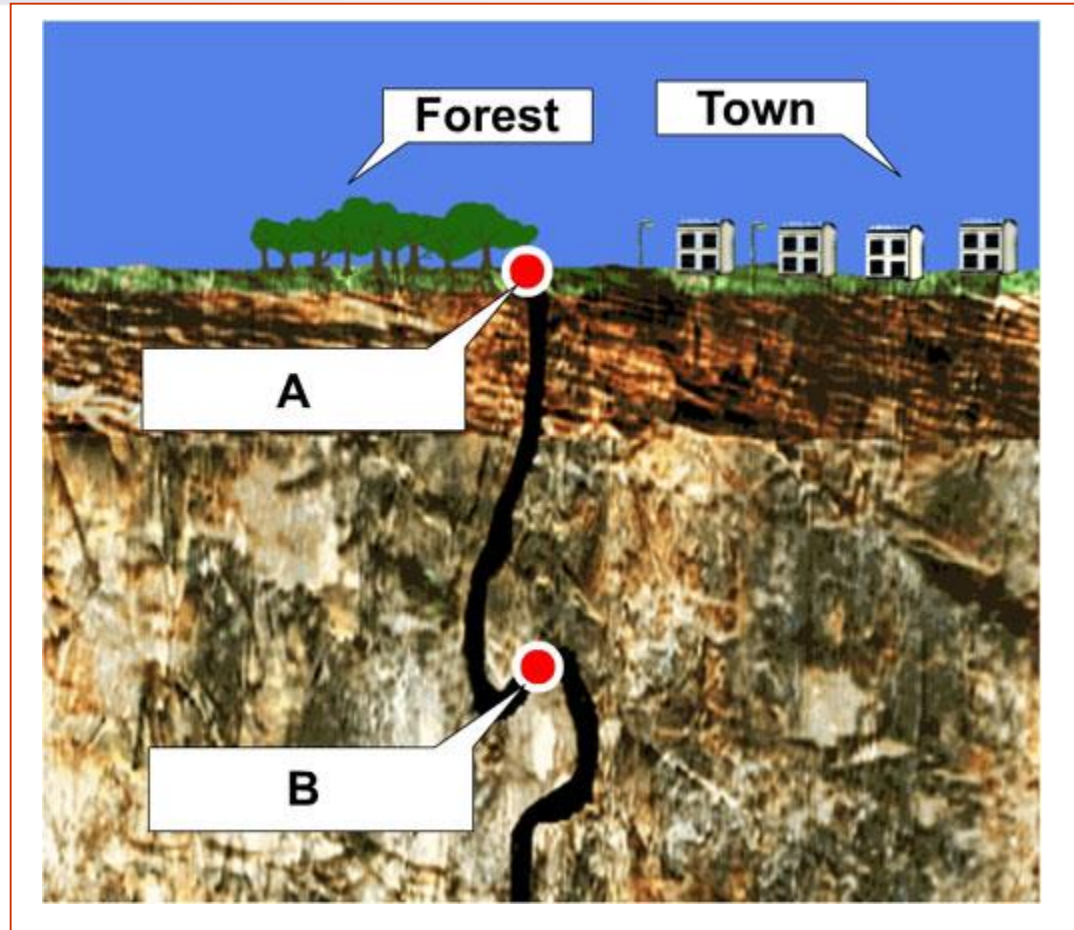
solve



Epicentre and focus

Focus

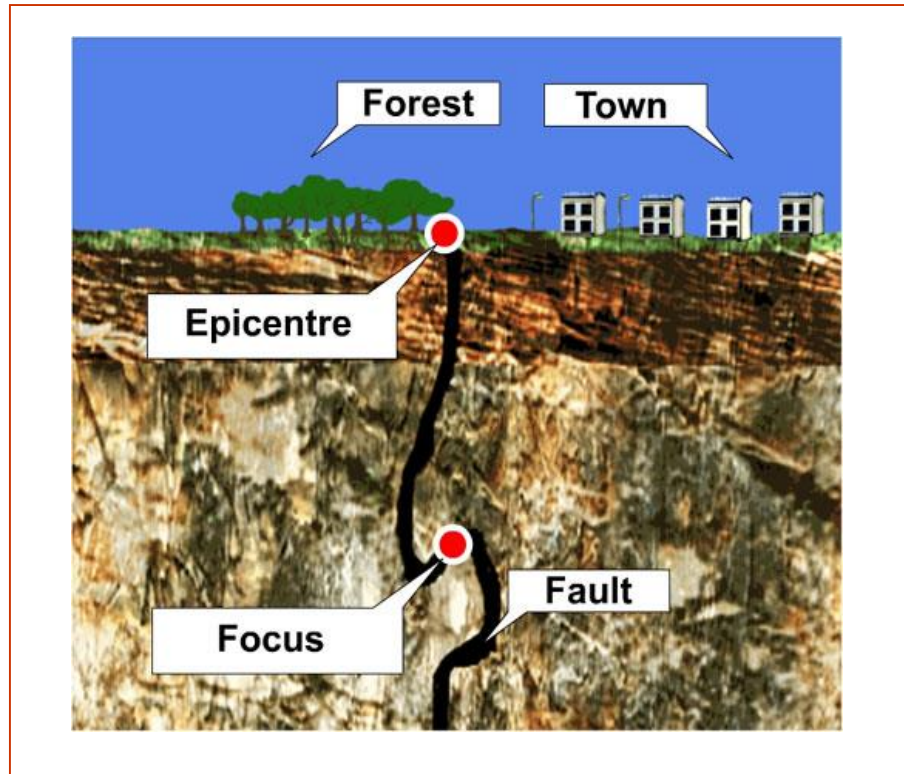
Epicentre



An earthquake has occurred along this fault line.
Match the letter with the correct label.



Epicentre and focus

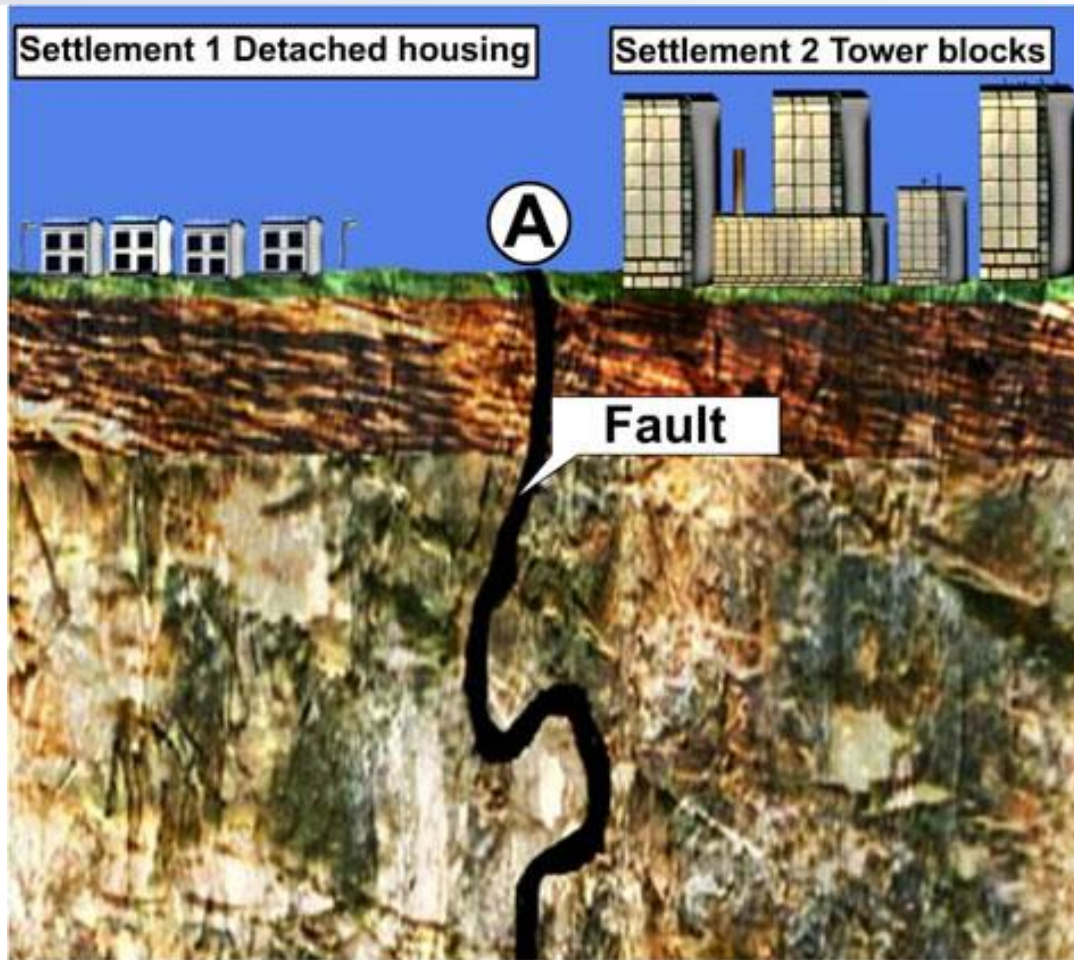


An earthquake has occurred in this area.

Which area (the **town** or the **forest**) will receive the stronger earthquake?

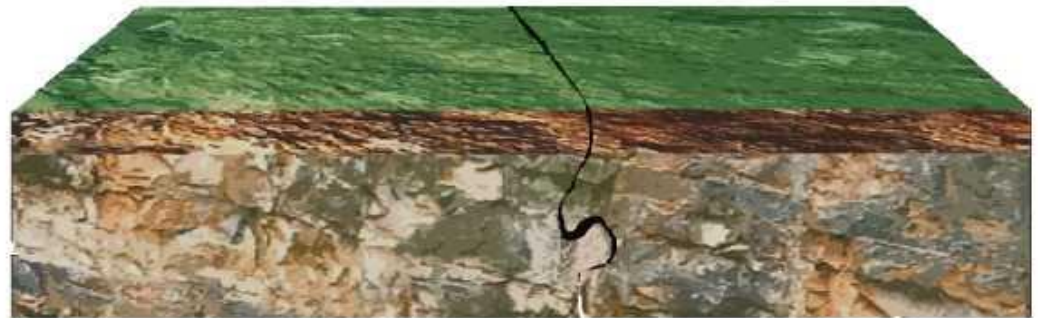
Which area will receive more damage from the earthquake?

Epicentre and focus



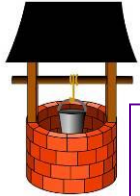
If the epicentre of an earthquake is at 'A', which settlement will be damaged the most? Give reasons for your answer.

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How can we limit earthquake damage?

predict → plan → protect



water levels can rise in wells and lakes because of cracks in the rock

a tiltmeter can check any movement within the rocks

Predict



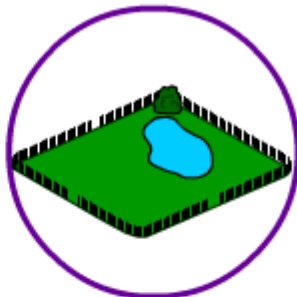
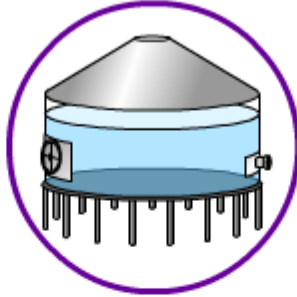
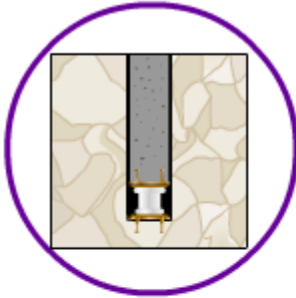
foreshocks before the main quake can be detected by a seismometer

animals can act strangely before the earthquake

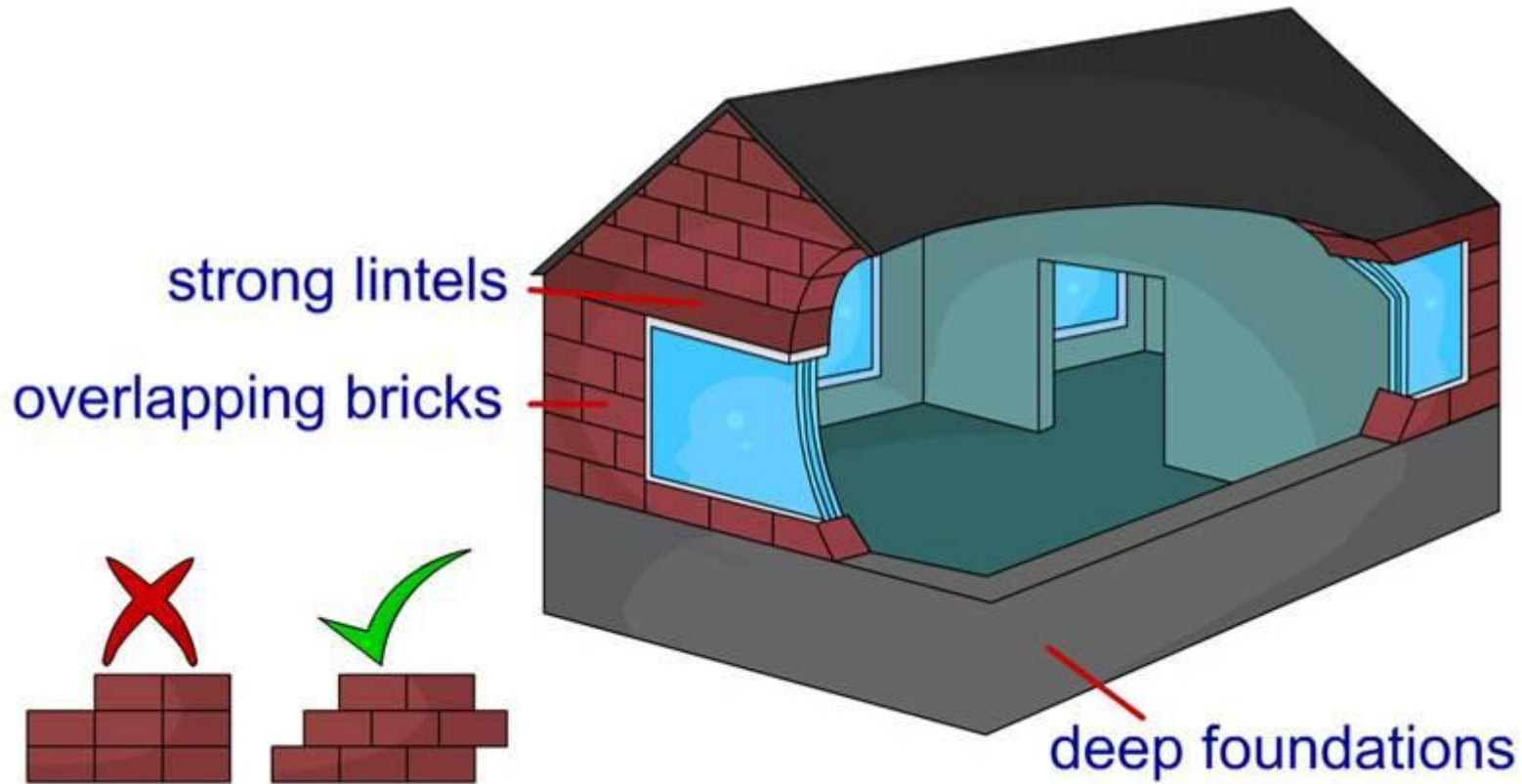


Plan and protect

How can people plan for earthquakes?

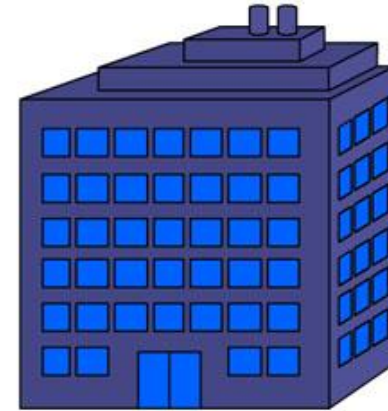
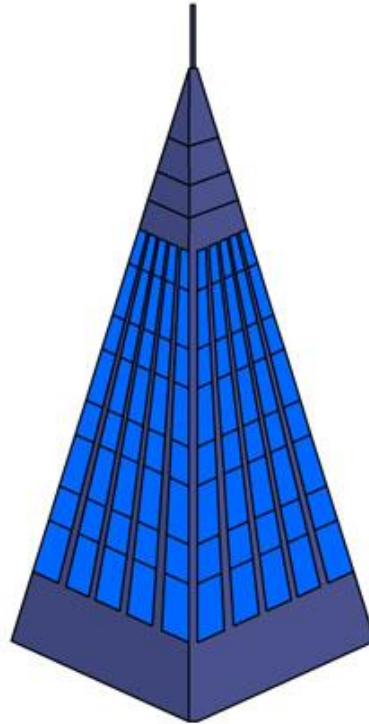
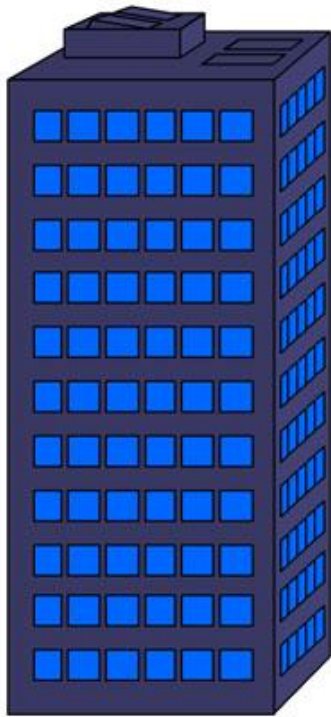


Building regulations in earthquake zones



What other measures would make buildings less likely to collapse in an earthquake?

Buildings in earthquake zones



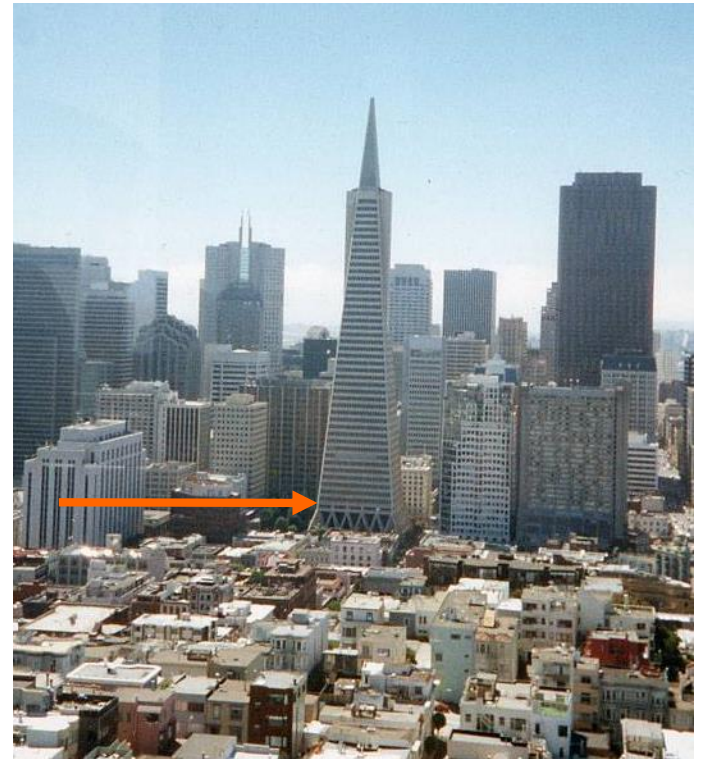
Which shape of building would be most 'earthquake proof'?
Explain your answer.



This is San Francisco in the USA.

San Francisco is near the **San Andreas Fault** and therefore the city experiences earthquakes.

This skyscraper has been built to be 'earthquake-proof'. Its wide base lowers the centre of gravity of the building and makes it more stable.





This is Sky Tower in Auckland, New Zealand.

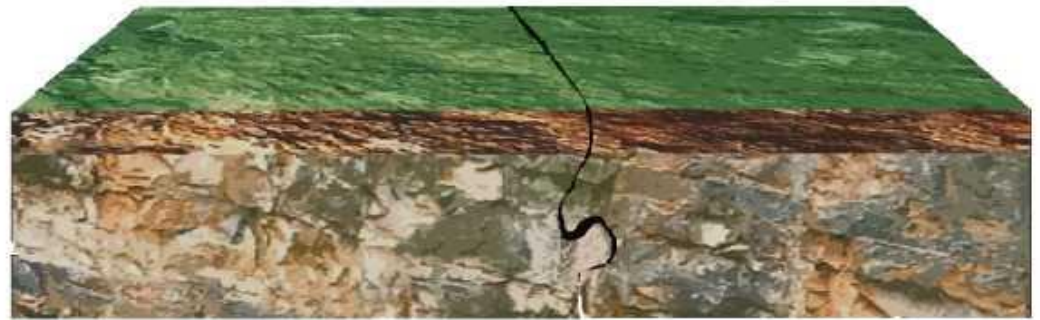
Sky Tower is the tallest tower (328 metres) in the Southern Hemisphere. It weighs 21 million kilos (20,000 tonnes), which is equivalent to 6,000 elephants!

Auckland is in an earthquake zone and so the tower is constructed from a high strength, high performance concrete.

Sky Tower's foundations go down more than 15 metres.



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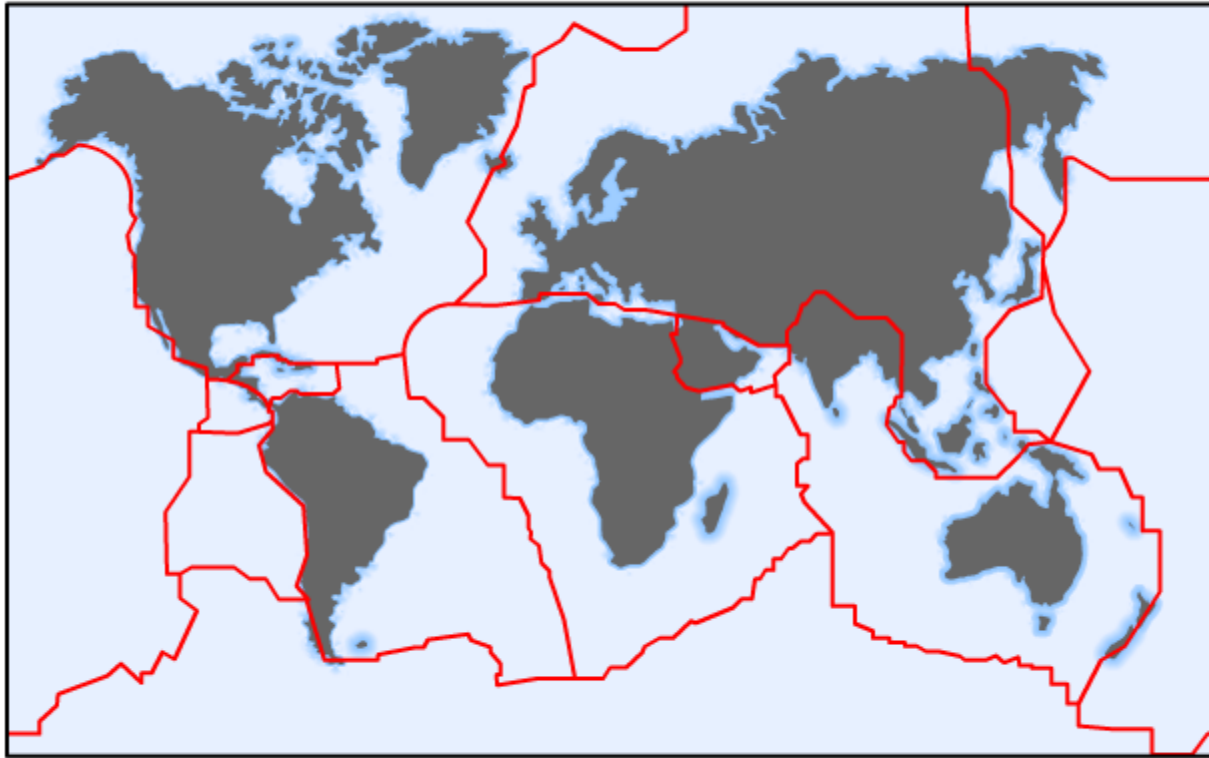
Tsunamis are tidal waves triggered by underwater earthquakes. The rate of travel of a tsunami is between 400-600 miles per hour.



The tsunami in SE Asia occurred on the 26th December 2004. The earthquake measured 9.0 on the Richter Scale and occurred off the northern tip of Sumatra. The tsunami spread across the Indian Ocean and hit coastal areas of Sri Lanka, India, Bangladesh, Myanmar, Indonesia and Malaysia. The death toll is believed to be 290,000.

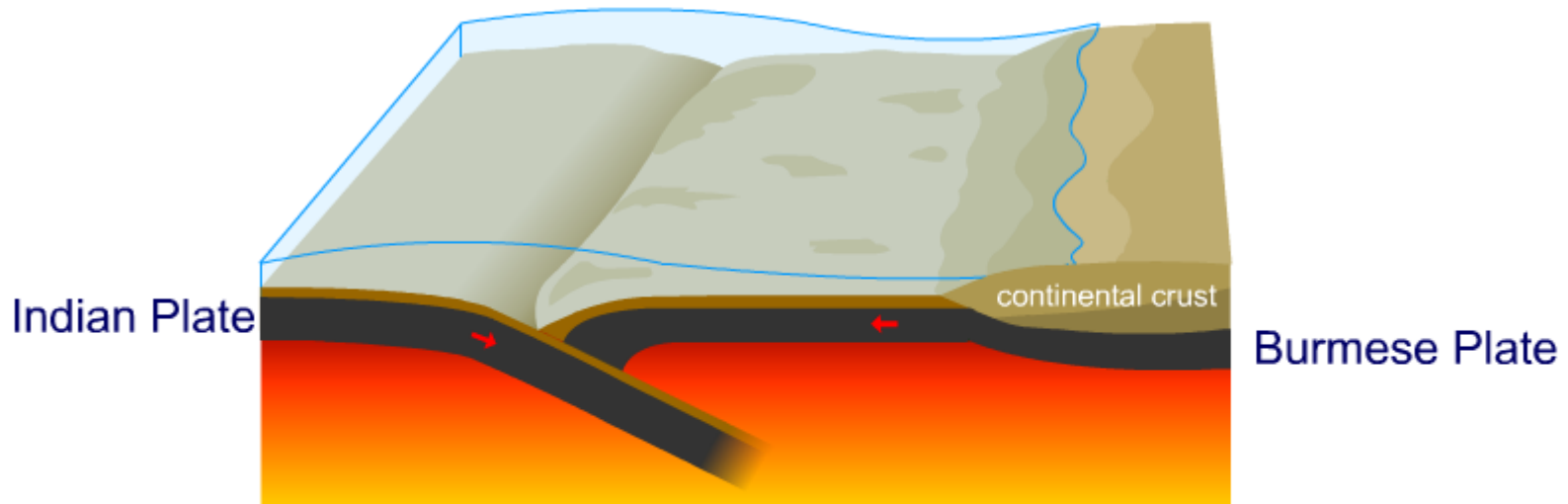


Where was the tsunami?



What caused the tsunami?

At the Sunda Trench, the Indian Plate descends underneath the Burmese Plate.



Next: Case study of Japanese Earthquake, 2011

