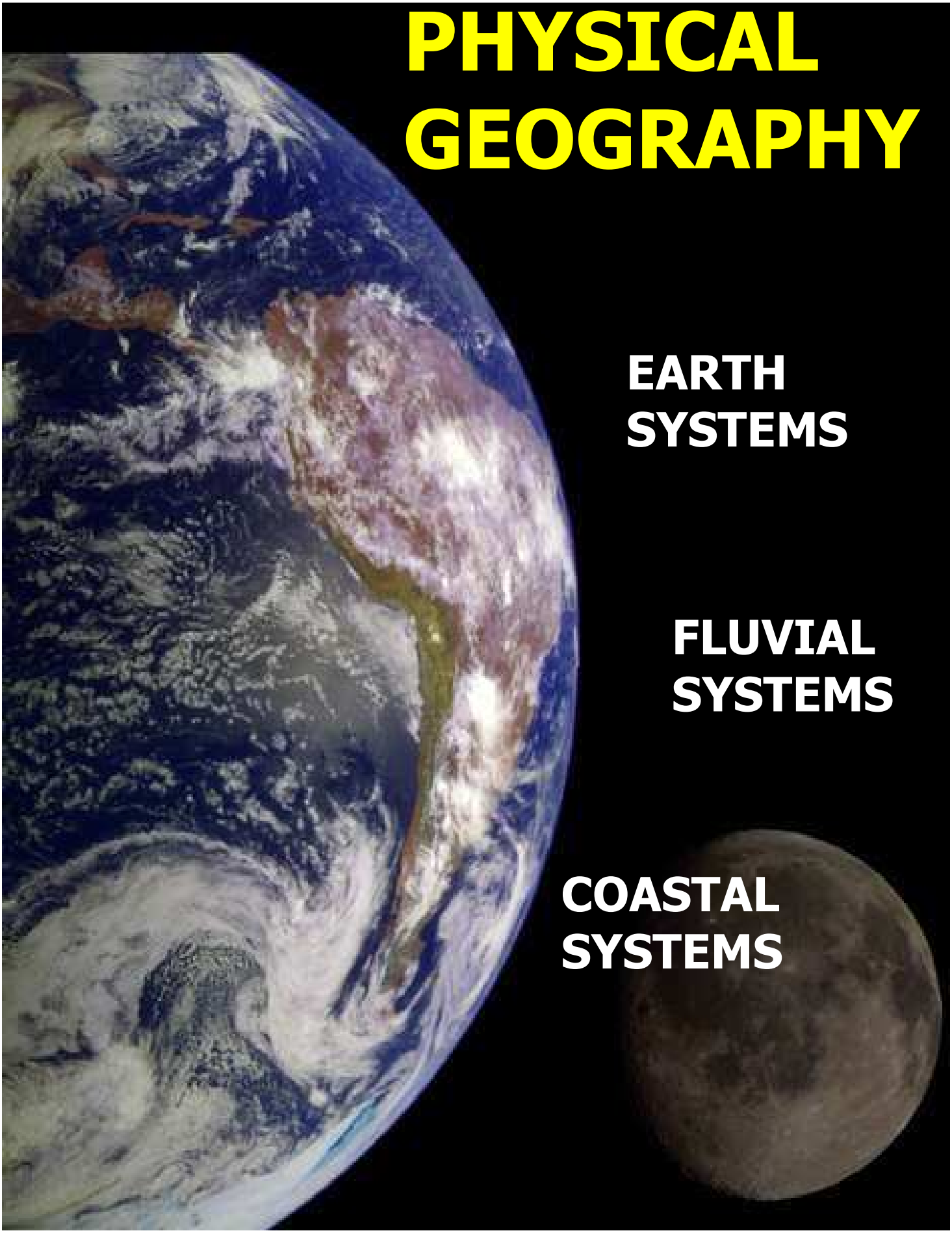
# PHYSICAL GEOGRAPHY

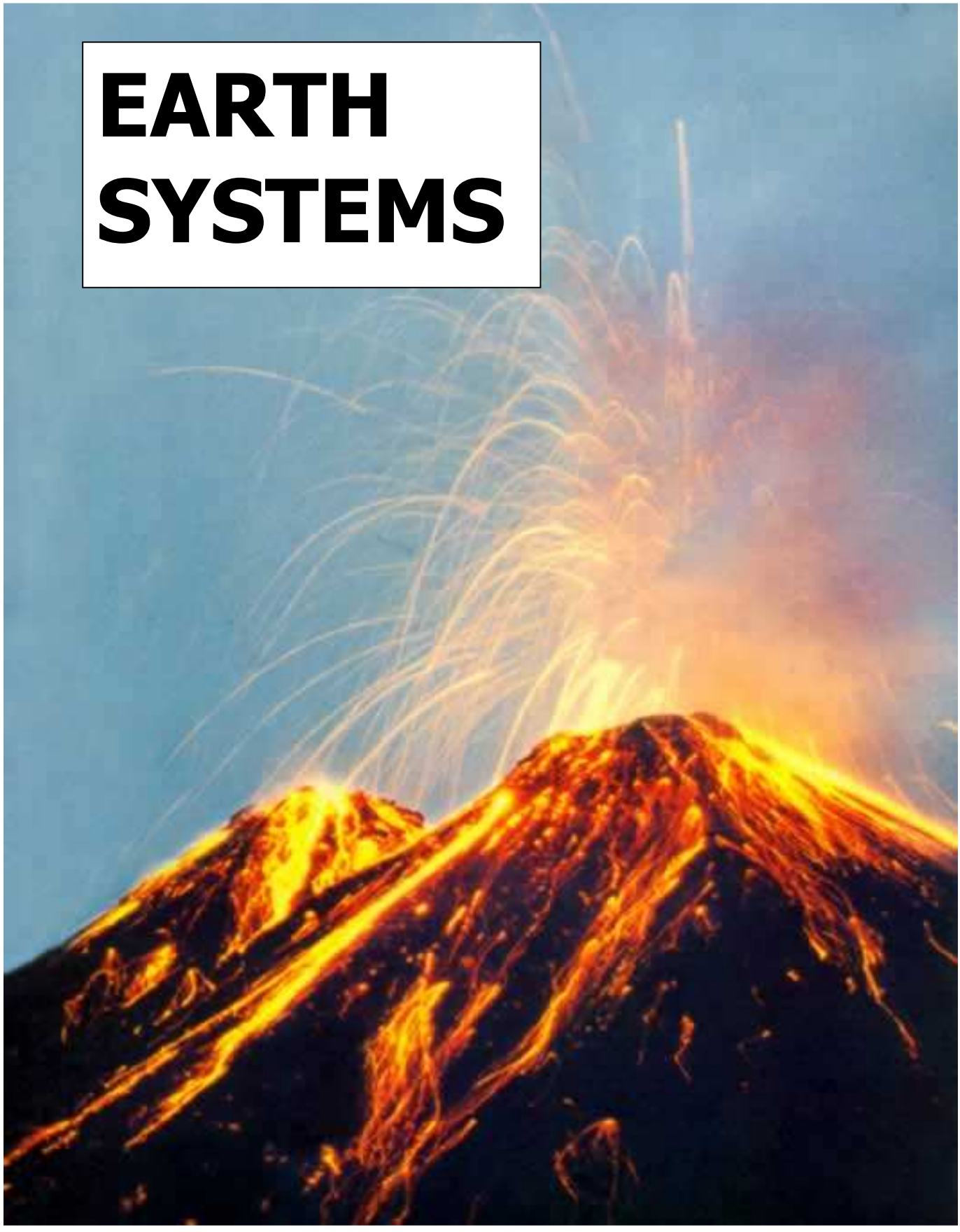


EARTH SYSTEMS

FLUVIAL SYSTEMS

COASTAL SYSTEMS

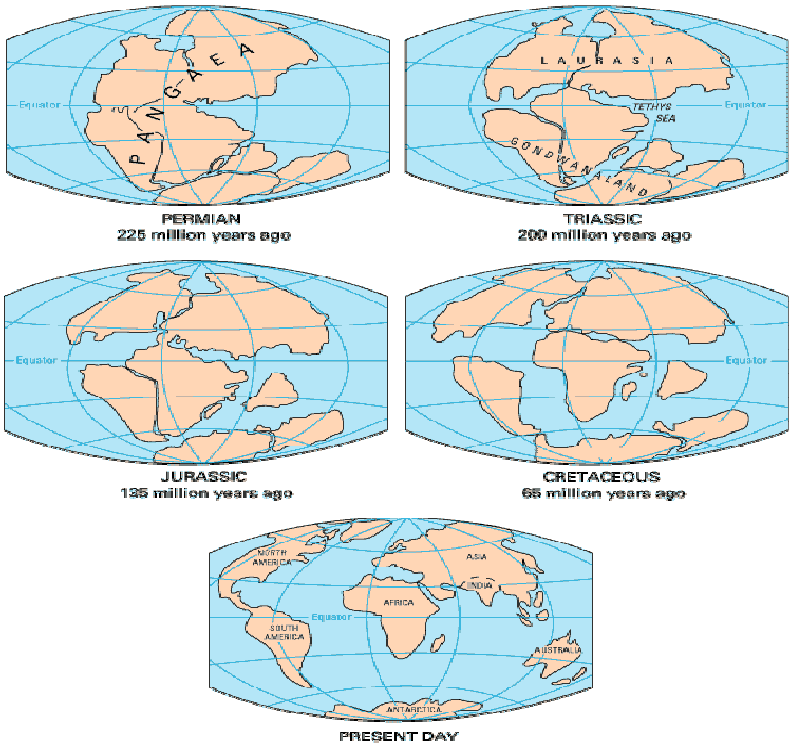
# EARTH SYSTEMS

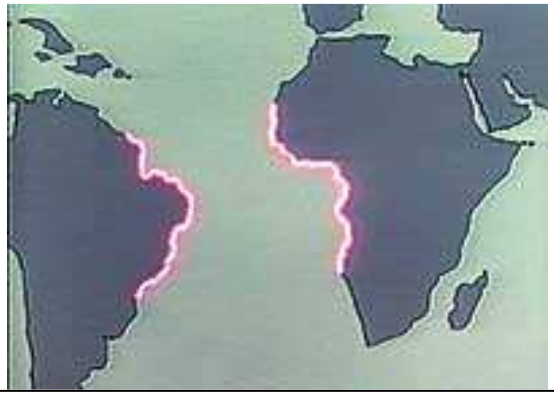


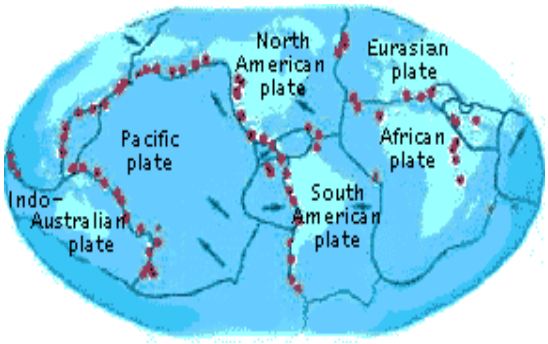
# EARTH SYSTEMS

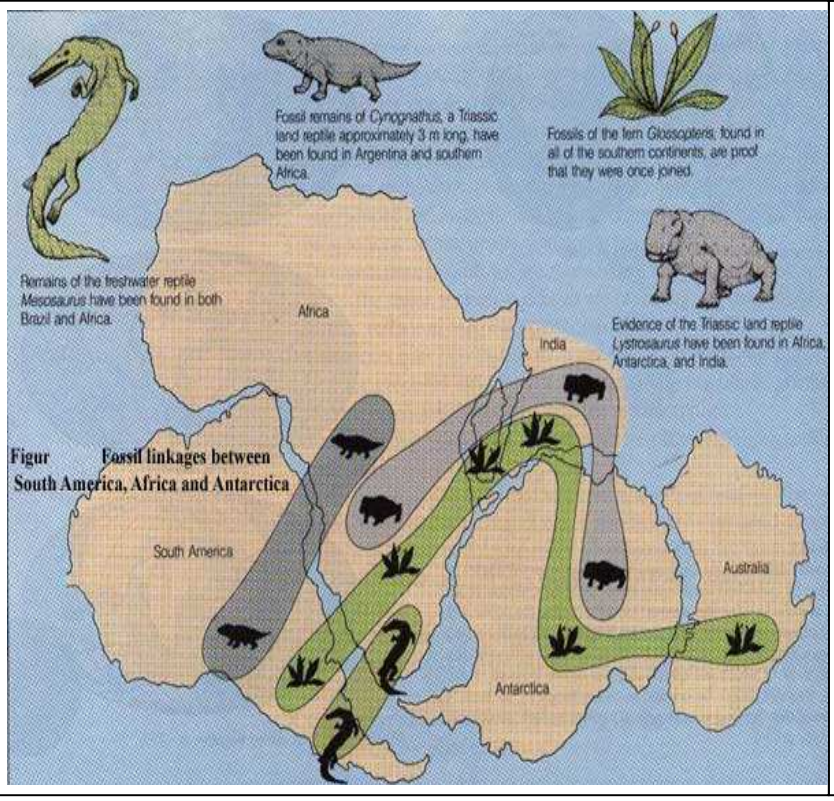
## CONTINENTAL DRIFT

- The continents move due to convection currents in the mantle beneath the crust
- There is evidence that the continents were once together as a massive super-continent
- The excellent jig-saw fit of some of the continental edges was the first evidence for continental drift
- Similar rocks and mountain ranges on widely separated continents suggests they were once together
- Fossils found on widely separated continents such as S America and Africa confirms the theory
- The movement of continents is evidence for the theory of Plate Tectonics






Figur Fossil linkages between South America, Africa and Antarctica

Use the information on this page to write a description of Continental Drift and the evidence for it:

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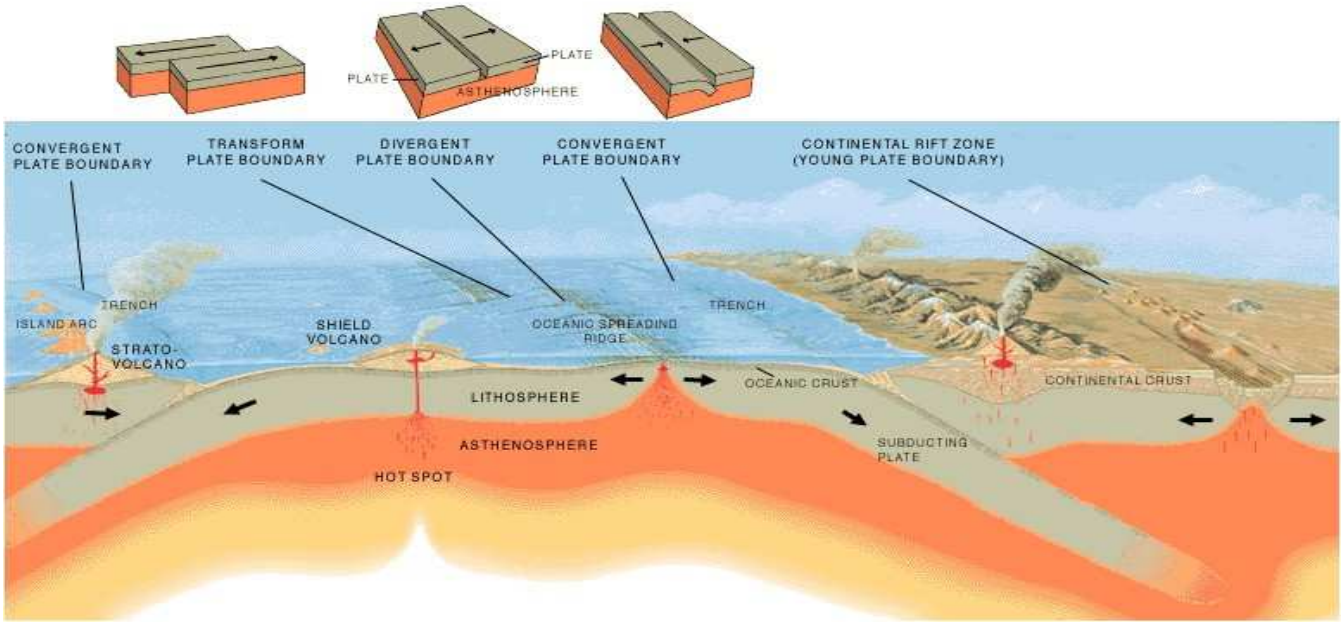
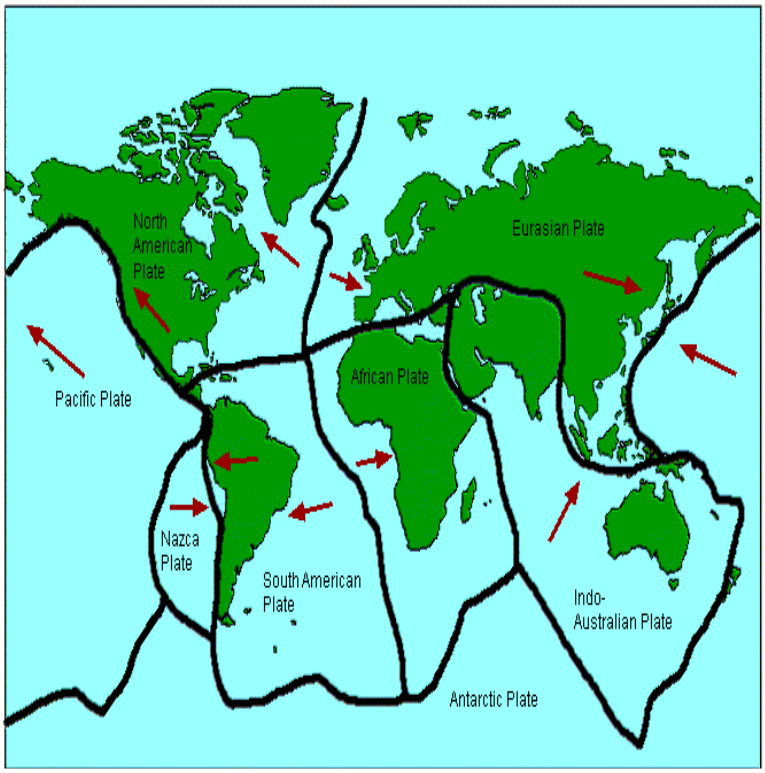
# EARTH SYSTEMS

## PLATE TECTONICS

- The earth is divided into a number of rigid crustal plates
- Convection currents within the upper mantle beneath the crust move the plates
- Plate movements account for the ‘drift’ or movement of the continents
- Plate boundaries are places of great seismic ‘earthquake’ activity and volcanic activity
- Trenches, volcanoes and fold mountains form at converging boundaries (where two plates converge)
- Rift valleys, sea floor spreading, mid ocean ridges and volcanoes are found at diverging boundaries




Use the information on this page to compare converging and diverging plate boundaries:

Converging

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Diverging

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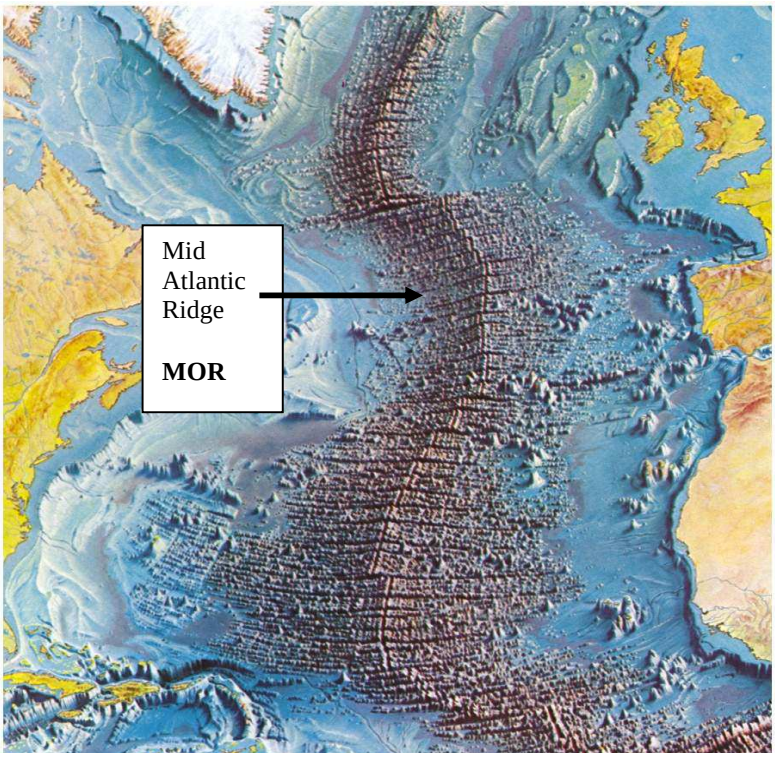
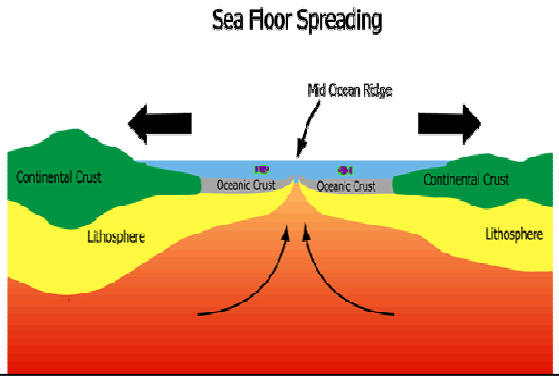
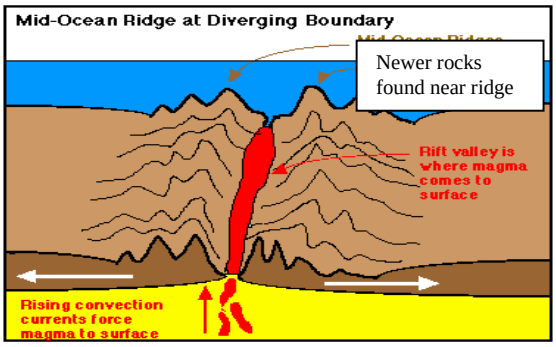
# EARTH SYSTEMS

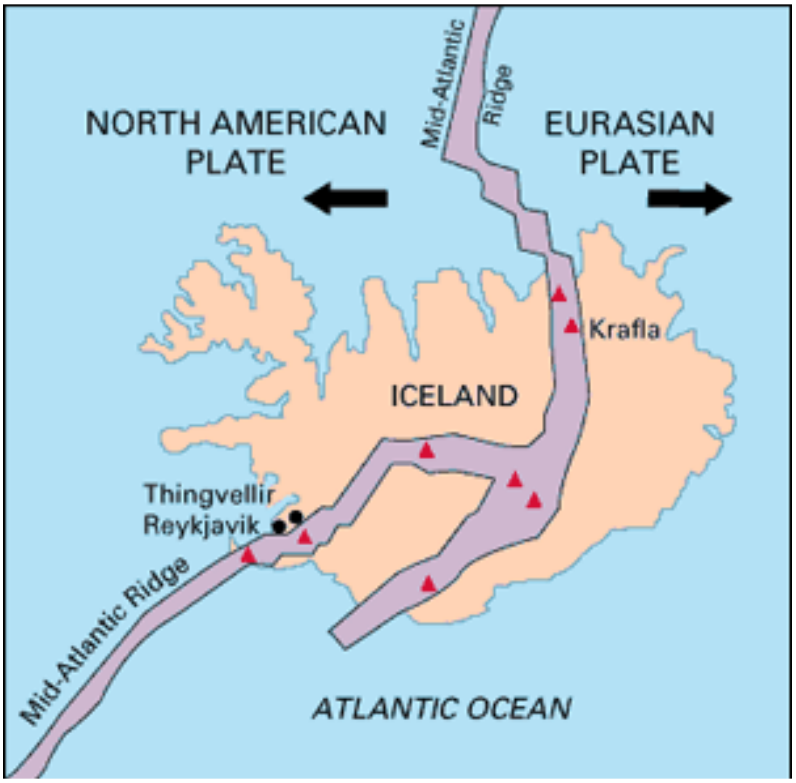
## CONSTRUCTIVE / DIVERGING PLATE BOUNDARY

- At a Diverging Plate Boundary crustal rocks are constructed or created by rising magma
- Sea floor spreading at a Constructive Boundary causes the formation of the oceans
- A mid ocean ridge, a rift valley and volcanoes are found at Diverging Plate Boundaries
- The rising magma can cause pillow lavas to form on the sea floor
- The mid Atlantic ridge is a good example of a Diverging Boundary, spreading a few cms a year
- Iceland sits above the mid Atlantic sea floor spreading zone and has volcanoes and lava flows




Use the information on this page to write a description and explanation of sea floor spreading:

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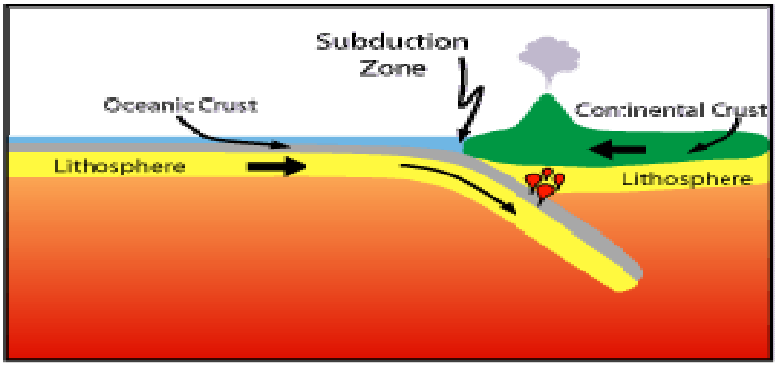
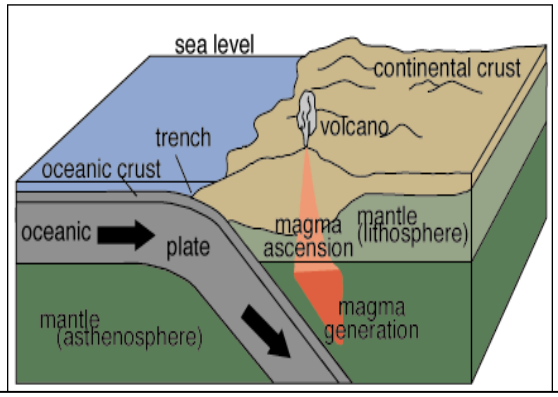
# EARTH SYSTEMS

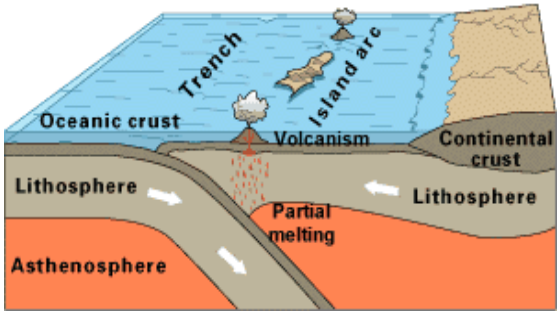
## DESTRUCTIVE / CONVERGING PLATE BOUNDARY

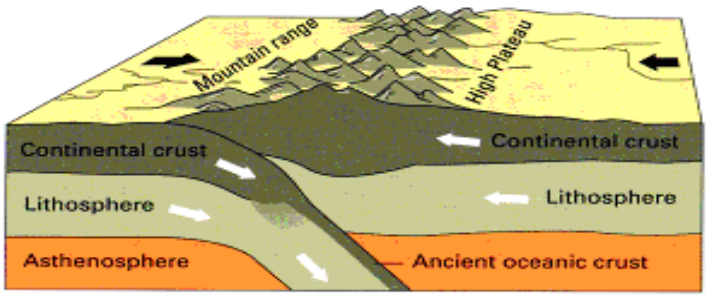
- At a Converging Plate Boundary two plates come together and one is destroyed by Subduction
- The Subducting Plate causes earthquakes and rising magma to give a line of volcanoes
- The Ring of Fire around the Pacific is a zone of convergence, earthquakes and volcanoes
- On the east coast of S America the Nazca and S American plates converge to produce a trench
- The convergence of 2 oceanic plates produces an Island Arc of volcanoes like the Japanese islands
- The convergence of 2 continental plates gives Young Fold Mountains like the Himalayas








Continental-continental convergence


Use the information on this page to write a description and explanation of the features of converging plate boundaries:

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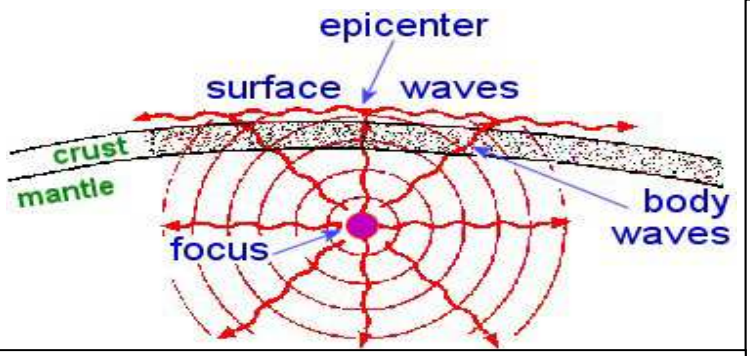
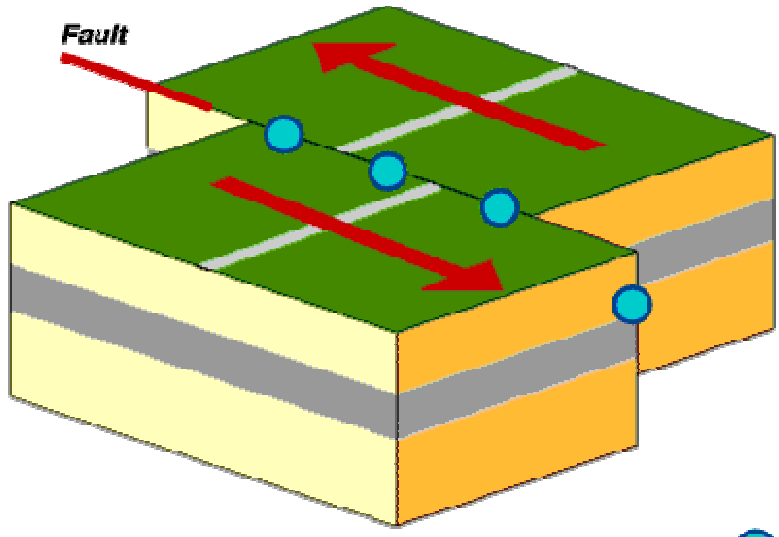
# EARTH SYSTEMS

## CONSERVATIVE PLATE BOUNDARY

- At a Conservative Plate Boundary plates slide past each other, crust is neither created nor destroyed
- A Conservative Plate Boundary is a Transform Fault where earthquakes are common
- An earthquake takes place on the fault at the focus, directly above this on the surface is the epicentre
- The Richter Scale is used to assess the magnitude of an earthquakes based on the seismic waves
- The Mercalli Scale is used to assess the intensity of an earthquake based on the earthquake effects
- The San Andreas in California is a transform fault; the Pacific plate moves past the American plate




| Modified Mercalli Intensity Scale | |
|---|---|
| I | Recorded only by seismographs |
| II and III | Felt by some people who are indoors |
| IV | Felt by many people; windows rattle |
| V | Slight building damage; plaster cracks, bricks fall |
| VI and VII | Much building damage; chimneys fall; houses move on foundations |
| VIII and IX | Serious damage, bridges twisted, wall fractured; many masonry buildings collapse |
| XI | Great damage; most buildings collapse |
| XII | Total damage, waves seen on ground surface, objects thrown into the air |


**Conservative plate margin** *earthquake foci*

relative movement of adjacent continental plates

*actual movement in opposite directions*

*actual movement in the same direction - but at different speeds*

Use the information on this page to write an account of the causes and effects of earthquakes at Conservative boundaries:

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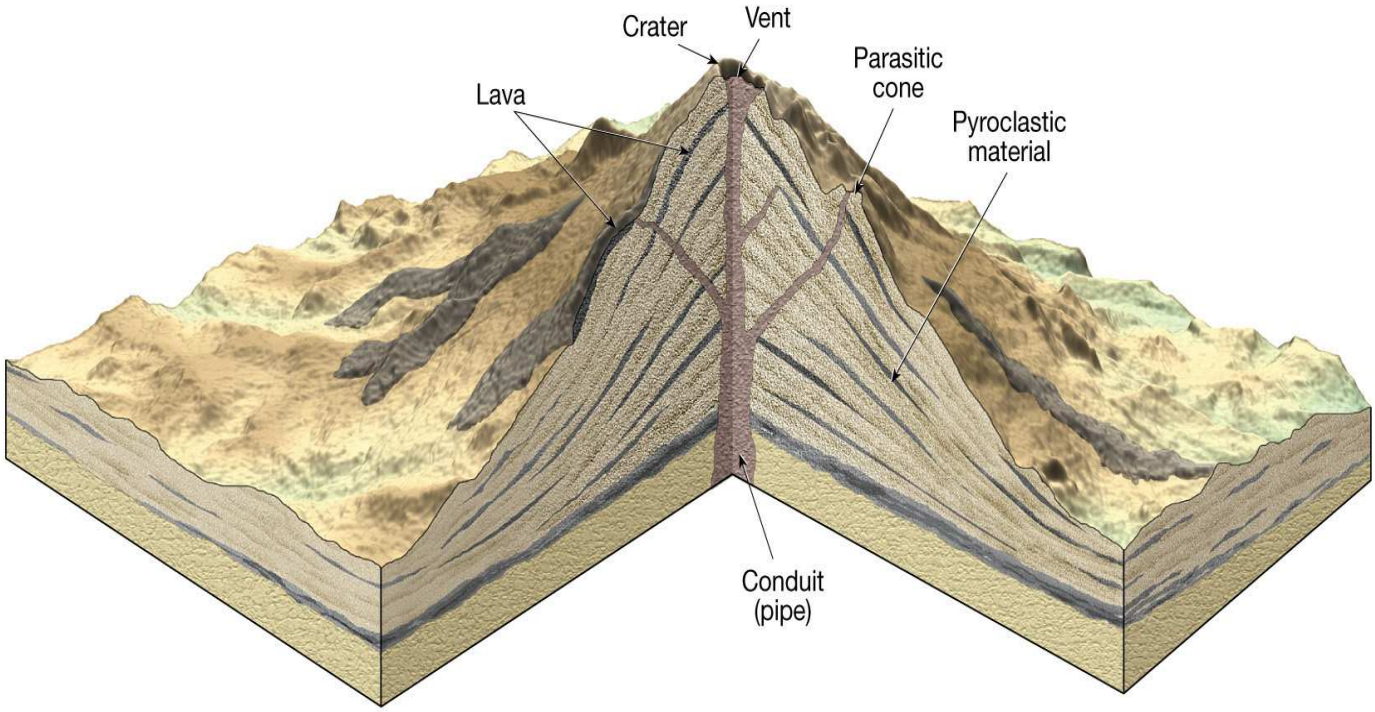
# EARTH SYSTEMS

## VOLCANOES

- A volcano forms when magma or molten rock reaches the surface of the earth as lava
- Some volcanoes also emit gas, ash and pyroclastic material
- A typical volcano has a cone shape and an open top called a crater
- The magma is fed to the volcano by a magma chamber beneath the volcano
- Volcanoes are usually found at plate boundaries
- Volcanoes are classified as Active, Dormant (sleeping), or Extinct (dead)




Study the photograph of Mt Saint Helens found in the Cascades mountain range of north west USA. Briefly describe the likely events of this eruption:

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# EARTH SYSTEMS

## TYPES OF VOLCANOES

- Gas, ash, lava or pyroclastic debris can be emitted from a volcano depending on the type of eruption
- The type and shape of the volcanic cone depends on the type of material emitted
- Hot, basic lava is fluid producing a gently sloping volcanic shield, such as Mauna Loa on Hawaii
- Cooler, acidic lava is more viscous producing explosive volcanoes with steep sides
- Diverging, constructive plate boundaries give basic lava shield and quiet eruptions
- Converging, destructive plate boundaries give acid lava cones and explosive eruptions

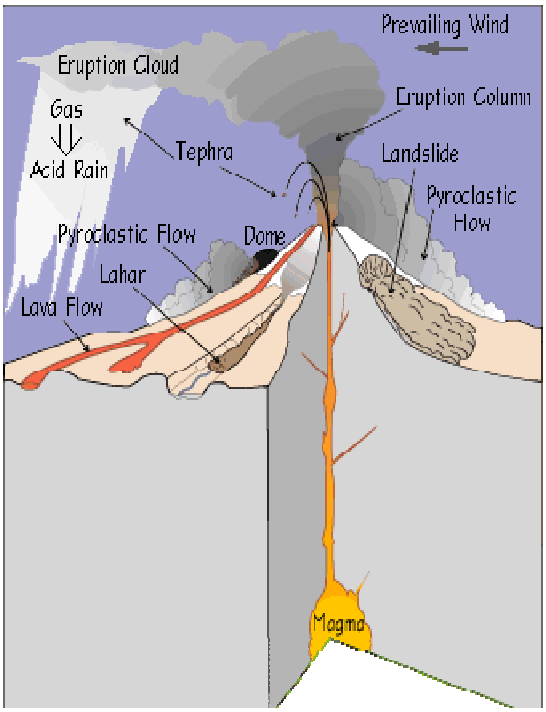
### Types of Volcanoes

Increasing Violence / Increasing Viscosity

| Volcano Type | Characteristics | Examples | Simplified Diagram |
|---|---|---|---|
| Flood or Plateau Basalt | Very liquid lava; flows very widespread; emitted from fractures | Columbia River Plateau | 1 mile: |
| Shield Volcano | Liquid lava emitted from a central vent; large; sometimes has a collapse caldera | Larch Mountain, Mount Sylvania, Highland Butte, Hawaiian volcanoes | |
| Cinder Cone | Explosive liquid lava; small; emitted from a central vent; if continued long enough, may build up a shield volcano | Mount Tabor, Mount Zion, Chamberlain Hill, Pilot Butte, Lava Butte, Craters of the Moon | |
| Composite or Stratovolcano | More viscous lavas, much explosive (pyroclastic) debris; large, emitted from a central vent | Mount Baker, Mount Rainier, Mount St. Helens, Mount Hood, Mount Shasta | |
| Volcanic Dome | Very viscous lava; relatively small; can be explosive; commonly occurs adjacent to craters of composite volcanoes | Novarupta, Mount St. Helens Lava Dome, Mount Lassen, Shastina, Mono Craters | |
| Caldera | Very large composite volcano collapsed after an explosive period; frequently associated with plug domes | Crater Lake, Newberry, Kilauea, Long Valley, Medicine Lake, Yellowstone | |

USGS

*Topinka, USGS/CVO, 1997, Modified from: Allen, 1975, Volcanoes of the Portland Area, Oregon, Ore-Bin, v.37, no.9*




Label the two photos to the left with the correct terms:

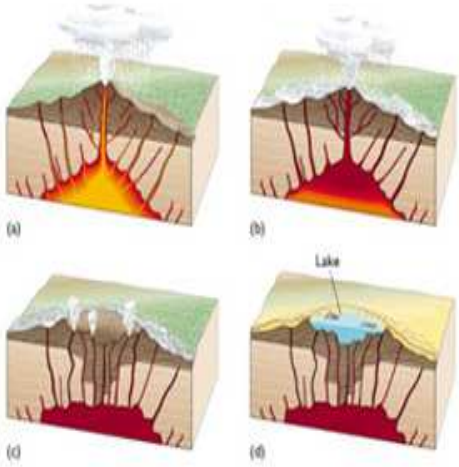
ACID LAVA
BASIC LAVA
FLUID LAVA
VISCOUS LAVA
QUIET ERUPTION
VIOLENT ERUPTION
COMPOSITE VOLCANO
SHIELD VOLCANO
DESTRUCTIVE PLATE MARGIN
CONSTRUCTIVE MARGIN
LAVA FLOWS
PYROCLASTIC FLOWS

# EARTH SYSTEMS

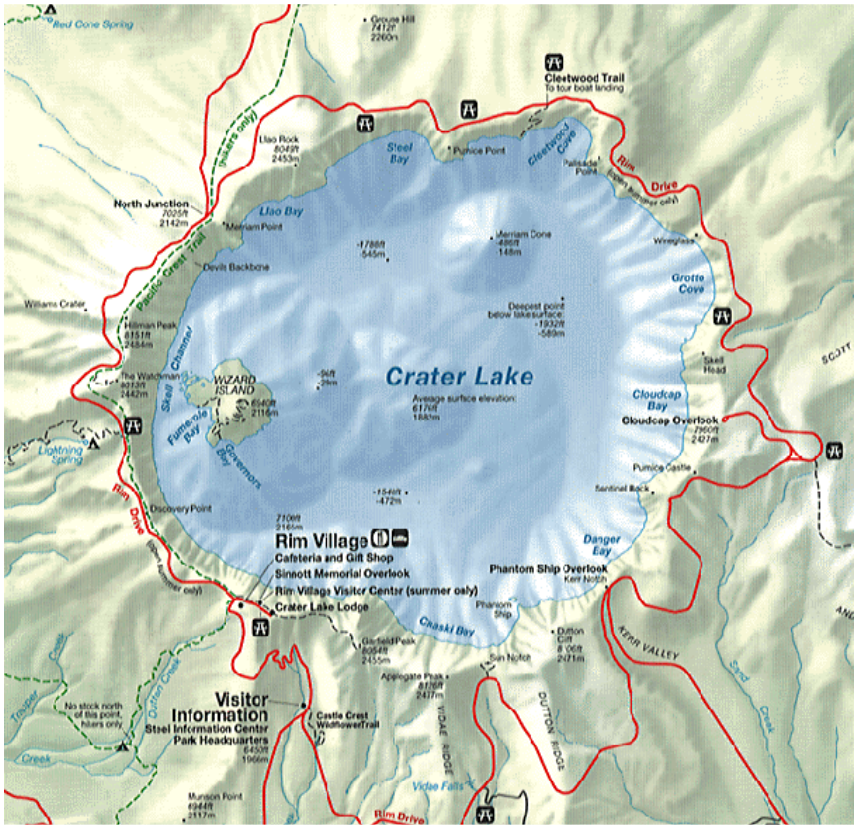
## CALDERA

- A caldera is a large volcanic crater produced by an extremely violent eruption
- Calderas occur at Converging, Destructive plate boundaries where eruptions are explosive
- The explosive eruption will cause Pyroclastic flows and blow the top off the volcanic cone
- This is followed by the magma chamber beneath the cone emptying causing it to collapse
- Crater Lake found in the Rocky Mountain range of North America is a very good example
- Wizard island is a small parasitic cone in the lake showing activity may still be taking place

Crater lake in Oregon USA, With Wizard island a small, later parasitic cone




Stages in the formation of a Caldera




Use the information on this page to write an explanation of the formation of a Caldera:

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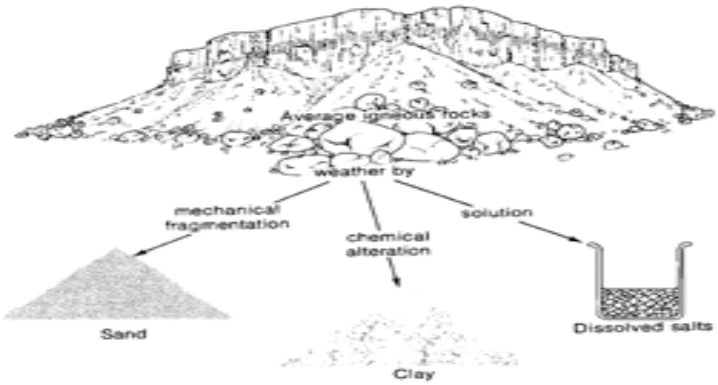
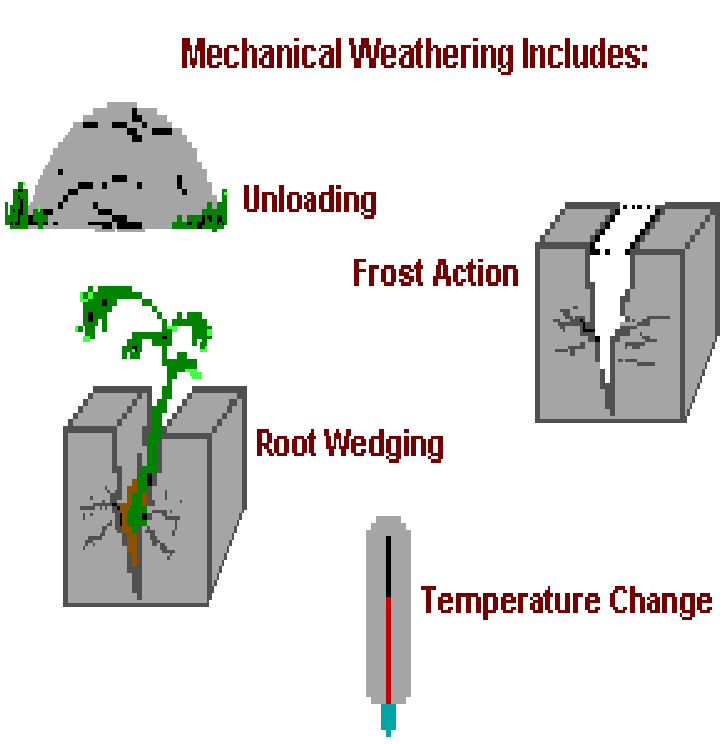
# EARTH SYSTEMS

## WEATHERING

- Weathering is the break-up of rocks by the elements of the weather to form debris called regolith
- In occurs ‘in situ’; any transport by rivers or ice is a process called erosion
- There are 3 types of weathering: Physical / Mechanical, Chemical and Biological
- Physical weathering breaks up rocks exposed on the surface by changes in temperature
- Chemical weathering is the disintegration of rocks at any depth by water and chemical processes
- Biological weathering is caused by plant roots and biological or humic acids produced by plants








Use the information on this page to explain what weathering is:

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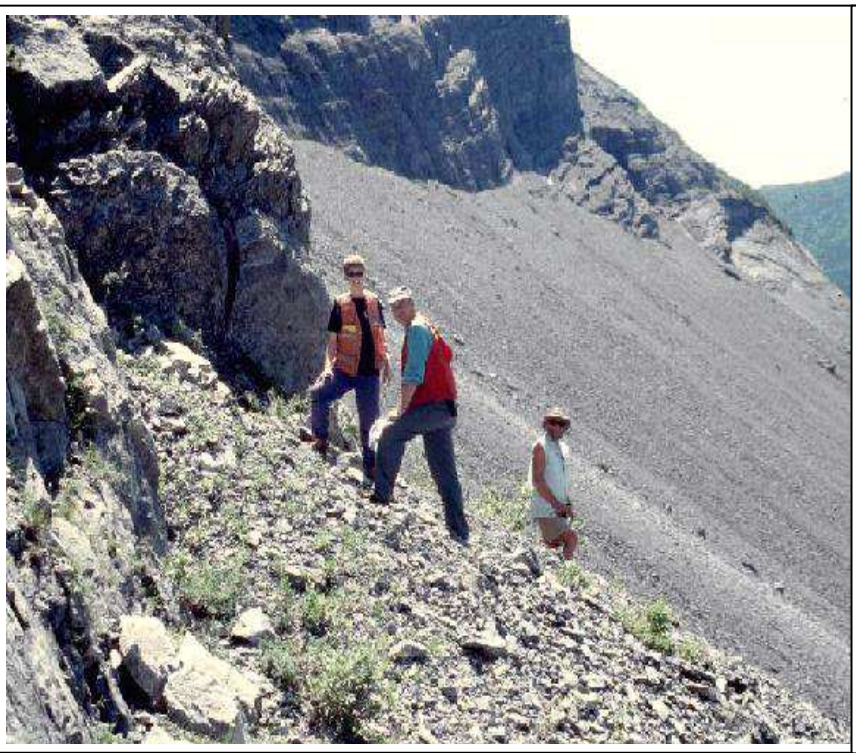
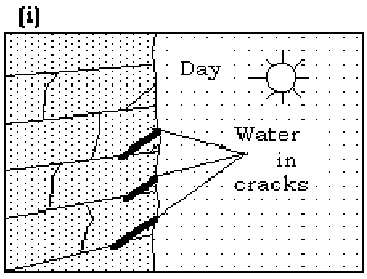
# EARTH SYSTEMS

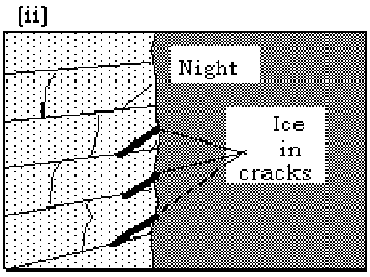
## FROST SHATTERING

- Frost shattering is a form of physical or mechanical weathering affecting exposed rock surfaces
- It needs temperatures to vary around 0 degrees C, these are called freeze-thaw cycles
- When water freezes in cracks and joints it expands by 9% which can shatter rocks
- Frost shattering is most important in upland areas like the Alps and Tundra / Arctic areas
- The debris produced by frost shattering has sharp, angular edges called scree
- Scree slopes build up beneath weathered cliff due to rock fall from weathered cliffs

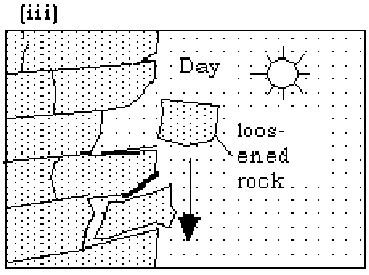




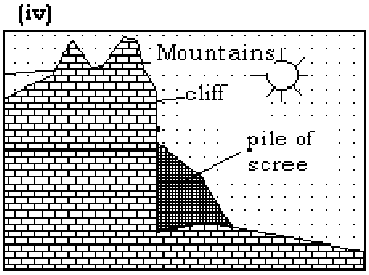

Meltwater runs into cracks in the solid cliff




Meltwater freezes, expands and forces cracks to widen




Ice melts again. Loosened blocks fall as scree. Water fills the new crack




Pile of scree forms below the cliff

Use the information on this page to write a description and explanation of frost shattering and the features it produces:

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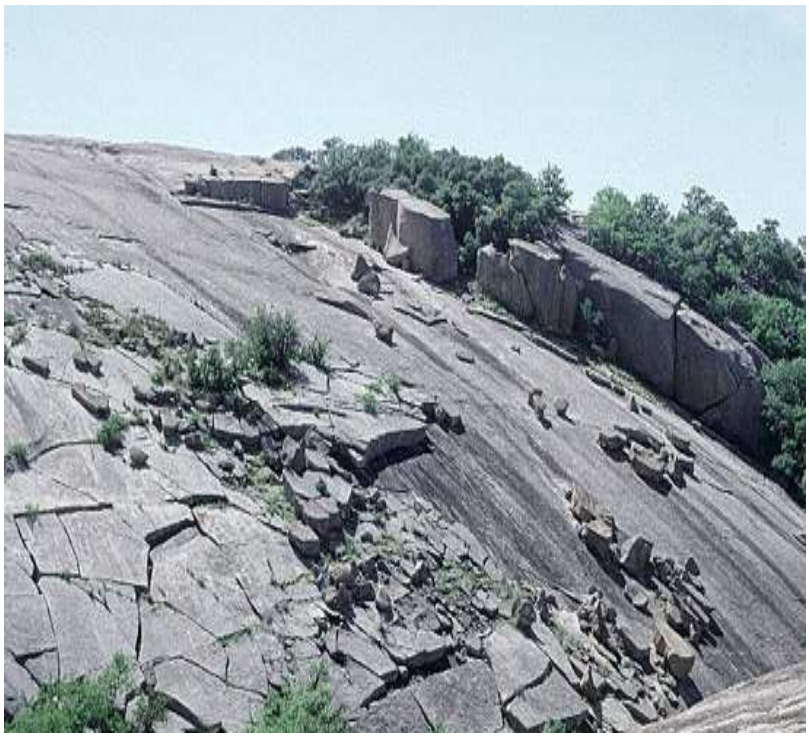
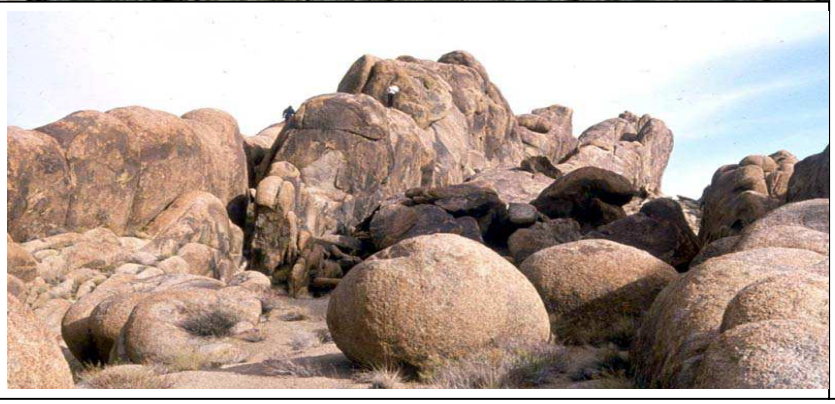
# EARTH SYSTEMS

## EXFOLIATION

- Exfoliation is a form of physical or mechanical weathering, affecting exposed rock surfaces
- It needs large temperature variations to cause rocks to heat up and cool down
- This temperature change occurs between day and night, this a called a diurnal temperature change
- Exfoliation is most likely to occur in arid and semi-arid areas which have large diurnal changes
- Expansion of rocks as they heat up and contraction as they cool down causes them to crack and break
- Pressure release exfoliation gives smooth exfoliation domes and sharp, angular debris





Use the information on this page to write a description and explanation of exfoliation and the features it produces:

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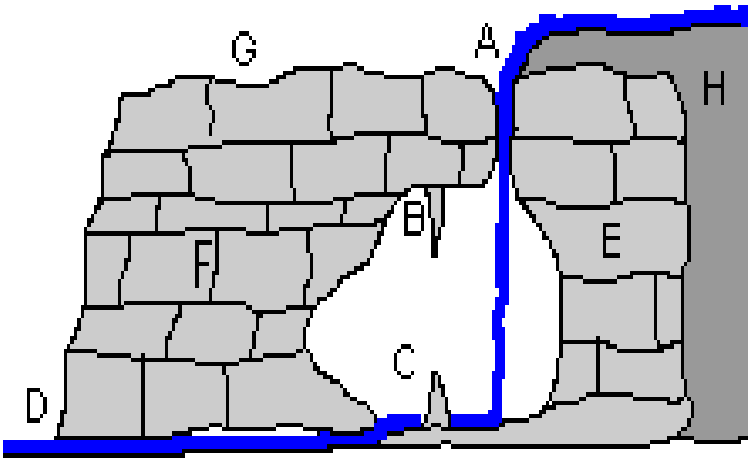
# EARTH SYSTEMS

## LIMESTONE : UNDERGROUND

- Little surface water is found on Limestone, since it is a permeable rock and water passes through joints
- Limestone is dissolved by a carbonic acid of water and carbon dioxide
- Underground caves and caverns are formed by solution and erosion by underground streams
- Stalactites form on the roof of a cave as water evaporates before it drips away
- Stalagmites form on the floor of the cave and may join with stalactites to give a pillar
- The limestone caverns of the Peak District in Derbyshire show all of these features

### Limestone (karst) Scenery




A - Swallow Hole B - Stalactite C - Stalagmite
D - Resurgence E - Bedding Plane F - Joint
G - Limestone Pavement H - Impermeable Rock

Use the information on this page to write a description and explanation of underground limestone features:

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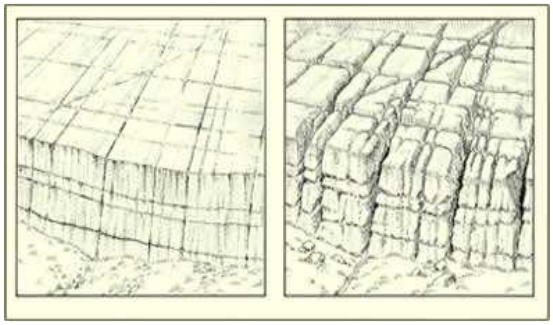
# EARTH SYSTEMS

## LIMESTONE : ABOVE GROUND

- Little surface water is found on Limestone, since it is a permeable rock and water passes through joints
- Swallow holes or sinks are found where streams disappear underground via major joints or faults
- Underground streams may reappear further downstream as springs or resurgent streams
- Limestone is weathered by Carbonation, it is dissolved by a carbonic acid of rainwater and CO2
- Upland limestone areas have level pavements called clints and weathered joints called grykes
- Malham Cove in the Yorkshire Dales has a dry valley, a limestone pavement and a resurgent stream



Label the sketches and photos with the following labels in the correct places:

PAVEMENT

CLINT

GRYKE

MALHAM COVE

RESURGENT STREAM

LIMESTONE CLIFF

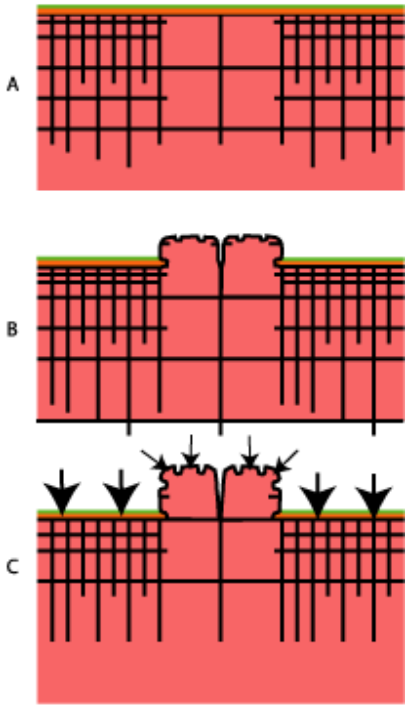
DRY SURFACE

JOINT

# EARTH SYSTEMS

## GRANITE : WEATHERING

- Granite is an igneous rock that undergoes both physical and chemical weathering
- Exposed upland areas like Dartmoor suffer from intense frost shattering, especially in winter
- Water entering the granite causes deep chemical weathering by Hydrolysis to form clay
- The degree of chemical weathering is determined by the amount of jointing in the rock
- Well jointed rock may be fully weathered, but widely spaced joints will leave unweathered corestones
- Erosion of weathered rock in granite areas leaves rocky outcrops called Tors on exposed summits





Use the information on this page to describe and explain the formation of granite tors:

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