Levelling Up Grades Through Skills

Pure Geography

Physical Geography | Cluster 4.2

Chapter 1:
How do tectonic processes affect the magnitude of earthquakes?

For more learning resources, do visit

t.me/levupeducation

Simple trick to remember landforms/structures formed from plate movement

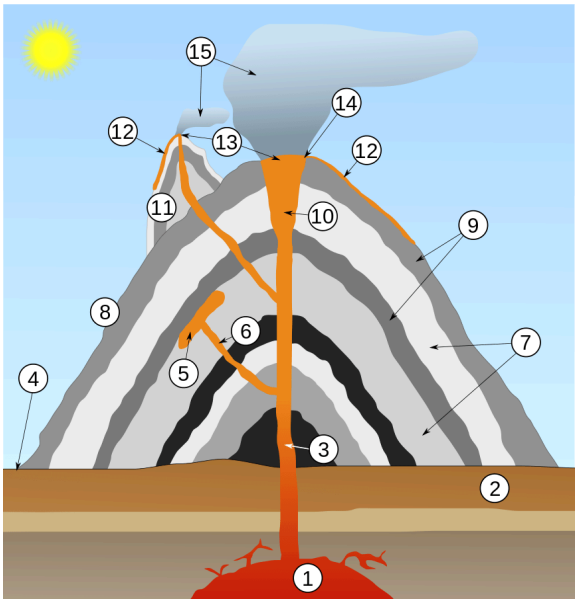
What is happening?	Landform
Stress build-up and released when plates move	Earthquakes occur in **ALL** plate movements Earthquakes are a vibration in the earth's crust caused by the sudden release of stored energy in the rocks found along fault lines <u>Process of formation of earthquakes:</u> - Rock masses on either side of the faultline are pushed by tectonic forces -> build-up of stress -> rocks cannot withstand pressure and slip -> earthquake formed <u>Terminologies:</u> - Earthquakes release **seismic waves** which radiate from the **focus**. - Area directly above the focus is called the **epicentre**. - Stress from the ground may also cause **aftershocks** after the original earthquake
Magma rises up through cracks and fractures, and lava erupts onto earth's surface	**<u>Convergent Plates</u>** 1) Magma rises through OC - undersea volcano then island arc 2) Magma rises through CC - Volcanoes on land 1. Subduction of plates -> high pressure forces water out of OC 2. Lowers melting point of mantle -> mantle melt to form magma 3. Magma contains dissolved gases and is less dense than the surrounding materials 4. Magma rises through fractures and erupts as lava -> cools and solidifies to form volcanoes **<u>Divergent Plates</u>** 3) Magma rises through rift valley (divergent plates) - Volcano formed 1. Plates moves apart, crush stretches and creates fractures 2. Decrease in overlying pressure causes underlying mantle to melt, forming magma 3. Magma contains dissolved gases and is less dense than the surrounding materials

	4. Magma rises through fractures and erupts as lava -> cools and solidifies to form volcanoes

Difference in explosiveness of volcanoes

High Silica Magma	Low Silica Magma
More **viscous** (sticky) magma	Less viscous magma
Dissolved gases in magma cannot escape easily -> more pressure built up -> violent, explosive eruption	Dissolved gases in magma can escape easily -> less pressure built up -> gentle, **effusive** (gentle outpouring/flowing of lava) eruption
Stratovolcanoes	Shield volcanoes
SO LONG AS DISSOLVED GASES CAN ESCAPE EASILY, eruption will be less explosive. While Mt. Merapi is a stratovolcano with viscous magma, its 2006 eruption was not as explosive as the viscous magma rose in a way that allowed dissolved gases to escape easily	

Stratovolcano

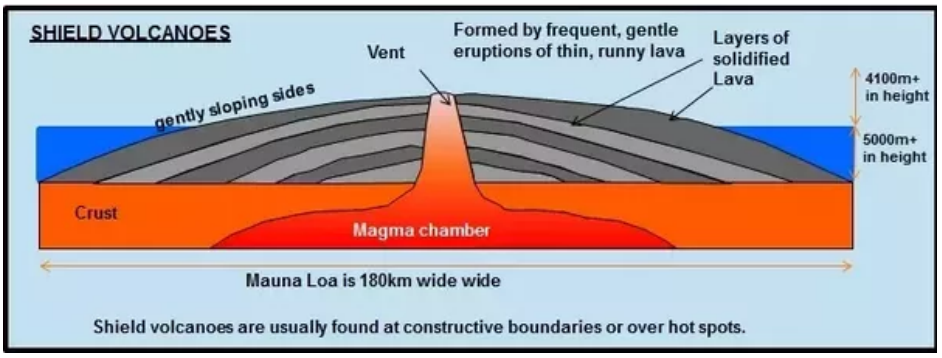


1. High viscosity magma rises through fractures in the crust and erupts explosively, pyroclasts (ash and rocks) are released.
2. Eruption of lava cover pyroclasts and builds up the volcano, forming alternate layers of lava and ash

3. High, slightly concave profile; steep sides and narrow summit as highly viscous lava travels a shorter distance

EG: Mount Pinatubo, Mount Merapi Indonesia

Shield volcano



1. Low-silica lava (Basic lava) -> low viscosity, less gases trapped in lava -> effusive eruption
2. Layers of lava accumulates with each successive eruption
3. Gently sloping sides, broad summit as lava flows a long distance before cooling

EG: Kilauea in Hawaii, USA

Measuring of Earthquakes:

- Measured using **seismometers** which are sensitive to ground vibrations, determining the **magnitude** of the earthquake

1) Richter scale (ML)

RICHTER SCALE

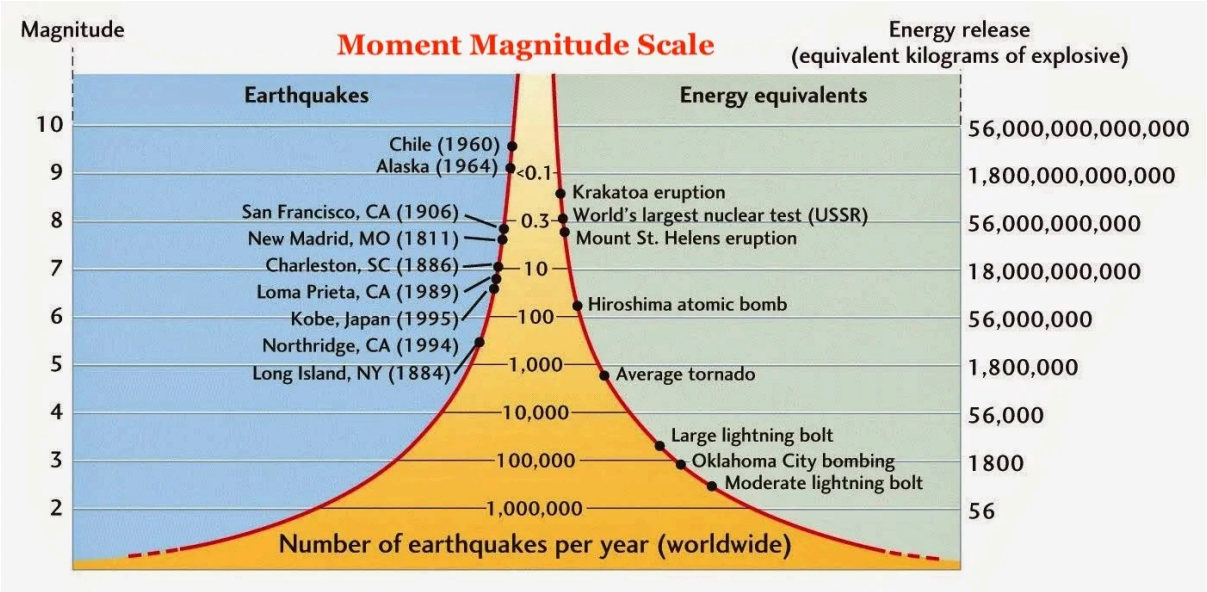
Magnitude	Description	What it feels like	Frequency
Less than 2.0	Micro	Normally only recorded by seismographs. Most people cannot feel them.	Millions per year.
2.0–2.9	Minor	A few people feel them. No building damage.	Over 1 million per year.
3.0–3.9	Minor	Some people feel them. Objects inside can be seen shaking.	Over 100,000 per year.
4.0–4.9	Light	Most people feel it. Indoor objects shake or fall to floor.	10,000 to 15,000 per year.
5.0–5.9	Moderate	Can damage or destroy buildings not designed to withstand earthquakes. Everyone feels it.	1,000 to 1,500 per year.
6.0–6.9	Strong	Wide spread shaking far from epicenter. Damages buildings.	100 to 150 per year.
7.0–7.9	Major	Wide spread damage in most areas.	10 to 20 per year.
8.0–8.9	Great	Wide spread damage in large areas.	About 1 per year.
9.0–9.9	Great	Severe damage to most buildings.	1 per 5-50 years.
10.0 or over	Massive	Never Recorded.	Never recorded.

Richter scale measures earthquake magnitude using the height of the largest wave recorded on seismometers -> **maximum seismic intensity** reached. For each increasing magnitude, earthquakes become 32 times greater in energy released.

Limitation

- Rather than measure the total seismic energy released through the earthquake event, it measures peak seismic energy -> an earthquake with repeated large, intense waves is lower in magnitude than an earthquake with a drastic spike in seismic energy.

2) Moment magnitude scale (Mw)



Mw scale measures magnitude based on total energy released during the earthquake event. It is more accurate for earthquakes of magnitude 8 and above. For each increasing magnitude, earthquakes become 32 times greater in energy released.

Scientists adjusted the 1964 Prince William Sound Earthquake in Alaska, USA from 8.6 ML on Richter Scale to 9.2 Mw on the Mw scale.

<u>Measuring of volcanic eruptions:</u>

Volcanic Explosivity Index (VEI) - Measured from 0 to 8, each step is 10 times more powerful than the previous step

- Volume of ejected material (Greater the vol., the higher the VEI)
- Height of the eruption cloud (Greater the height, the higher the VEI)
- Duration of the eruption (Longer the eruption, the higher the VEI)

Effusive eruptions are usually 0 to 1 as they are non-explosive with <0.0001km^3 of material ejected (Kilauea, Hawaii)

Mega-colossal explosive eruptions can eject >1000km^3 of **tephra** (pyroclasts), volcanic cloud of >25 km in height (Toba volcano in Northern Sumatra, Indonesia 74000 years ago which erupted 2800km^3 of material)

Exam Requirements

- Be able to understand the various types of volcanoes and their formation processes.
- Be able to explain the tectonic processes of earthquakes, magnitude of earthquakes and measuring of earthquakes.

Exam Questions

Q1. Provided in class.