Bell Ringer

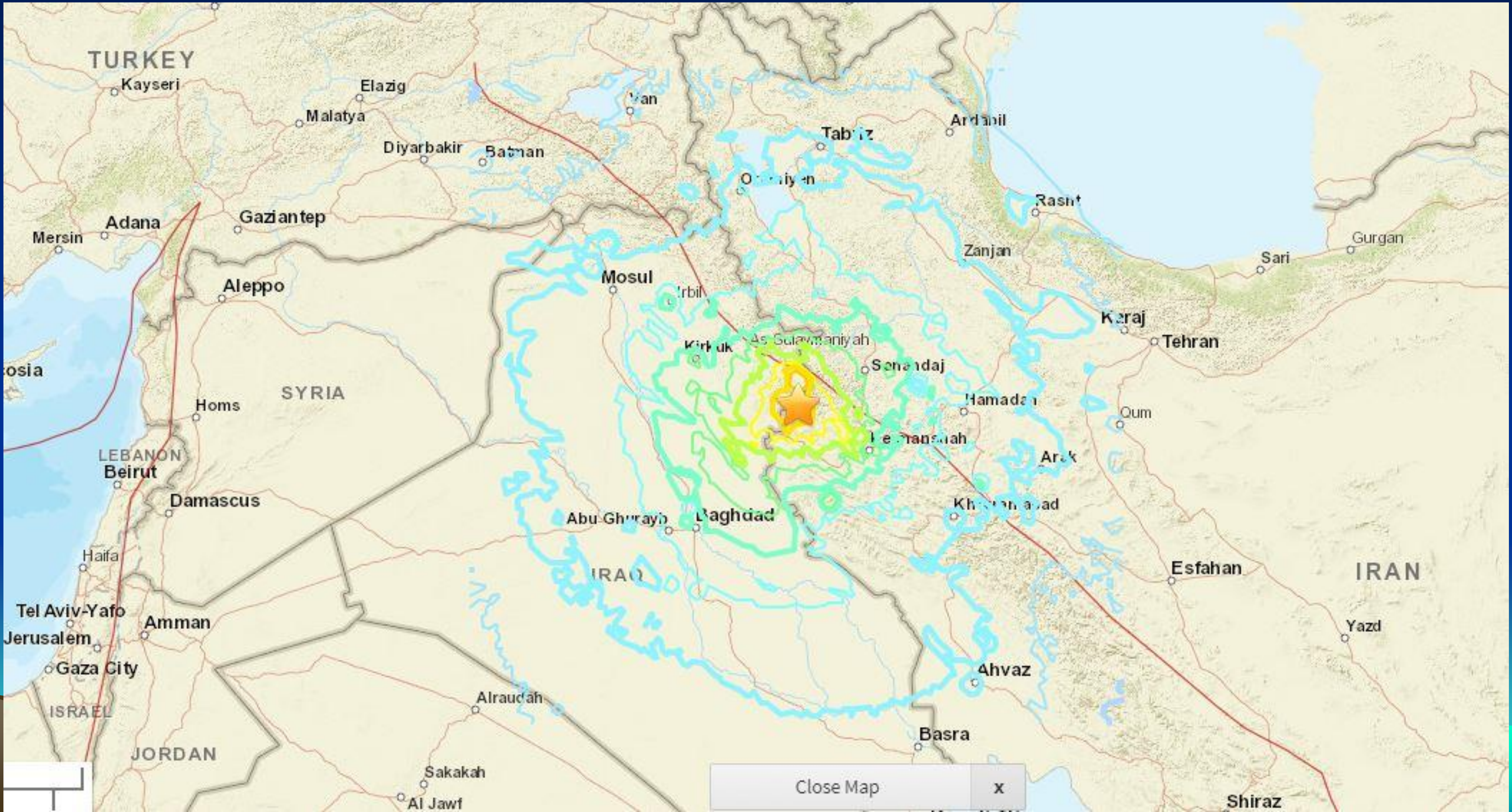
1. What are the three main kinds of faults?
2. At what kind of plate boundary would you most likely find a Normal Fault?
3. What is the Focus of an Earthquake?

Fault Blocks

- Compression
- Extension
- Strike-Slip?

Subduction – Earthquakes and Volcanoes

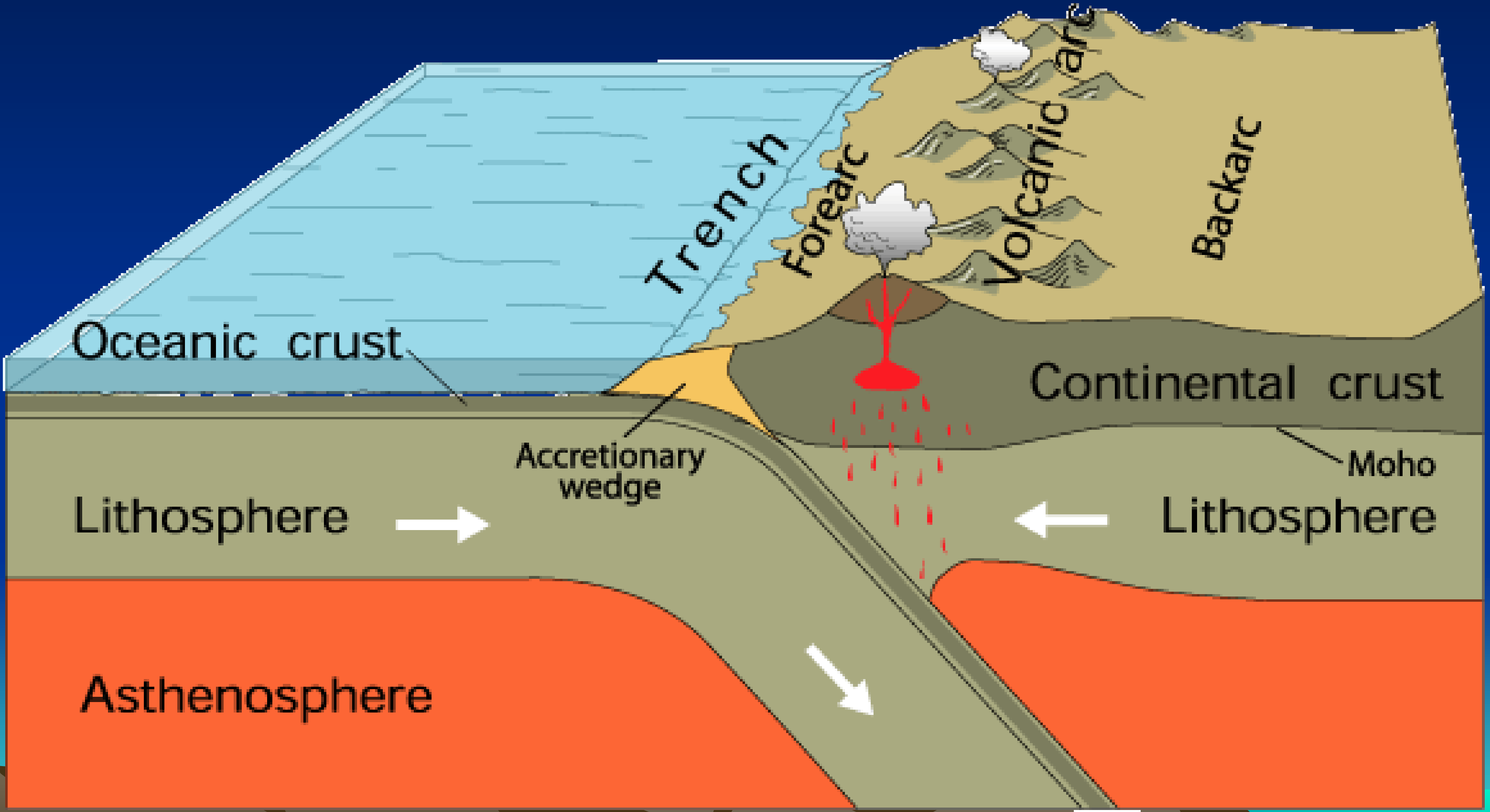
11/12/17 – Iraq/Iran – 7.3

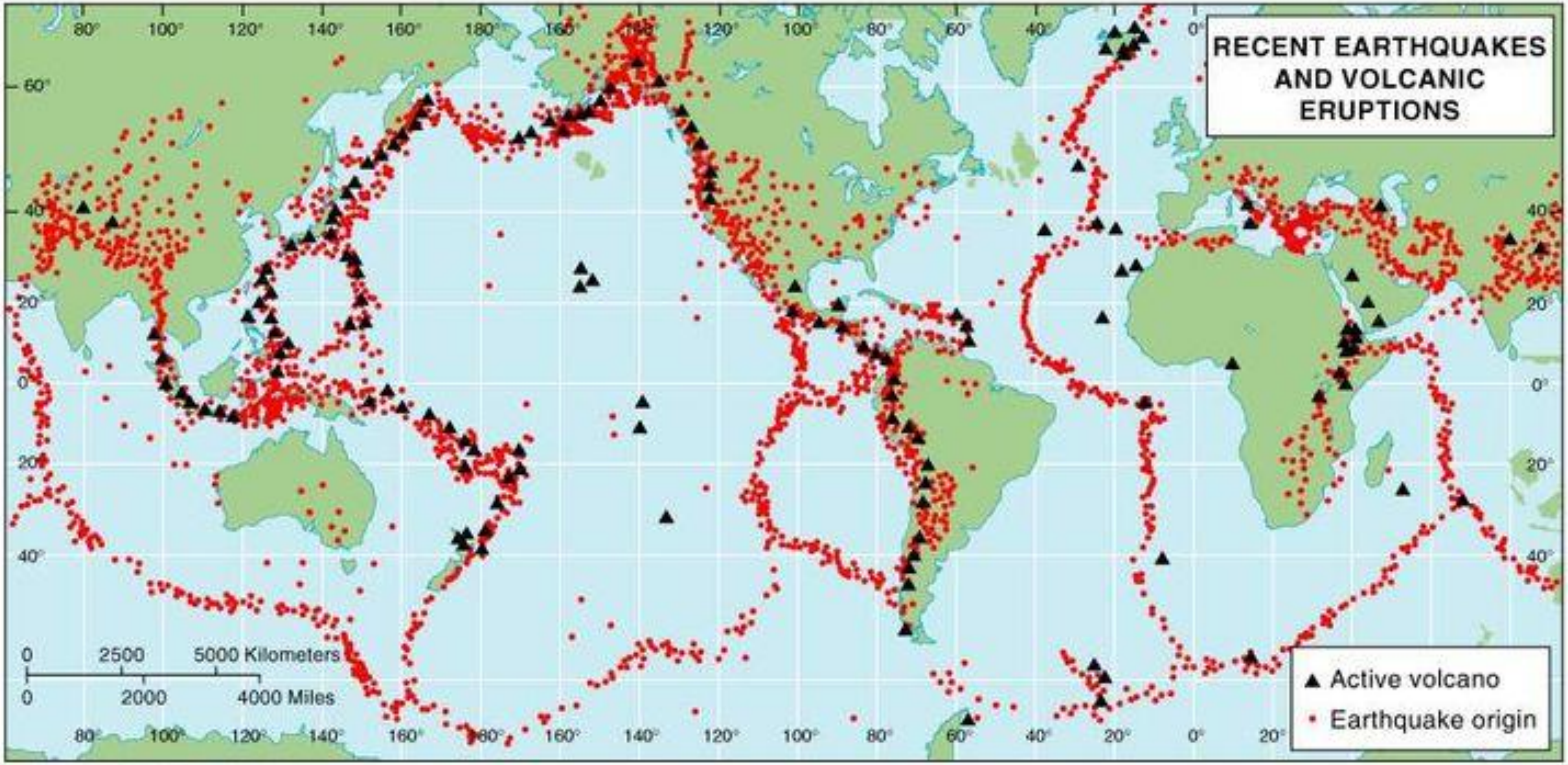


Eurasian plate
North American plate
Eurasian plate
Juan de Fuca plate
Filipino plate
Caribbean plate
Arabian plate
Indian plate
Cocos plate
EQUATOR
Nazca plate
Pacific plate
Australian plate
South American plate
African plate
Australian plate
Scotia plate
Antarctic plate

Subduction Activity

Subduction


Trench
Forearc
Volcanic arc
Backarc
Oceanic crust
Continental crust
Accretionary wedge
Moho
Lithosphere
Lithosphere
Asthenosphere


RECENT EARTHQUAKES AND VOLCANIC ERUPTIONS
Active volcano
Earthquake origin
0 2500 5000 Kilometers
0 2000 4000 Miles
80° 100° 120° 140° 160° 180° 160° 140° 120° 100° 80° 60° 40° 20° 0° 20°
60° 40° 20° 0° 20° 40°

Earthquakes

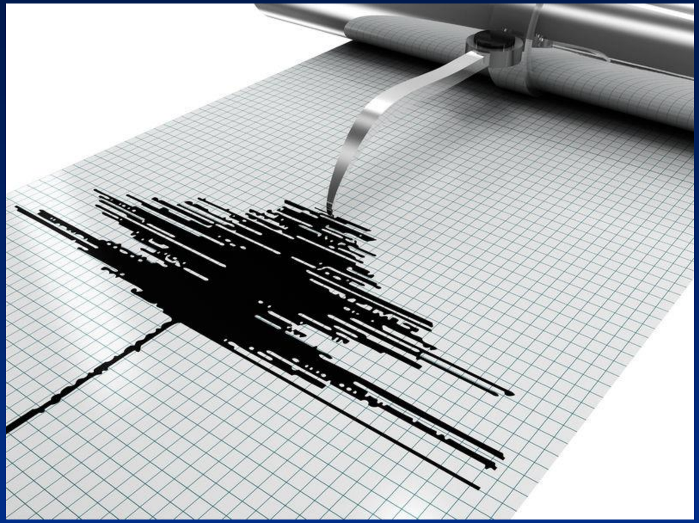
- How do we measure the strength of an earthquake?
- How do we prepare for earthquakes?
- How do we deal with earthquakes once they happen?

Magnitudes / Intensities

- An Earthquake is measured in two different ways, magnitude and intensity.
- Magnitude measures how much energy is released.
- Intensity measures how much shaking actually occurs.

EMS-98 Intensity	Felt	Impact	Magnitude (Approxi-mat Value)	Building Damage (Masonry)
I	Not felt	Not felt		
II-III	Weak	Felt indoors by a few people. People at rest feel a swaying or light trembling.	2 3	
IV	Light	Felt indoors by many people, outdoors by very few. A few people are awakened. Windows, doors and dishes rattle.		
V	Moderate	Felt indoors by most, outdoors by few. Many sleeping people wake up. A few are frightened. Buildings tremble throughout. Hanging objects swing considerably. Small objects are shifted. Doors and windows swing open or shut.	4	
VI	Strong	Many people are frightened and run outdoors. Some objects fall. Many houses suffer slight non-structural damage like hair-line cracks and falling of small pieces of plaster.		
VII	Very strong	Most people are frightened and run outdoors. Furniture is shifted and objects fall from shelves in large numbers. Many well-built ordinary buildings suffer moderate damage: small cracks in walls, fall of plaster, parts of chimneys fall down; older buildings may show large cracks in walls and failure of in-fill walls.	5	
VIII	Severe	Many people find it difficult to stand. Many houses have large cracks in walls. A few well built ordinary buildings show serious failure of walls, while weak older structures may collapse.		
IX	Violent	General panic. Many weak constructions collapse. Even well built ordinary buildings show very heavy damage: serious failure of walls and partial structural failure.	6	
X+	Extreme	Most ordinary well built buildings collapse, even some with good earthquake resistant design are destroyed.	7	

Magnitude



1 – Not felt
2 – Not felt
3 – Felt, barely perceptible
4 – Ceiling lights might swing
5 – Minor damage, walls might crack in weak structures.
6 – Moderate damage. Walls crack in strong structures. (Energy equivalent to Hiroshima bomb)
7 – Widespread damage in populated areas. Weak structures begin to collapse.
8 – Devastating impacts. Strong structures begin to crumble.
9 – Destruction of hundreds/thousands of buildings, cities start to collapse.
10 – Never recorded. Unimaginable destruction

Frequency of Earthquakes

Magnitude	Description	Earthquake effects	Frequency of occurrence
Less than 2.0	Micro	Micro earthquakes, not felt.[15]	Continual
2.0–2.9	Minor	Generally not felt, but recorded.	1,300,000 per year (est.)
3.0–3.9		Often felt, but rarely causes damage.	130,000 per year (est.)
4.0–4.9	Light	Noticeable shaking of indoor items, rattling noises. Significant damage unlikely.	13,000 per year (est.)
5.0–5.9	Moderate	Can cause major damage to poorly constructed buildings over small regions. At most slight damage to well-designed buildings.	1,319 per year
6.0–6.9	Strong	Can be destructive in areas up to about 160 kilometres (99 mi) across in populated areas.	134 per year
7.0–7.9	Major	Can cause serious damage over larger areas.	15 per year
8.0–8.9	Great	Can cause serious damage in areas several hundred kilometres across.	1 per year
9.0–9.9		Devastating in areas several thousand kilometres across.	1 per 10 years (est.)
10.0+	Massive	Never recorded, widespread devastation across very large areas; see below for equivalent seismic energy yield.	Extremely rare (Unknown/May not be possible)

Examples – Mexico City, 2017

- https://www.youtube.com/watch?v=8OrC0k44X0c
- 7.1 Earthquake
- 370 dead
- Thousands injured

Examples – Los Angeles/Northridge, 6.7

57 dead.
>8000 injured

Examples – Japan 2011

- Most powerful earthquake to hit Japan
- 4th most powerful earthquake ever recorded.
- 16,000 deaths
- 130,000 buildings completely destroyed
- 280,000 buildings half collapsed
- Massive Tsunami created
- Nuclear Power plant destroyed. Widespread contamination.
- We'll see more of this later.

Volcanoes

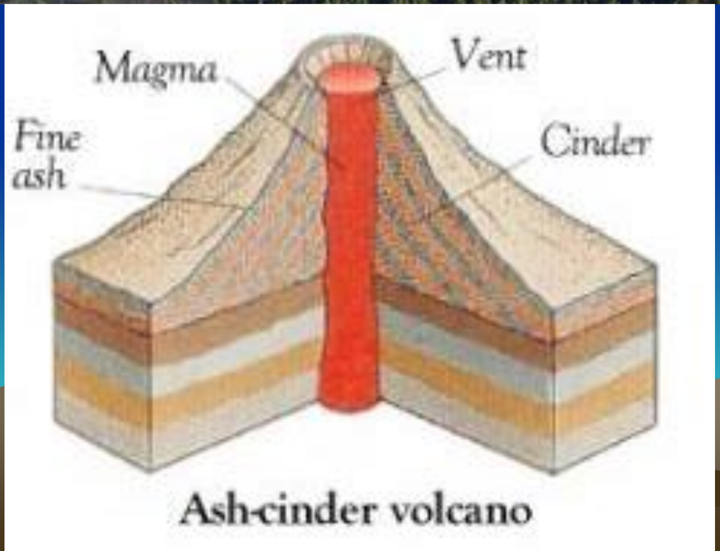
- What kind of volcanoes are there?
- How bad are they really?

Types

- Cinder cone volcano
- Shield volcano
- Composite volcano

- Hot spots.

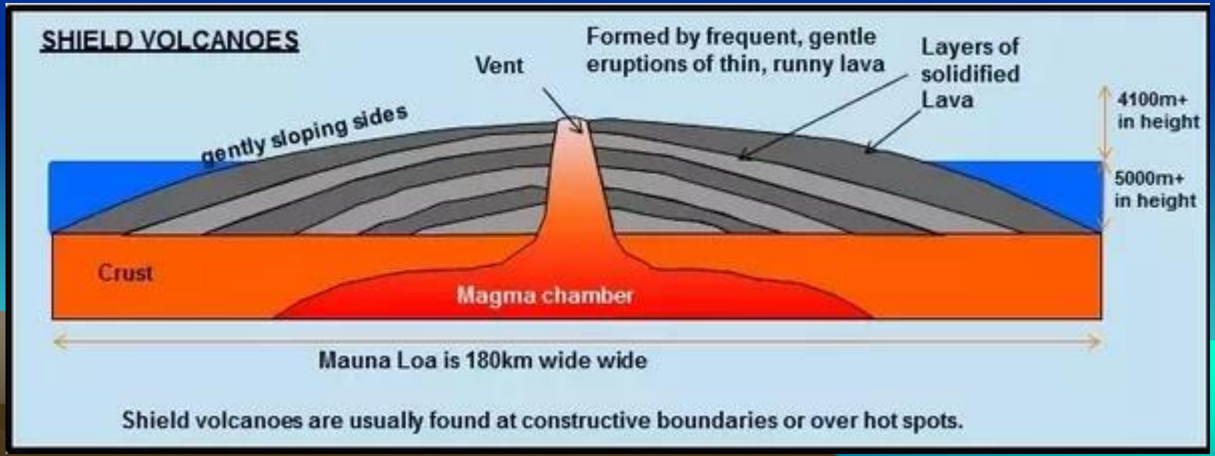
Cinder cone



- Made up of loose grains and cinders, almost no lava.
- Steep sides
- Typically pretty short.
- Crater on the top.

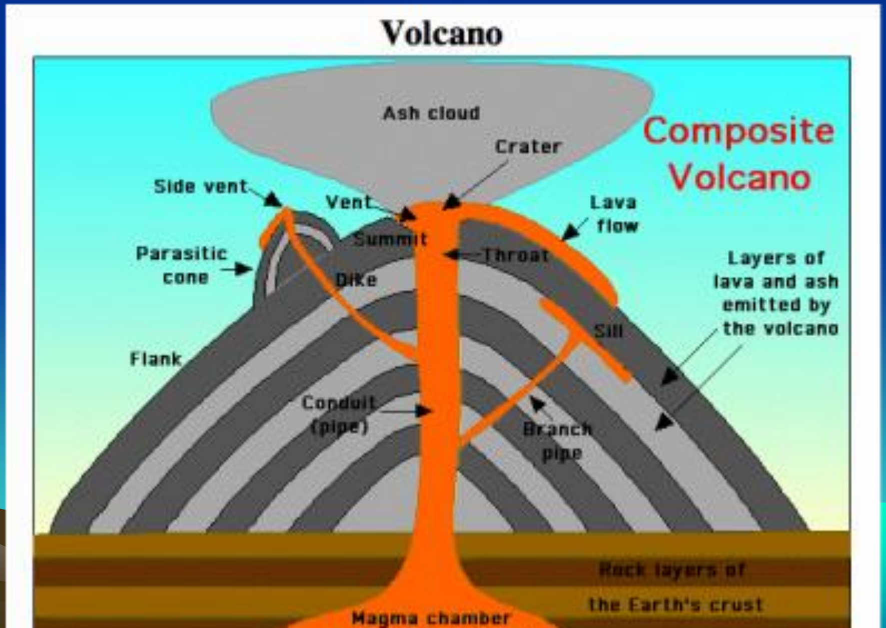
Shield

- Made up almost entirely of solidified lava.
- Shallow slopes
- Typically very large
- Hawaii

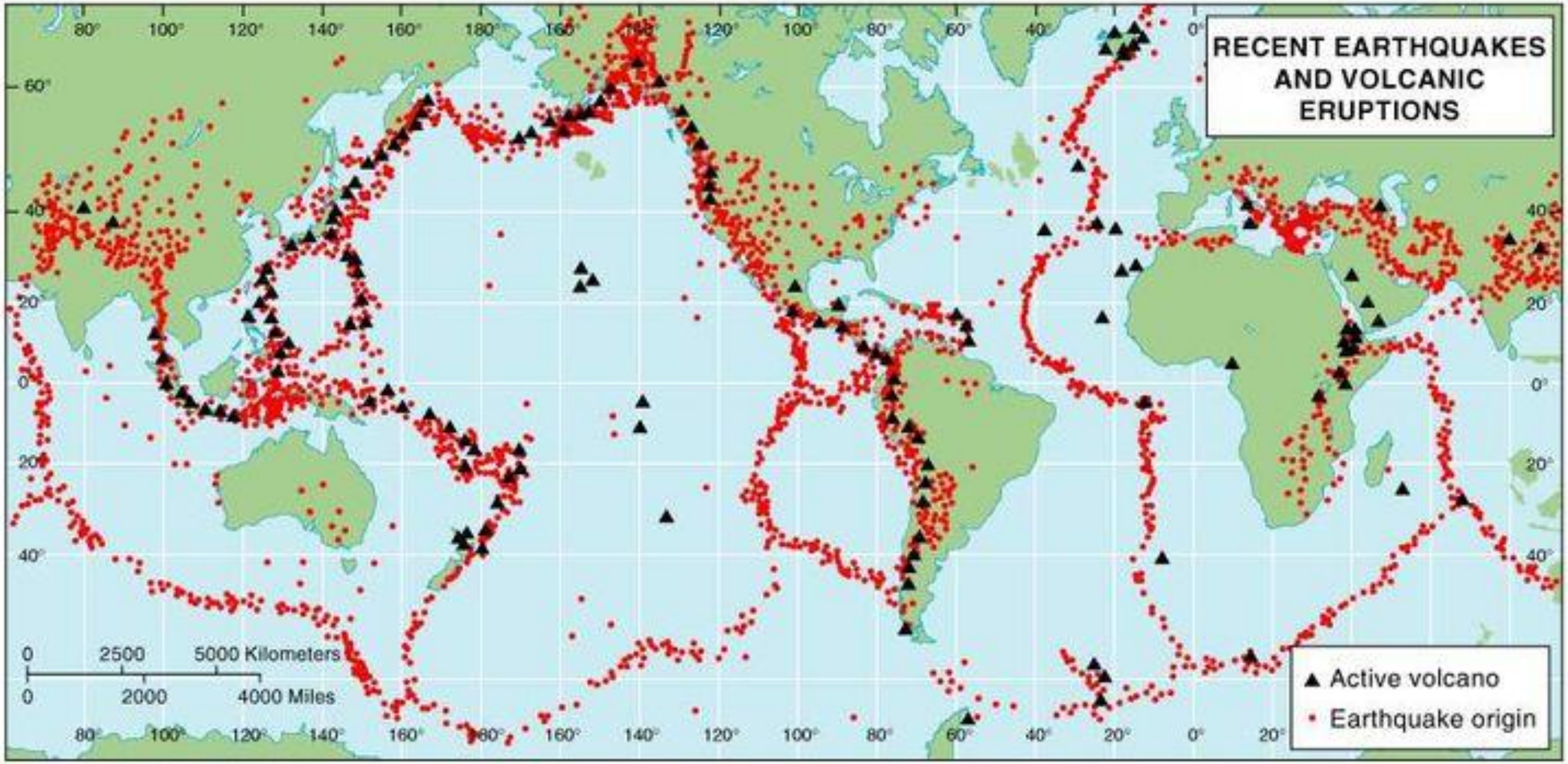


Composite

- Somewhere in between Shield and Cinder cone.
- Layers of solidified lava and ash.
- Moderately sloping sides



Hot Spots



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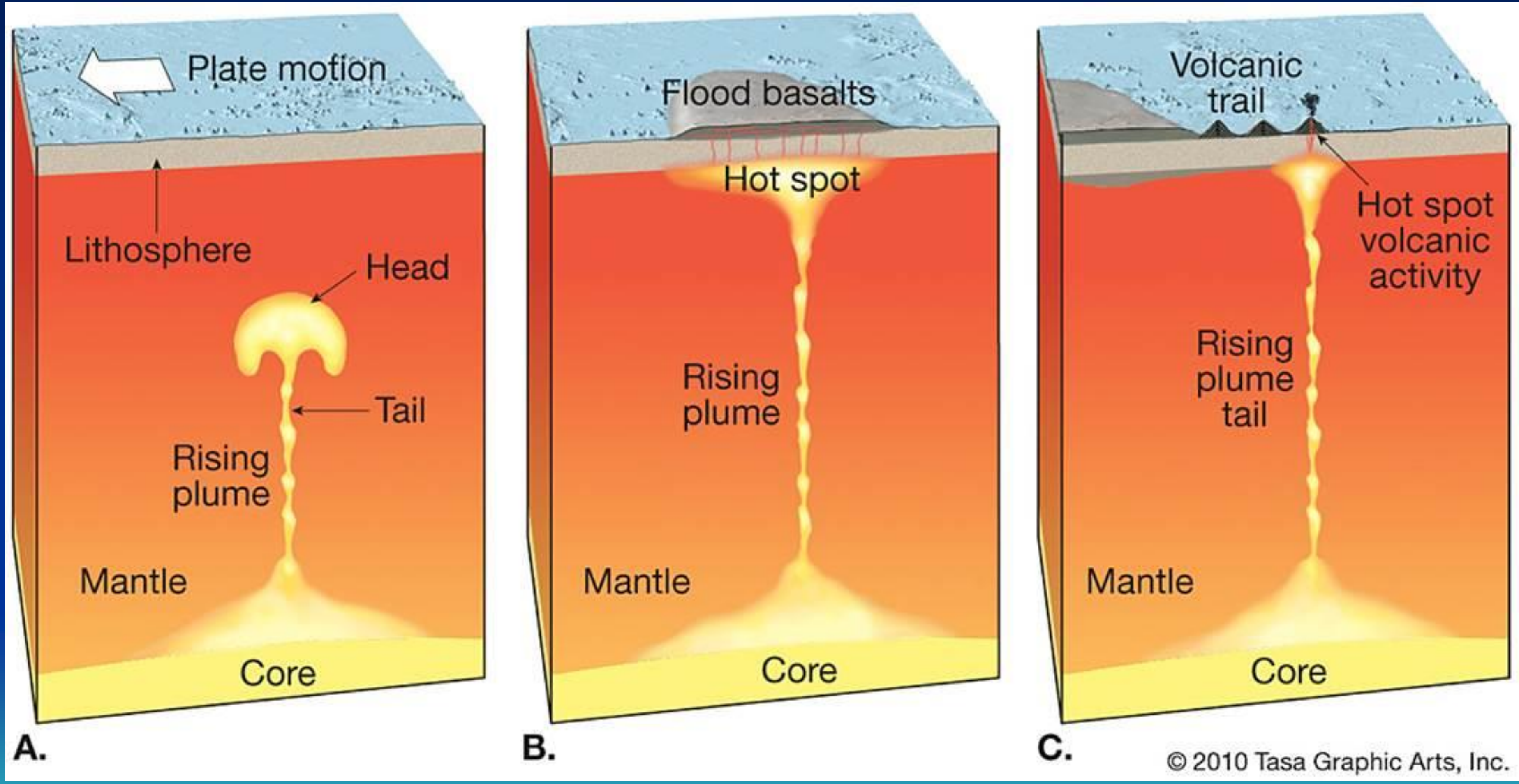
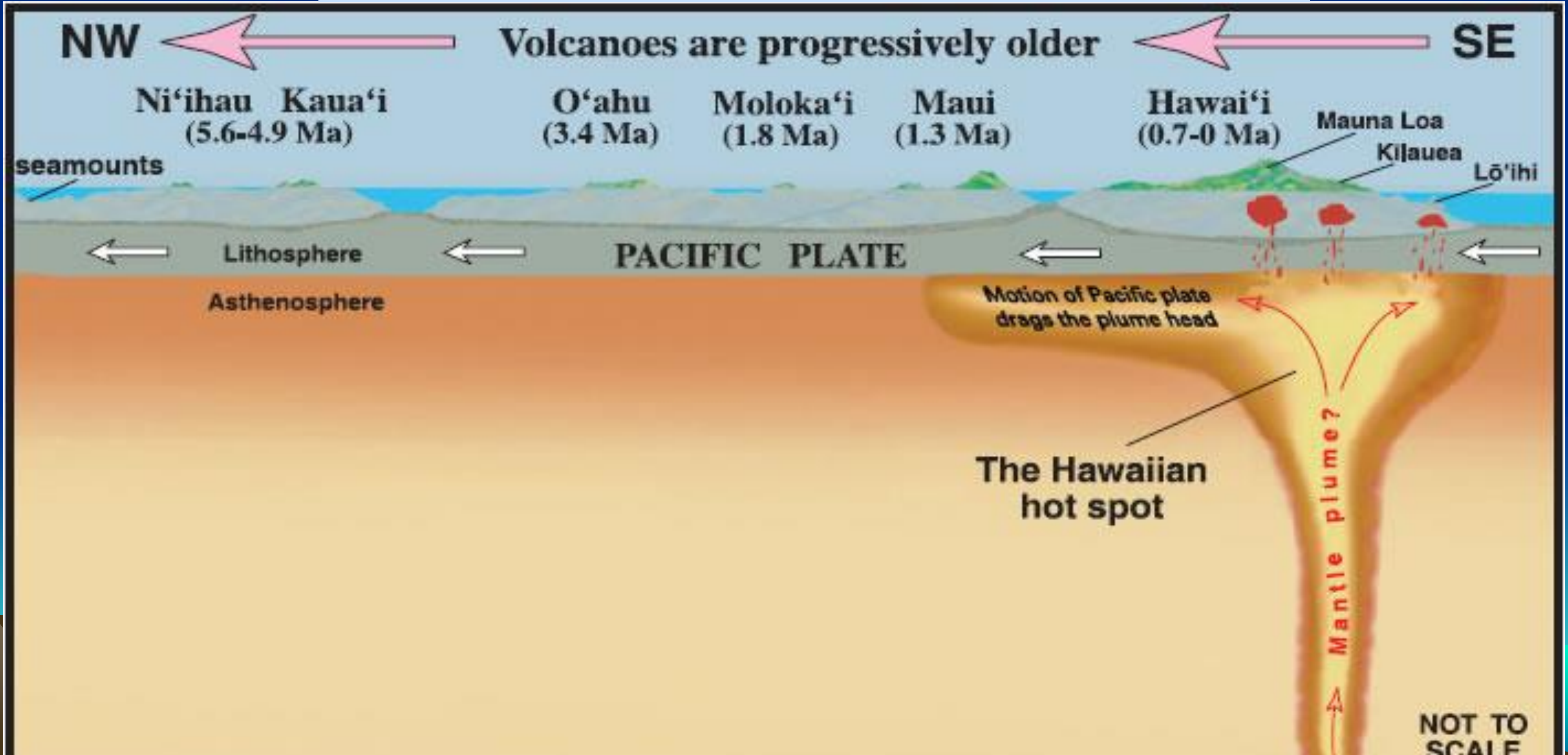
Hot Spots

- Not on plate boundaries.
- Material directly from the core boundary.
- Typically create Shield volcanoes.
- Creates chains of islands.
- Plume doesn't move, but as the plate moves, new islands are formed.



Which island is the oldest?

Which island is the youngest? (Being born right now)



Examples

- Papua New Guinea
- https://www.youtube.com/watch?v=BUREX8aFbMs

Examples

- Mt. St. Helens
- https://www.youtube.com/watch?v=AYla6q3is6w

Hazards

- Lava isn't greatest hazard.
- Pyroclastic flow – Ash and poisonous gasses, thousands of degrees hot, moves at hundreds of miles per hour.
- https://www.youtube.com/watch?v=Cvjwt9nnwXY
- Mudslides – Lahars: https://www.youtube.com/watch?v=WEAfXO7q8Xs