30 The typical **number of small earthquakes** that occur in **southern California every day.**

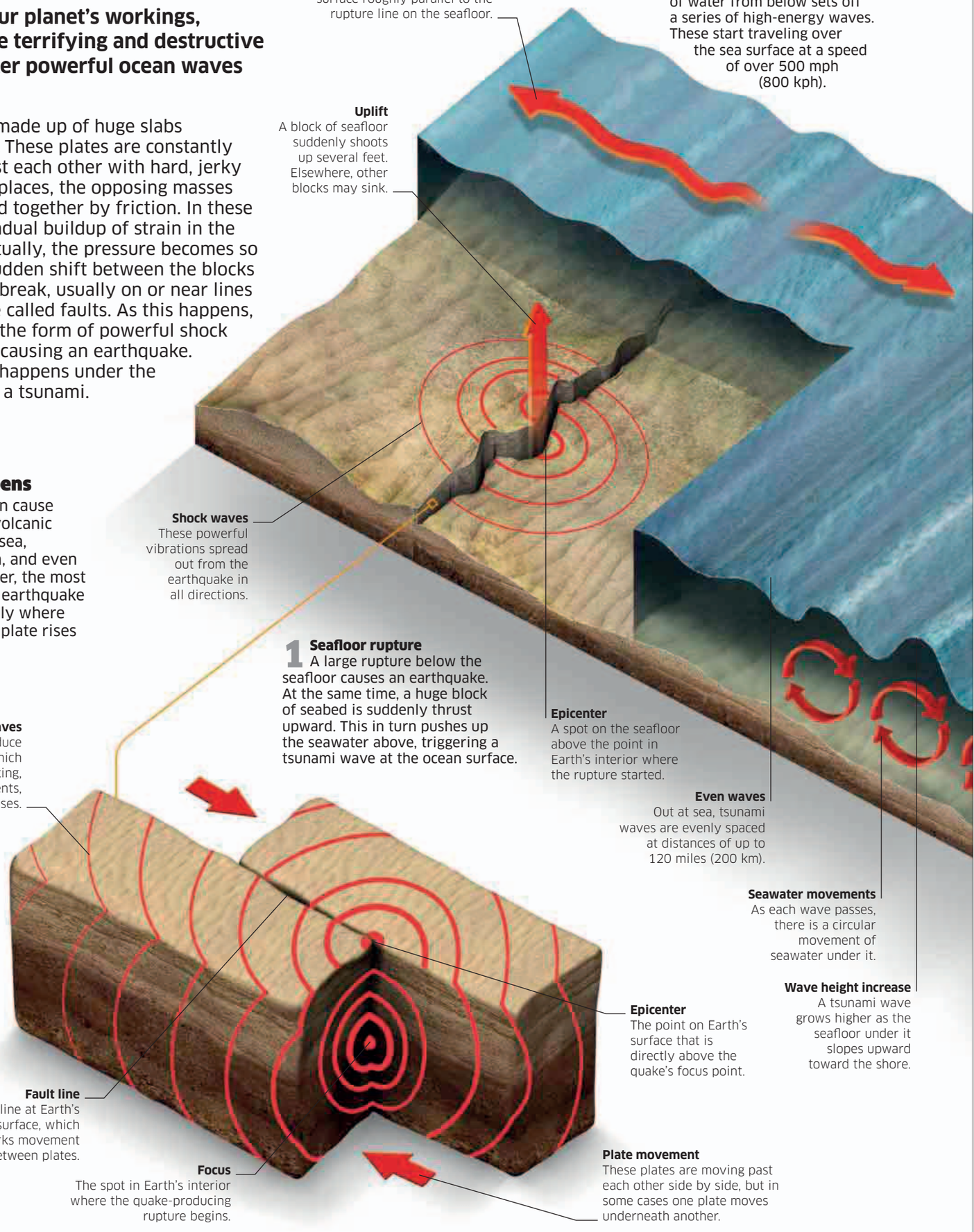
Earthquakes

A natural part of our planet's workings, earthquakes can be terrifying and destructive events. Some trigger powerful ocean waves called tsunamis.

Earth's outer shell is made up of huge slabs called tectonic plates. These plates are constantly moving, and push past each other with hard, jerky movements. In some places, the opposing masses of rock become locked together by friction. In these periods, there is a gradual buildup of strain in the locked-up area. Eventually, the pressure becomes so high that there is a sudden shift between the blocks of rock, or a massive break, usually on or near lines on the Earth's surface called faults. As this happens, energy is released in the form of powerful shock waves, or vibrations, causing an earthquake. When an earthquake happens under the seafloor, it can create a tsunami.

How a tsunami happens

Many types of events can cause tsunamis, including big volcanic eruptions near or in the sea, landslides into the ocean, and even asteroid impacts. However, the most common cause is a huge earthquake under the seafloor, usually where the edge of one tectonic plate rises above another.



Waves in both directions
Waves spread out in opposite directions from a line in the sea surface roughly parallel to the rupture line on the seafloor.

2 Wave origination
At the sea surface, the sudden upthrust of a mass of water from below sets off a series of high-energy waves. These start traveling over the sea surface at a speed of over 500 mph (800 kph).

Uplift
A block of seafloor suddenly shoots up several feet. Elsewhere, other blocks may sink.

Shock waves
These powerful vibrations spread out from the earthquake in all directions.

1 Seafloor rupture
A large rupture below the seafloor causes an earthquake. At the same time, a huge block of seabed is suddenly thrust upward. This in turn pushes up the seawater above, triggering a tsunami wave at the ocean surface.

Epicenter
A spot on the seafloor above the point in Earth's interior where the rupture started.

Even waves
Out at sea, tsunami waves are evenly spaced at distances of up to 120 miles (200 km).

Seawater movements
As each wave passes, there is a circular movement of seawater under it.

Wave height increase
A tsunami wave grows higher as the seafloor under it slopes upward toward the shore.

Energy waves
Earthquakes produce massive waves, which can produce shaking, up-and-down movements, and loud noises.

Inside a fault
Faults at the boundaries of tectonic plates are prone to earthquakes. Here, two plates move past each other in opposite directions. Occasionally, the movement becomes stuck and stress builds up between the plates. Eventually, the buildup of stress causes a sudden shift or rupture, releasing vast amounts of energy.

Epicenter
The point on Earth's surface that is directly above the quake's focus point.

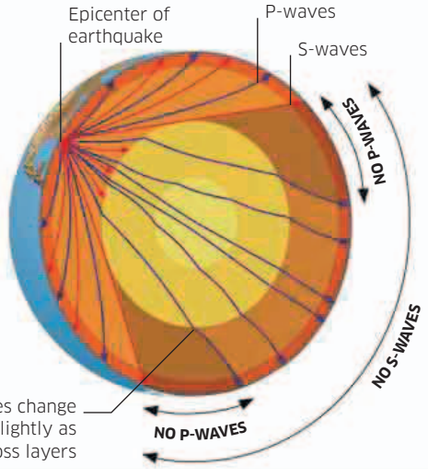
Fault line
A line at Earth's surface, which marks movement between plates.

Focus
The spot in Earth's interior where the quake-producing rupture begins.

Plate movement
These plates are moving past each other side by side, but in some cases one plate moves underneath another.

Shock waves

Earthquakes produce two types of shock waves, called P and S waves, which travel through parts of Earth's interior. Scientists can work out where and when a quake happened by detecting these waves as they arrive back at the surface.



Living on the edge

Some countries are more affected by earthquakes than others, because they sit on the boundaries between tectonic plates. This map shows the ten countries with most earthquake fatalities.

Low-height waves
In the open ocean, each wave has a low amplitude (height) and may pass unnoticed.

3 Amplification
When a tsunami wave approaches a shore, it slows down and its height increases. The upward-sloping seabed creates a resistance to the water movement—it pushes the water so that the wave is amplified (gets bigger).

1,000 miles

The length of the rupture under the seafloor that caused the 2004 Indian Ocean tsunami.

Crest of wave
The top of a large tsunami wave usually foams as it approaches the shore.

Sea drawback
Sometimes water is drawn away from the shore a few minutes before a tsunami wave arrives.

Sea becomes shallower
As the seabed shelves upward, it also slows the approaching wave.

4 Inundation
When a tsunami wave hits a shore, it doesn't usually break and collapse. Instead, it continues to surge forward for a considerable distance, flooding the whole coast. The powerful rush of water can smash buildings and carry cars and people away.

Buildings in danger
Few buildings can survive the onslaught of a large tsunami wave—many are destroyed or swept away.