
FORCES THAT SHAPE THE EARTH

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Continental crust constantly changes over time due to plate tectonics.

Forces at plate boundaries are strong enough to break rocks or change their shape.

Stress

Force that acts on rock to change its shape or volume

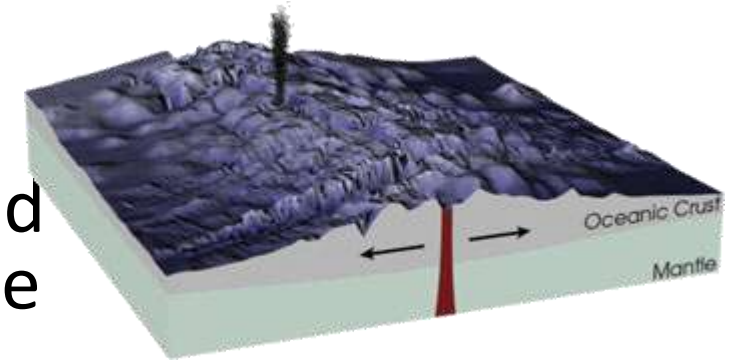
Three different kinds of stress can occur in the crust:

- Tension
- Compression
- Shearing

Tension

Pulls on the crust, stretching rock so it becomes thinner in the middle

Landforms Created by Tension



- Mid-ocean ridges – tension causes oceanic crust to spread allowing hot rock from mantle to rise creating high ridges
- Continental rifts – when divergent boundaries occur within a continent, they cause enormous splits in the crust

Compression

Squeezes rock until it folds or breaks

Landforms Created by Compression

- Mountain ranges – collision between two continental plates
- Ocean trenches – one plate goes under another during collision forming a deep trench where the two plates meet
- Volcanic arcs – curved line of volcanoes that forms parallel to plate boundaries

Shearing

Pushes a mass of rock in two opposite directions

Landforms Created by Shearing

- Transform faults – when plates slide horizontally past each other they form a fault, or a break in the rock of the crust
- Fault zones – an area of many fractured pieces of crust along a large fault

Strain – a change in the shape of a rock caused by stress

- Elastic strain – change in rock that is NOT permanent; when stress is removed rock goes back to original shape
- Plastic strain – creates a permanent change in the shape of a rock; usually occurs when rocks are weak or hot

VOLCANOES

Volcano

Weak spot in earth's crust where molten material, or magma, comes to the surface

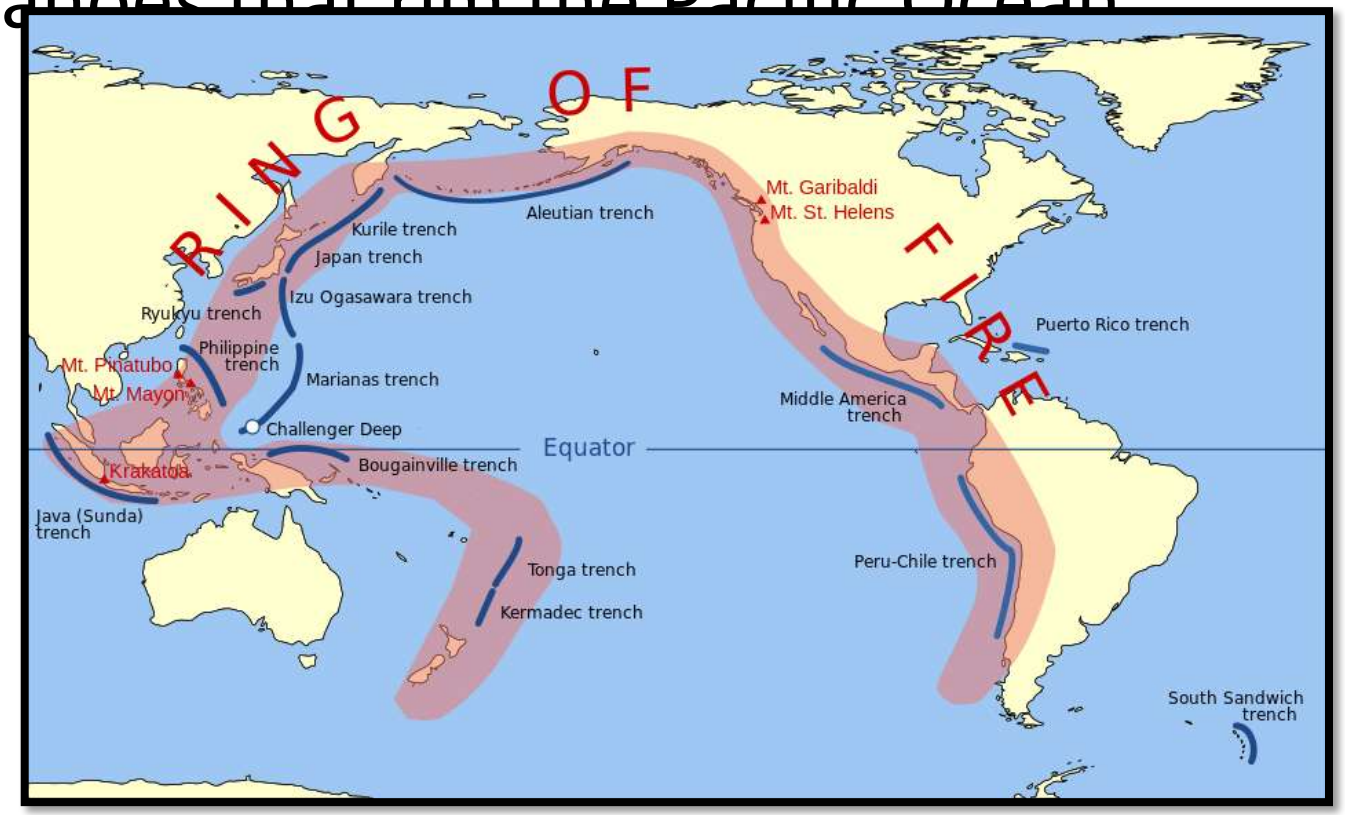
magma – molten mixture of rock-forming substances, gases and water from the mantle; when magma reaches Earth's surface it is called lava

At plate boundaries the crust often fractures due to the diverging (pulling) or converging (pushing) plates.

As a result, these fractures allow magma to reach the surface forming volcanic belts along the boundaries of Earth's plates.

Ring of Fire

Major belt is the Ring of Fire, formed by many volcanoes that rim the Pacific Ocean



island arc – string of islands created by volcanoes near boundaries where two oceanic plates collide and one sinks beneath the other

hot spot – area where material from deep within the mantle rises then melts, forming magma; a volcano forms above a hot spot when magma erupts through the crust (ex. Hawaiian Islands)

Geologists classify volcanic eruptions as quiet or explosive:

quiet eruption – magma has low silica content, flows easily and erupts quietly with gases bubbling out gently and lava oozing quietly producing both pahoehoe (fast moving hot lava) and aa (lava that is cooler and slower-moving)

explosive eruption – has magma high in silica with trapped gases building up pressure until they explode with incredible force creating a pyroclastic flow, or an eruption that hurls out ash, cinders and magma bombs.

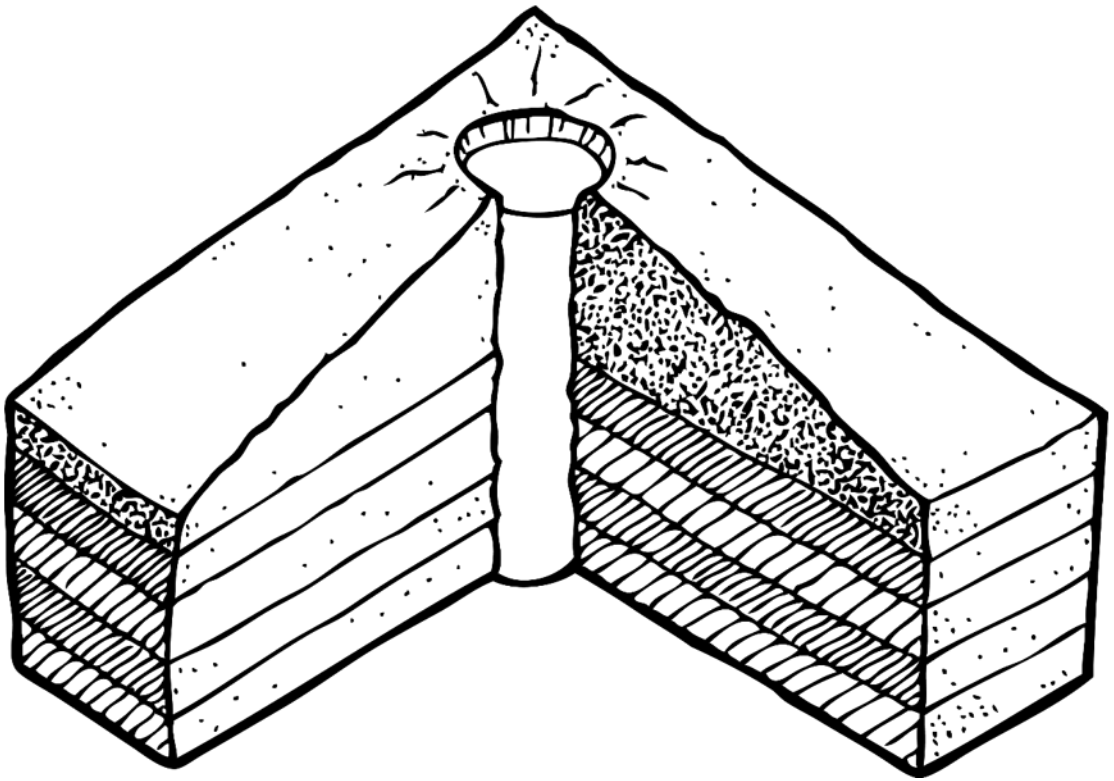
dormant volcano – not active, but may become active

extinct volcano – unlikely to erupt again

VOLCANIC LANDFORMS

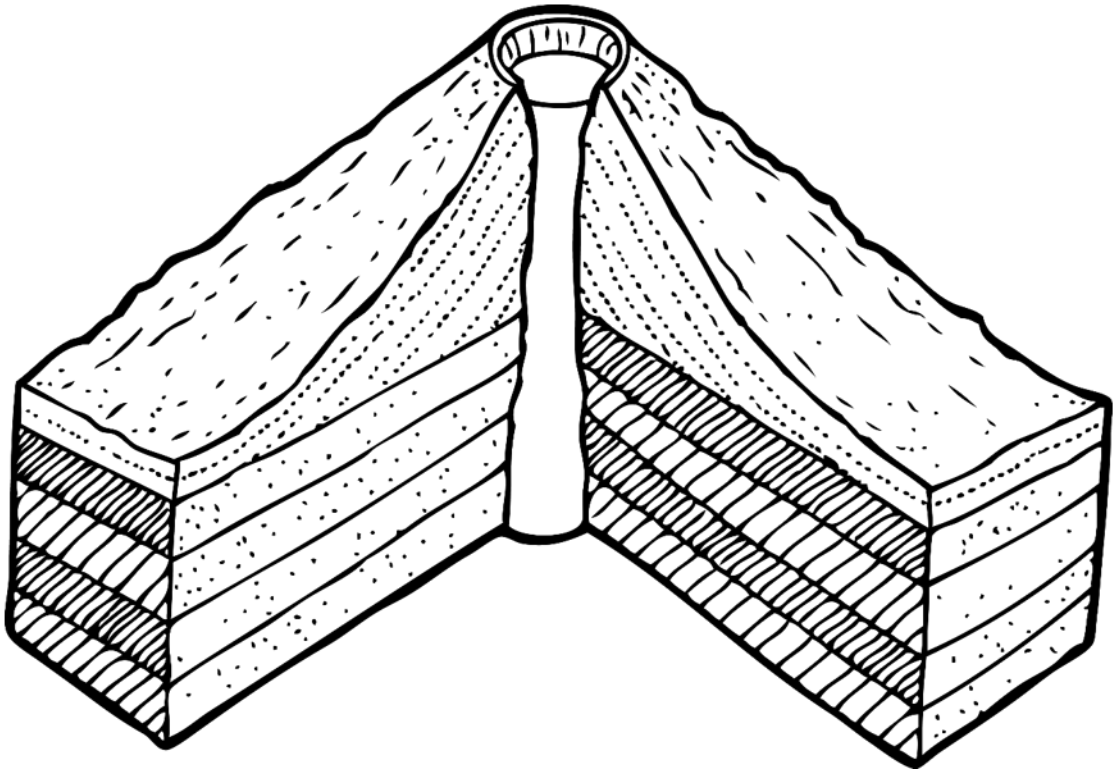
Landforms from Lava and Ash

1. Shield volcano – lava flows out gradually building a wide, gently sloping mountain



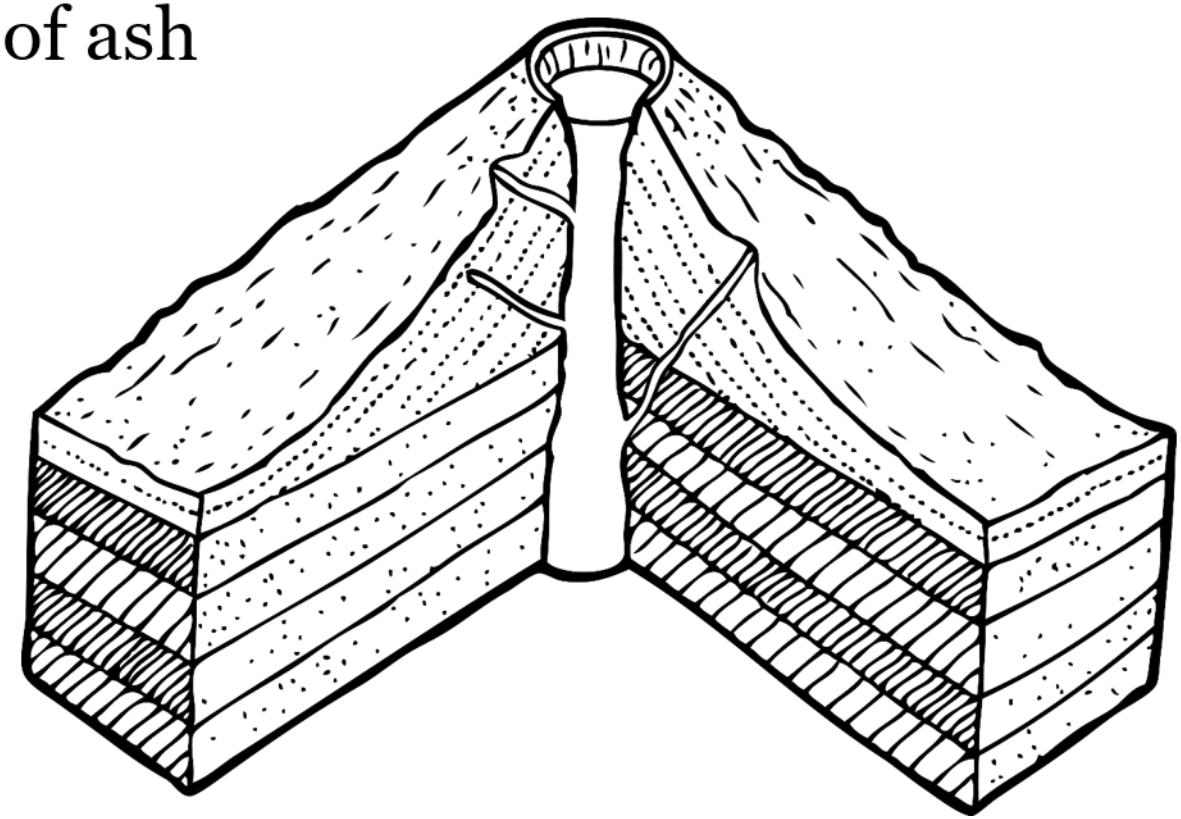
Landforms from Lava and Ash

2. Cinder cone volcano – when lava has high viscosity it produces ash, cinders and bombs which all build up around the vent in a steep, cone-shaped hill or small mountain



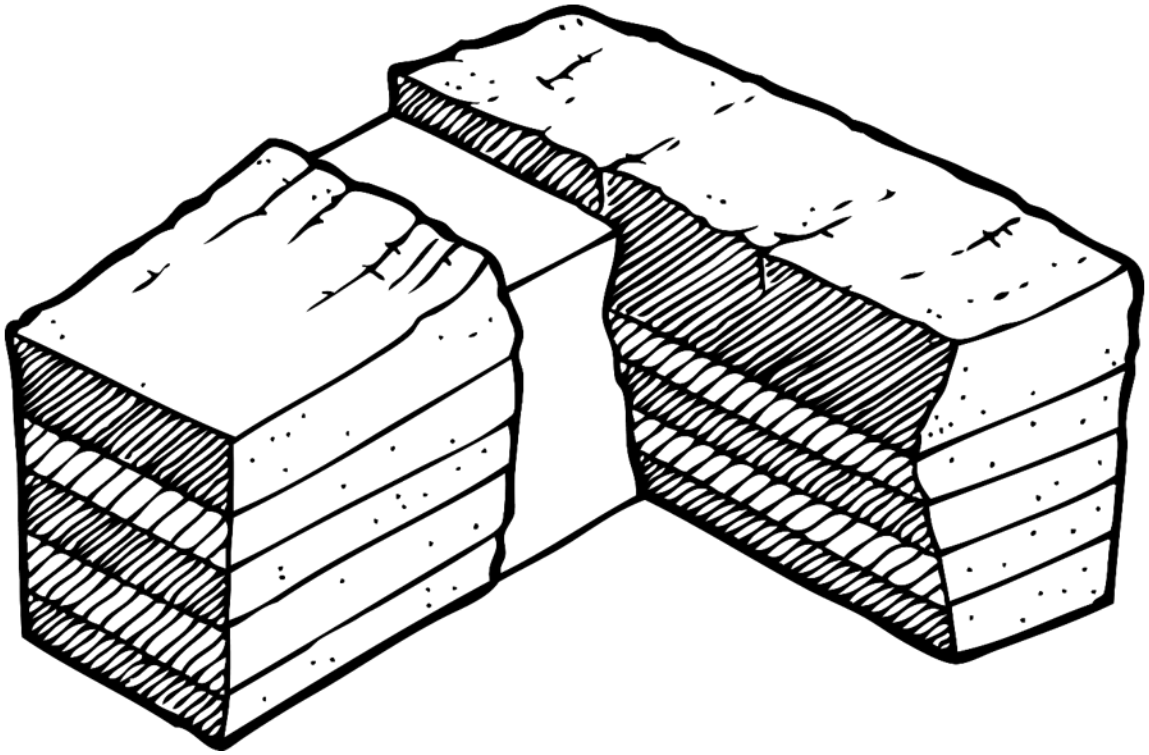
Landforms from Lava and Ash

3. Composite volcano – tall, cone-shaped mountains in which layers of lava alternate with layers of ash



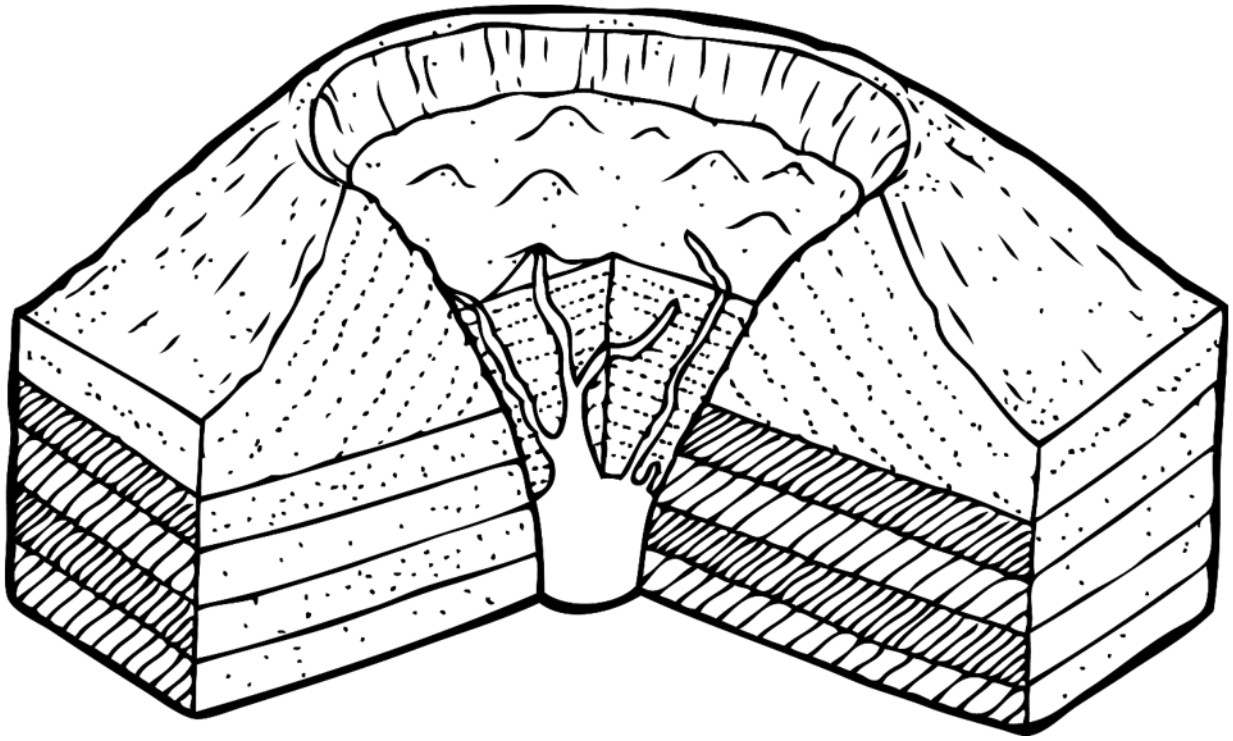
Landforms from Lava and Ash

4. Lava plateaus – high, level area that has been built up over time from lava seeping out of several cracks then traveling a distance before cooling and solidifying.



Landforms from Lava and Ash

5. Caldera – huge hole left by the collapse of a volcanic mountain

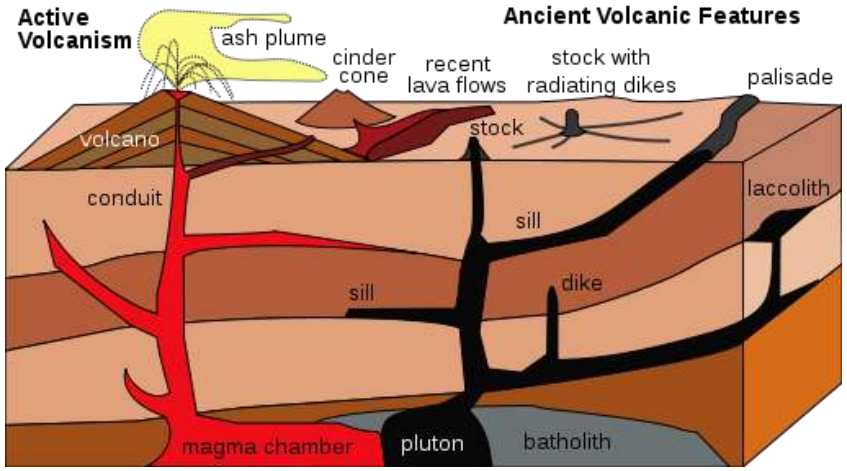


Landforms From Magma

1. Volcanic necks – forms when magma hardens in a volcano's pipe; softer rock around pipe wears away exposing hard rock

Landforms From Magma

2. Dikes – formed when magma forces itself across rock layers and hardens



Landforms From Magma

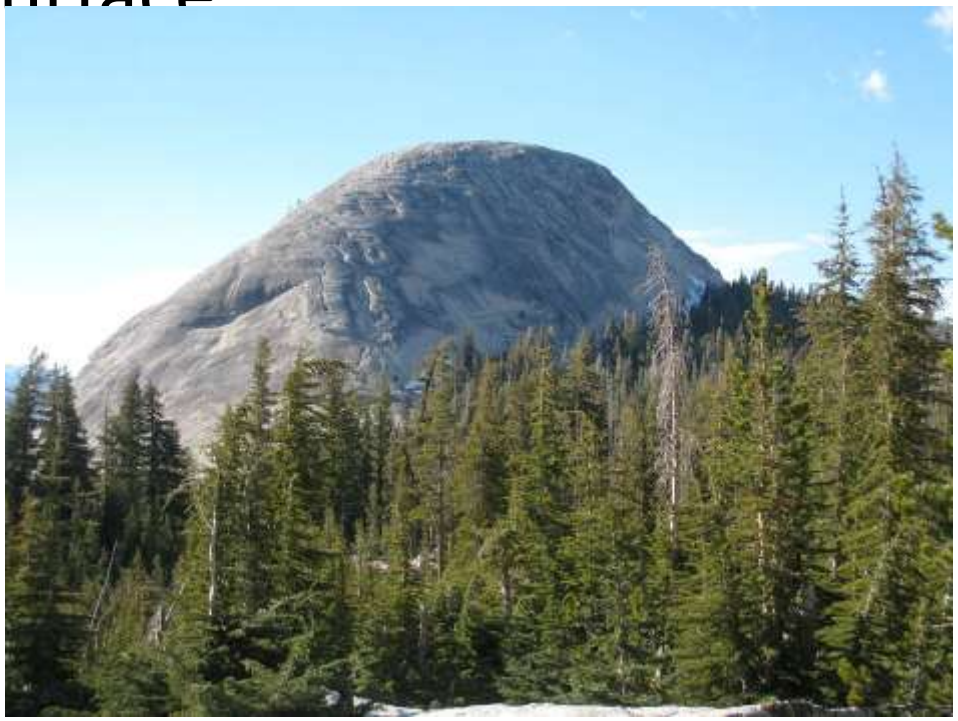
3. Sill – formed when magma squeezes between horizontal layers of rock

Landforms From Magma

4. Batholiths – mass of rock formed when a large body of magma cools inside the crust

Landforms From Magma

5. Dome mountain – forms when an uplift pushes a batholith or smaller body of hardened magma toward the surface



Geothermal Activity

Occurs when magma, a few kilometers, beneath Earth's surface, heats underground water and forms:

- Hot springs
- Geysers

Hot Springs

Formed when groundwater is heated by a nearby body of magma or hot rock and eventually rises to the surface to collect in a natural pool.

Geyser

Fountain of water and steam that erupts from the ground when buildup of pressure is released.

Geothermal Energy

Water heated by magma can provide an energy source called geothermal energy which can heat homes and make electricity.