Team 9

The 7th Material of Physics of The Earth

CONVECTION MOVEMENTS, STRESS IN THE EARTH'S CRUST, & EARTHQUAKE KINEMATICS

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Team 9

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LESSON OUTCOMES

01

Convection Movements

02

Stress in the Earth’s Crust

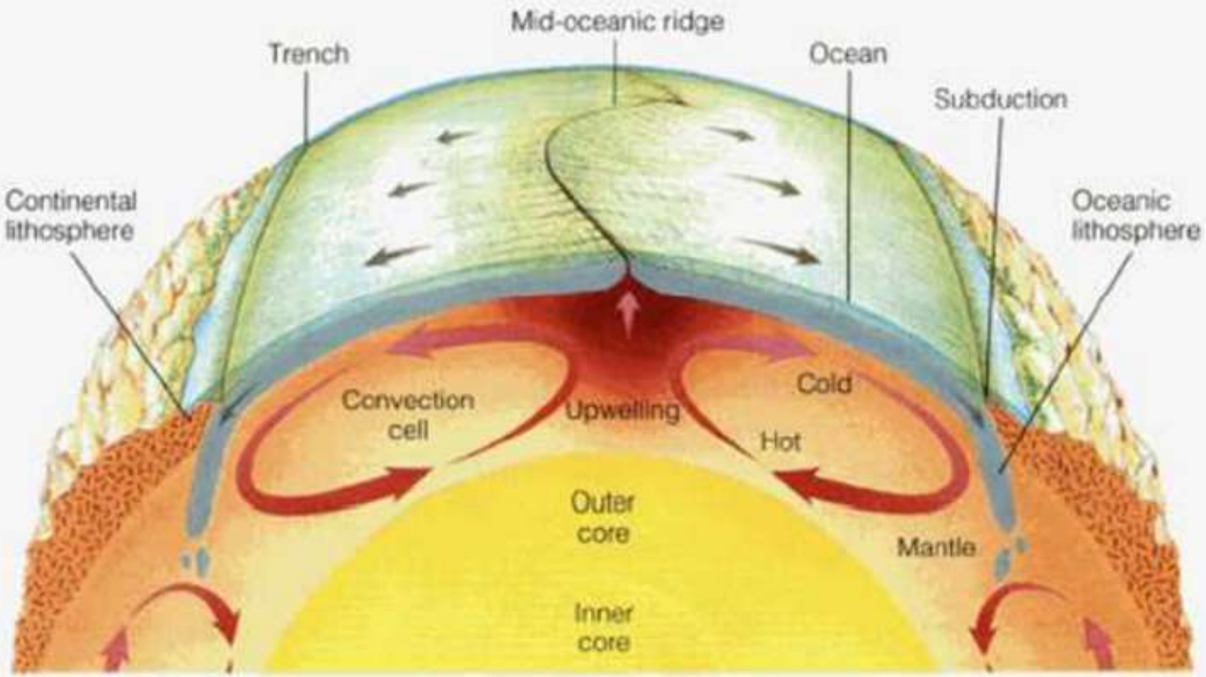
03

Earthquake Kinematics


1
CONVECTION
MOVEMENTS

Convection Movements

Convection movements is the motion of fluid masses caused by temperature differences between the earth's surface and the outer core. In the context of the earth, convection movements occur in the earth's mantle which is located between the earth's core and the earth's crust. The earth's mantle consists of solid rock which has plastic properties, so it can experience convection movements. Mantle convection is the slow movement of the Earth's solid silicate mantle caused by convection currents that carry heat from the Earth's interior to the surface.



Pict 1. Earth's mantle convection currents

Convection movement process

The convection process in the Earth's mantle occurs due to the temperature difference between the inside and outside of the mantle. The warmer inner part of the mantle will rise upward, while the cooler outer part of the mantle will sink. This movement forms convection currents which can influence the movement of tectonic plates in the earth's crust.

Mantle Convection Related to Plate Tectonics

The convective movement of the mantle breaks the lithosphere into plates and moves them around the planet's surface. These plates can move apart, come closer, or collide with each other. This process forms ocean basins, shifts continents, and pushes mountains upwards.

2

STRESS IN THE EARTH'S CRUST

STRESS IN THE EARTH'S CRUST CONCEPT

Tension of the earth's crust is the force acting on the earth's crust due to the movement of tectonic plates. This stress can cause deformation or change in the shape of the earth's crust. There are three types of stress in the earth's crust:

1

Tensile Stress/Tensional

Occurs when two tectonic plates move apart, for example at different boundaries.

2

Compressional

Occurs when two tectonic plates approach each other, for example at a convergent boundary.

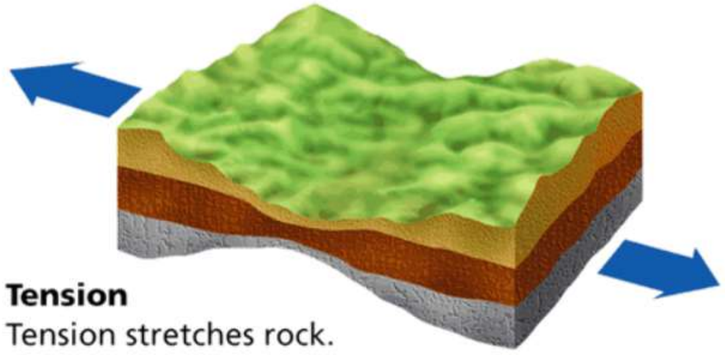
3

Shear

Occurs when two tectonic plates slide past each other horizontally, such as at a transform boundary.

1

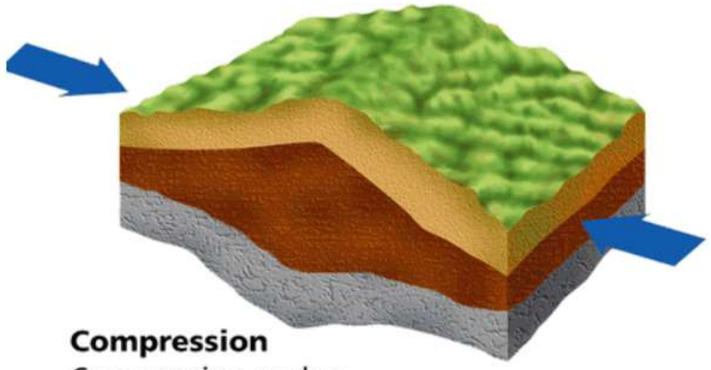
Tensile Stress/Tensional



Tension
Tension stretches rock.

2

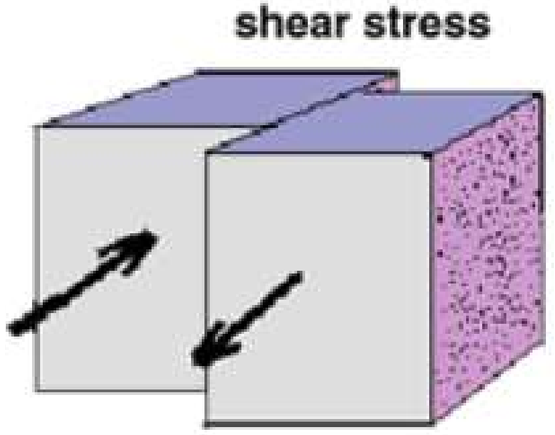
Compressional



Compression
Compression pushes rock together.

3

Shear



Effect of Stress

Earthquake 01

Fault 02

Volcano Formation 03

Mountain formation 04

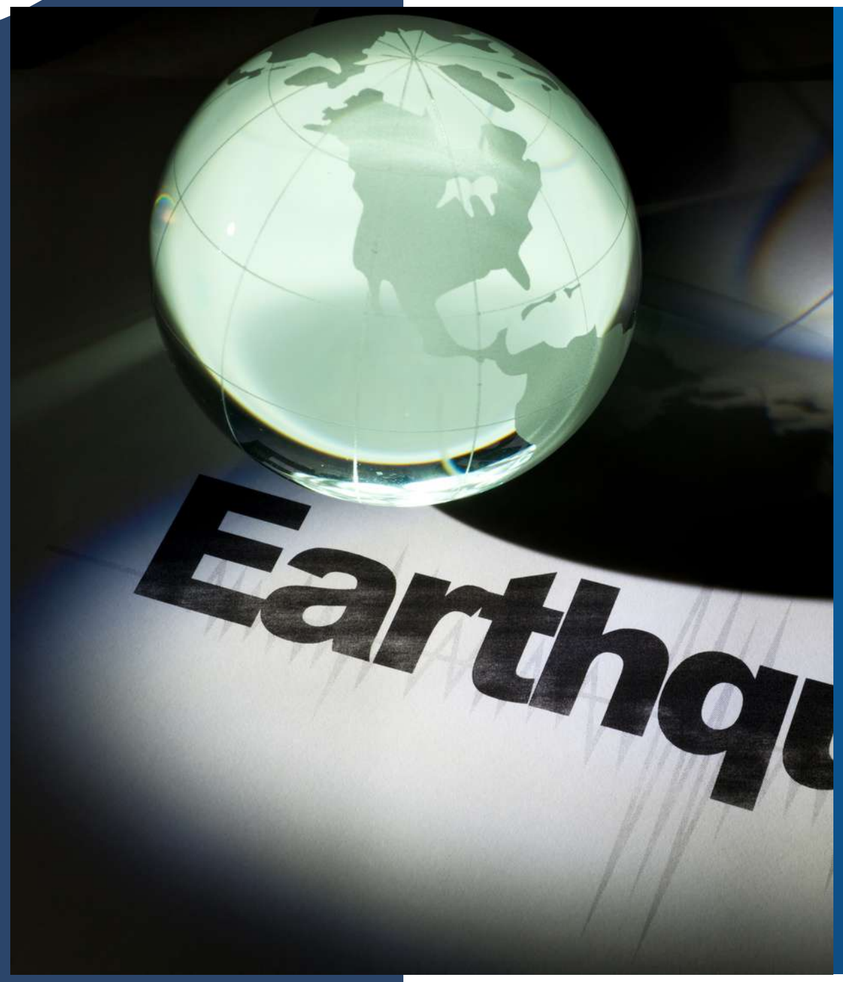
topographic changes 05

volcanic activity 06

potential tsunami 07

3

EARTHQUAKE KINEMATICS



Earthquake kinematics refers to the relative movement between rocks that break apart during an earthquake. When an earthquake occurs, the stress built up in the earth's crust is suddenly released, causing rocks to shift along faults. Earthquake kinematics includes parameters such as the magnitude of the earthquake, the depth of the earthquake source, the direction of movement, and the time and speed of rock shifting. This is an important concept in understanding how earthquakes occur and their potential impact on the environment and society.

Earthquake source mechanism

The source mechanism of an earthquake is the way rocks beneath the earth's surface move and release energy that causes an earthquake. These mechanisms include the type of rock deformation that occurs during an earthquake and the way the rock returns to its position after the earthquake. There are three main earthquake source mechanisms:

01

Strike-Slip Fault

a type of fault in which two blocks of rock move horizontally parallel to each other

02

Normal Fault

a type of fault where two blocks of rock move away from each other.

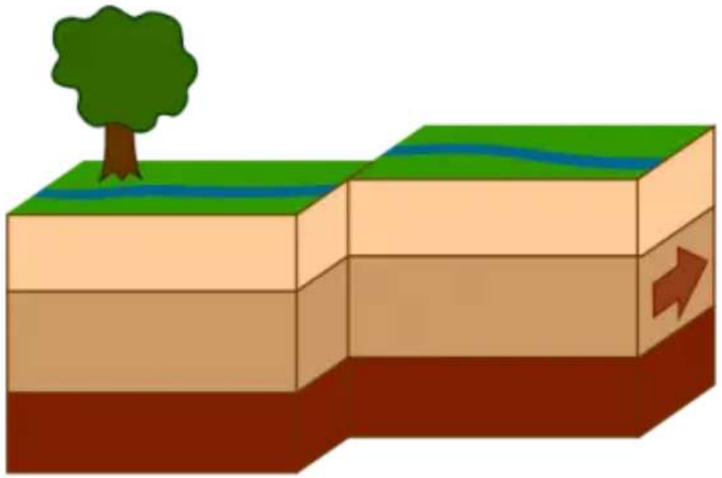
03

Reverse fault

a type of fault where two blocks of rock move closer to each other.

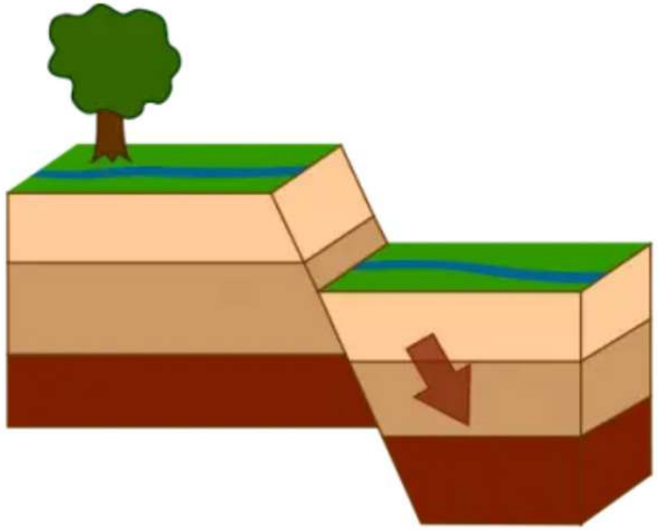
01

Strike-Slip Fault



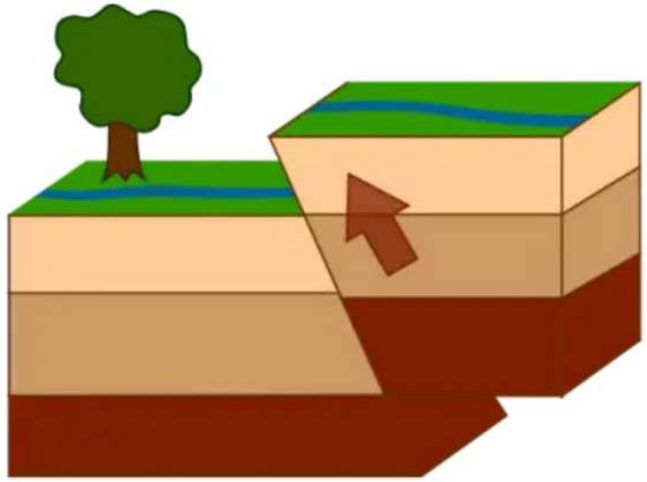
02

Normal Fault



03

Reverse fault



Causes of Earthquake Kinematics

Several factors and causes that influence earthquake kinematics are:

01 Plate tectonics

02 Stress and deformation

03 Volcanic earthquake

The Impact of Earthquake Kinematics

01 **Building Structure Damage**
Earthquake kinematics can cause strong vibrations that can damage buildings and infrastructure.

02 **Increased Risk of Injury and Death**
Earthquakes with strong kinematics can cause severe physical damage to humans, such as broken bones, burns, and traumatic injuries. Additionally, collapsed buildings can pose a risk of injury and death.

03 **Infrastructure Damage**
Critical infrastructure such as bridges, highways, airports, ports and water facilities can be damaged or destroyed during an earthquake. This can disrupt transportation and community services, making assistance difficult to access.

04 **Power and Communication Outages**
Earthquakes can cut off electricity supplies and damage communications systems, including telephone and internet networks. This can hinder rescue efforts and coordination in emergency situations.

05 **Tsunami**
If an earthquake occurs under the sea, such as in a tectonic plate subduction zone, it can trigger a tsunami.

06 **Landslide Movement**
Earthquakes can weaken the slopes of mountains or hills, causing landslides that can bury settlements or infrastructure beneath them.

07 **Damage to Education and Health Structures**
Schools, hospitals and other critical facilities needed in emergency situations can be damaged during an earthquake, complicating response and recovery.

08 **psychological impact**
Earthquakes can cause stress and psychological impacts on affected individuals and communities. Trauma, anxiety and depression often appear after an earthquake.

09 **Economic impact**
Earthquakes can cause significant economic impacts, including material losses, production losses and high recovery costs.


THANKS!
Any questions?