

# An Introduction to Geology

## 地質學入門



VW 12.2012

# Content

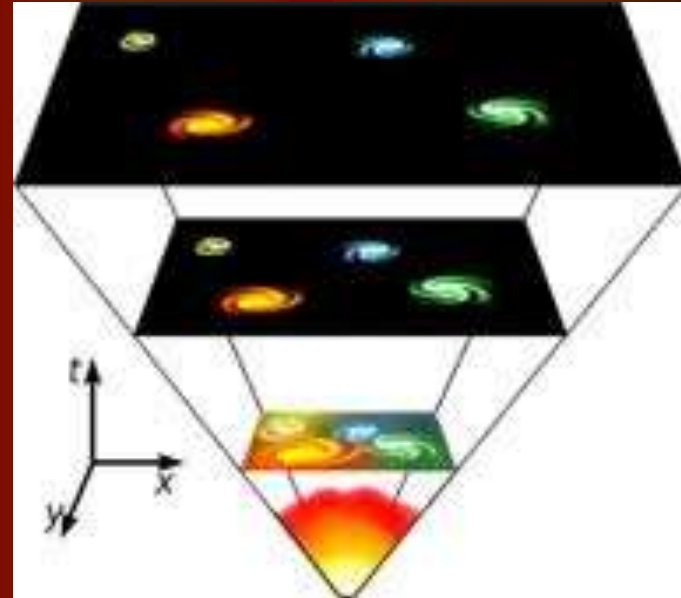
- Formation of the Earth 地球的構造
- Geological Time Table 地質年代表
- Continental Drift & Plate Tectonic 大陸飄移說  
与版塊運動
- Rock Formation, identification & related  
landform 岩石与地貌
- The Geology of Hong Kong 香港地質簡介

# Formation of the Earth

## 地球的構造

# The Big Bang 13.82 Bya 宇宙大爆炸

Creation of the COSMOS



Meteorite – remnants of the Big Bang

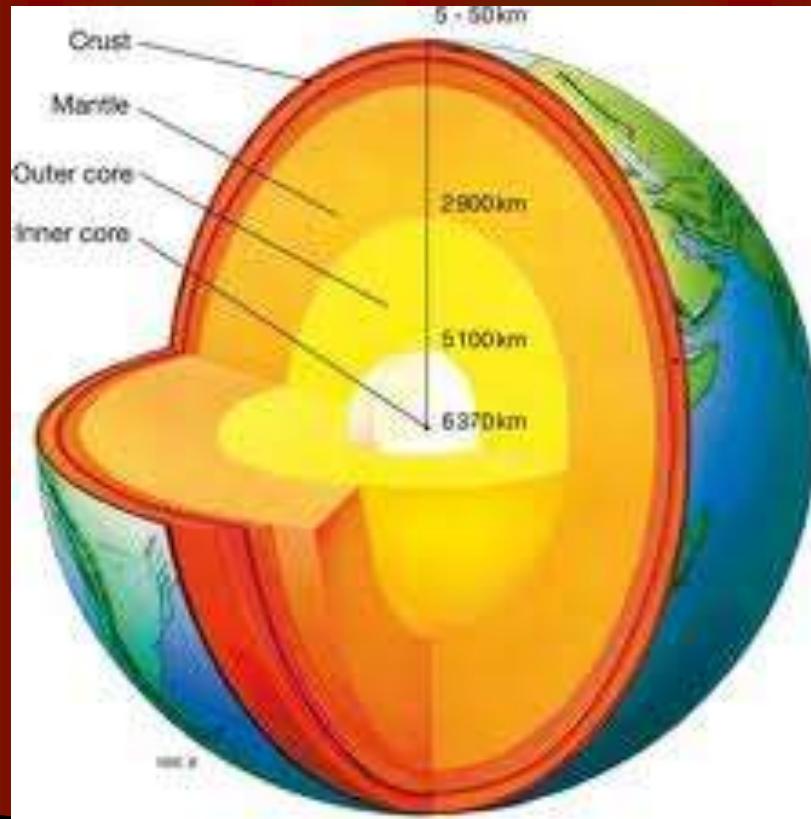


# Fireball Earth 4.567 Bya



# Formation of the Earth

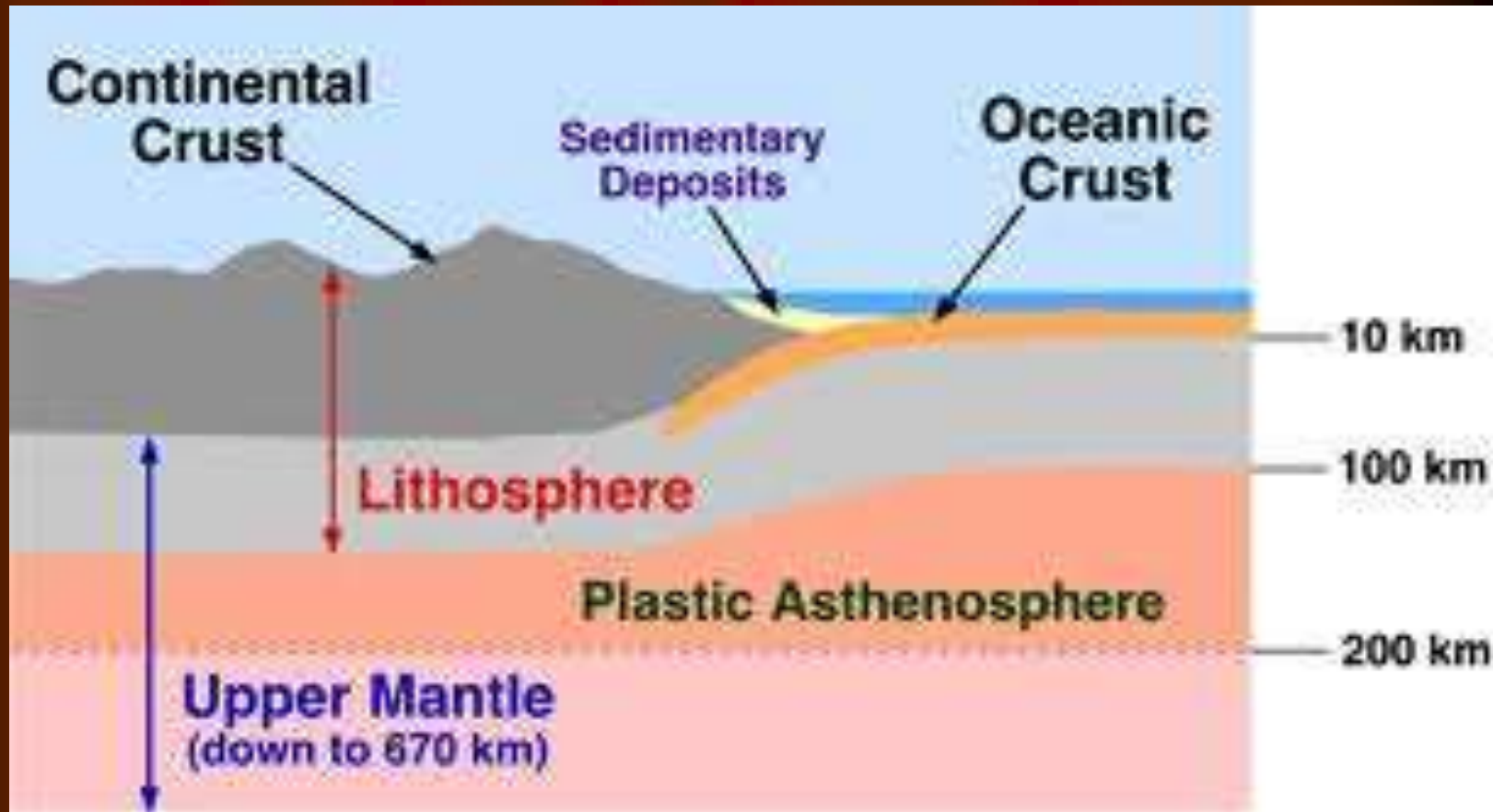
Weight differentiation kicked in forming  
Iron nickel Core 鐵鎳地核 ( Inner solid, outer liquid )  
Fe, Mg, Al, Si Mantle 鐵鎂鋁矽地幔 ( plastic )  
Sima & Sial Crust 矽鎂/矽鋁地殼



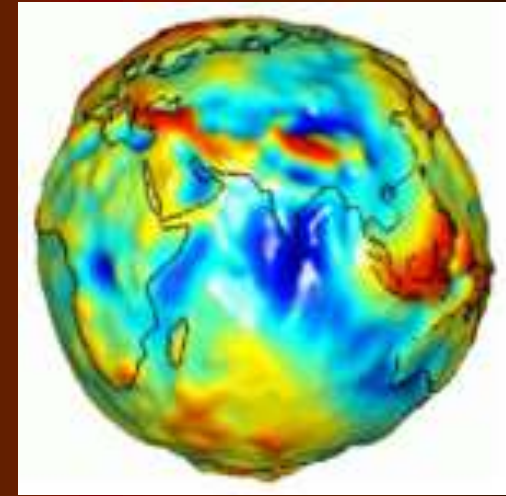
# Formation of the Earth

Continental Crust 大陸地殼 – SIAL

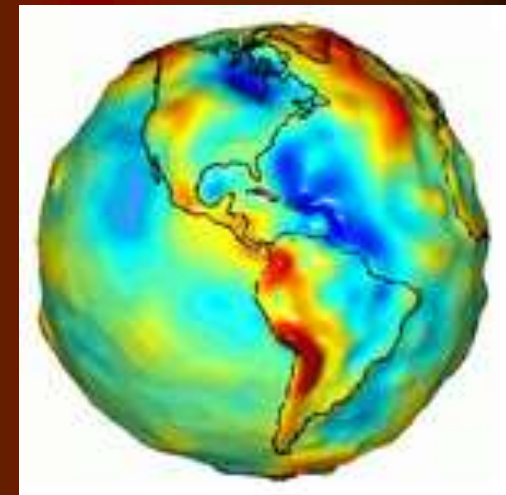
Ocean Crust 海洋地殼 - SIMA



# Heavy Iron Nickel Core creates Earth's Gravity Field 地心吸力 retaining our Atmosphere & Hydrosphere



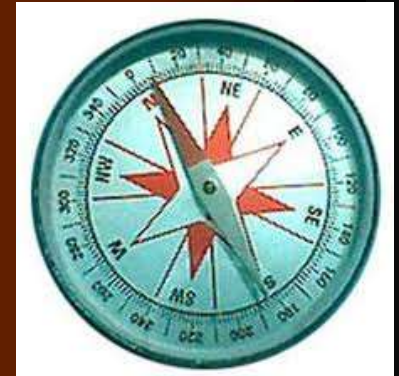
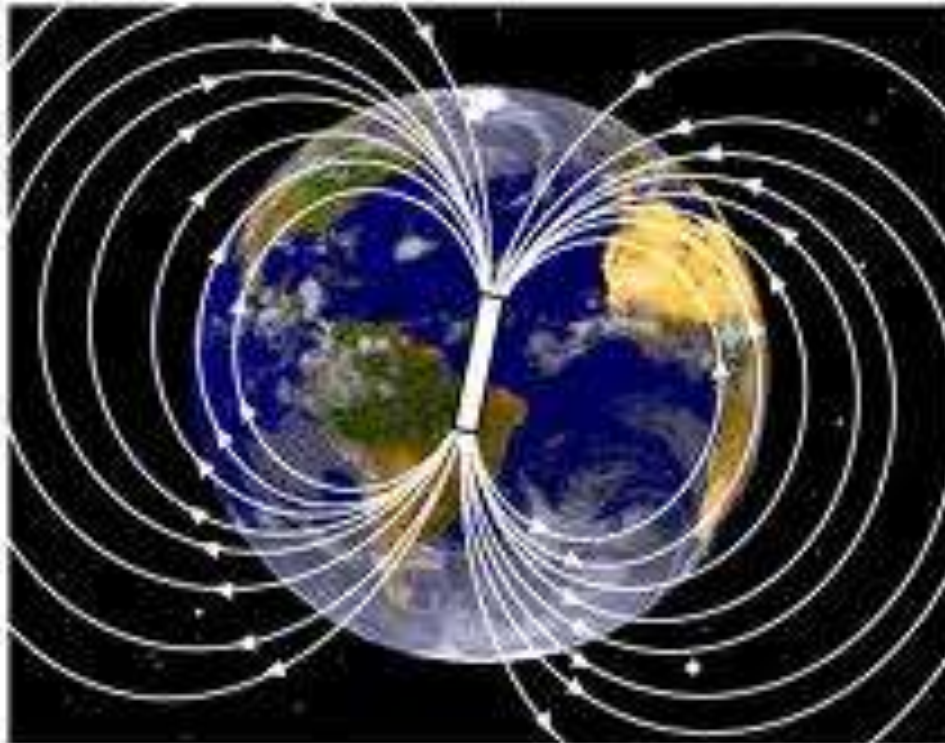
A poster for the Gravity Recovery and Climate Experiment (GRACE). The top half features a photograph of the two GRACE satellites in orbit over the Earth. Below the photo, the word "GRACE" is written in large, stylized letters, with "Gravity Recovery And Climate Experiment" written underneath. To the right of the main image is a vertical column of smaller graphics and text, including a small globe, a cross-section of the Earth's interior, and a map of the Americas.





# Earth's Magnetic field 磁場

A solid inner core & a liquid outer core plus earth's rotation act like a dynamo creating a magnetic field



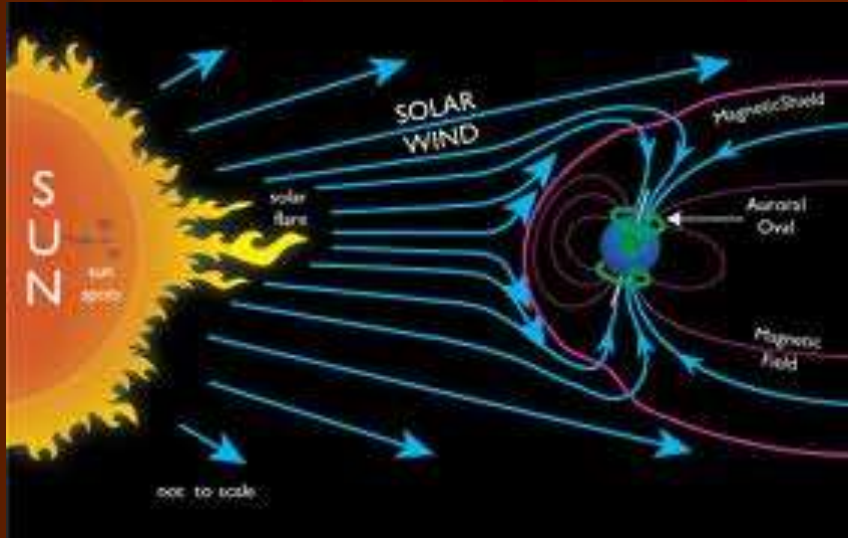
# Effect of Earth's Magnetic field 磁場

## Migration of birds, fish, butterflies & sea tortoise

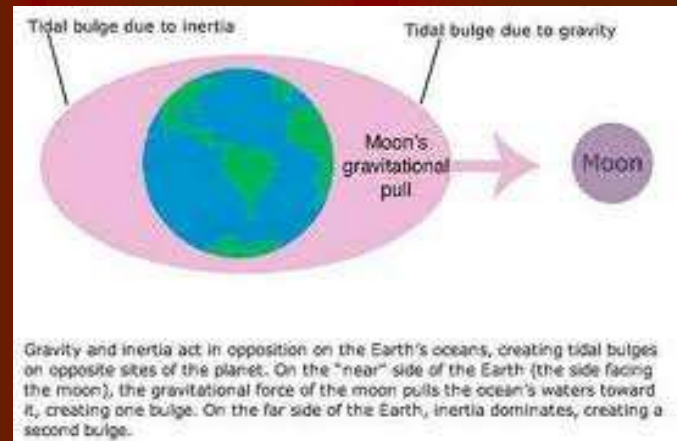
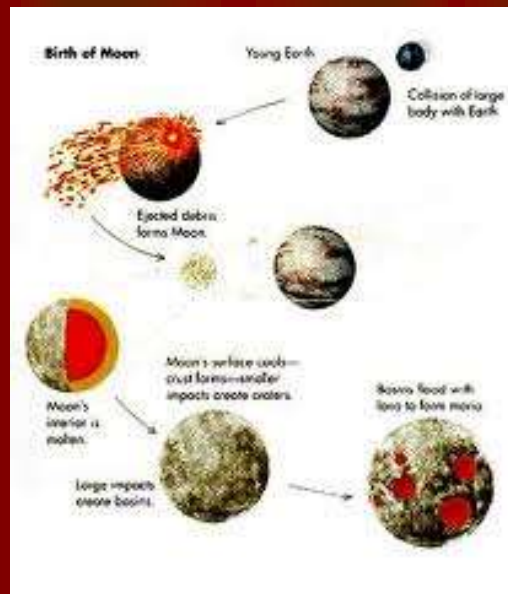
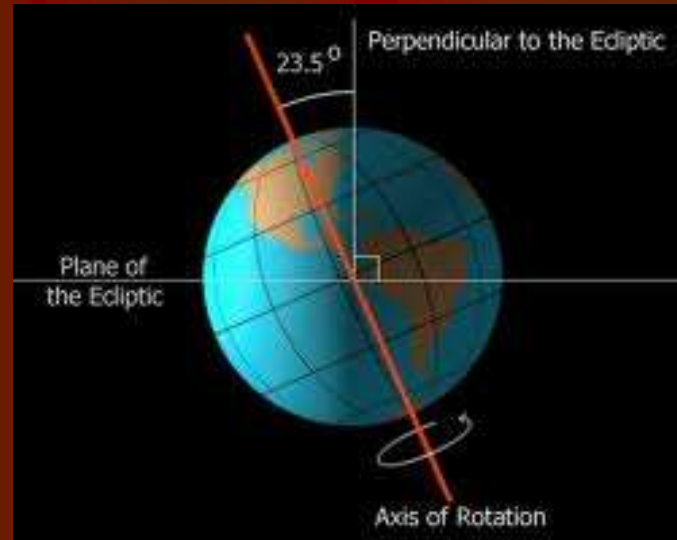


# Earth's Magnetic field 磁場

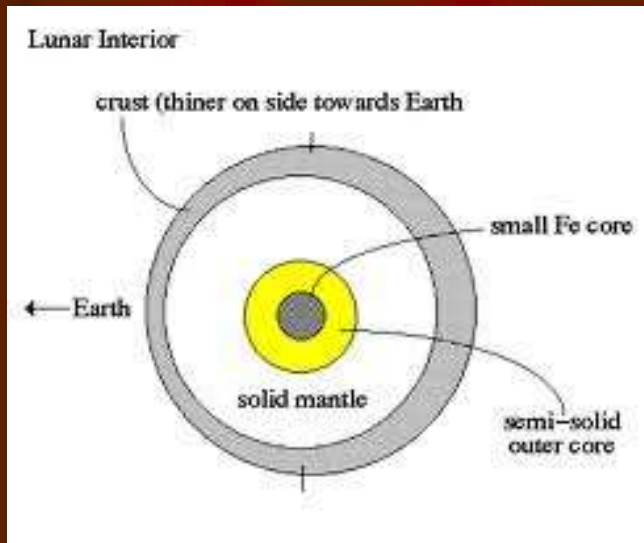
Acting as Earth's protective shield against solar wind Aurora borealis ( "Northern Light" ) & Aurora australis



Last major collision with an asteroid at 4.527 Bya led to a 23.5 degree inclination of the earth's axis resulting to 4 seasons, longer days & the formation of the moon



Gravity field strength of the moon is only 17% of that on Earth but enough to create very important tidal movement on Earth



# Importance of tide & lunar cycle

Feeding mangrove with nutrient; sea turtle egg laying; coral & giant clam reproduction & annual surge in Qiantang Jiang

錢塘觀潮

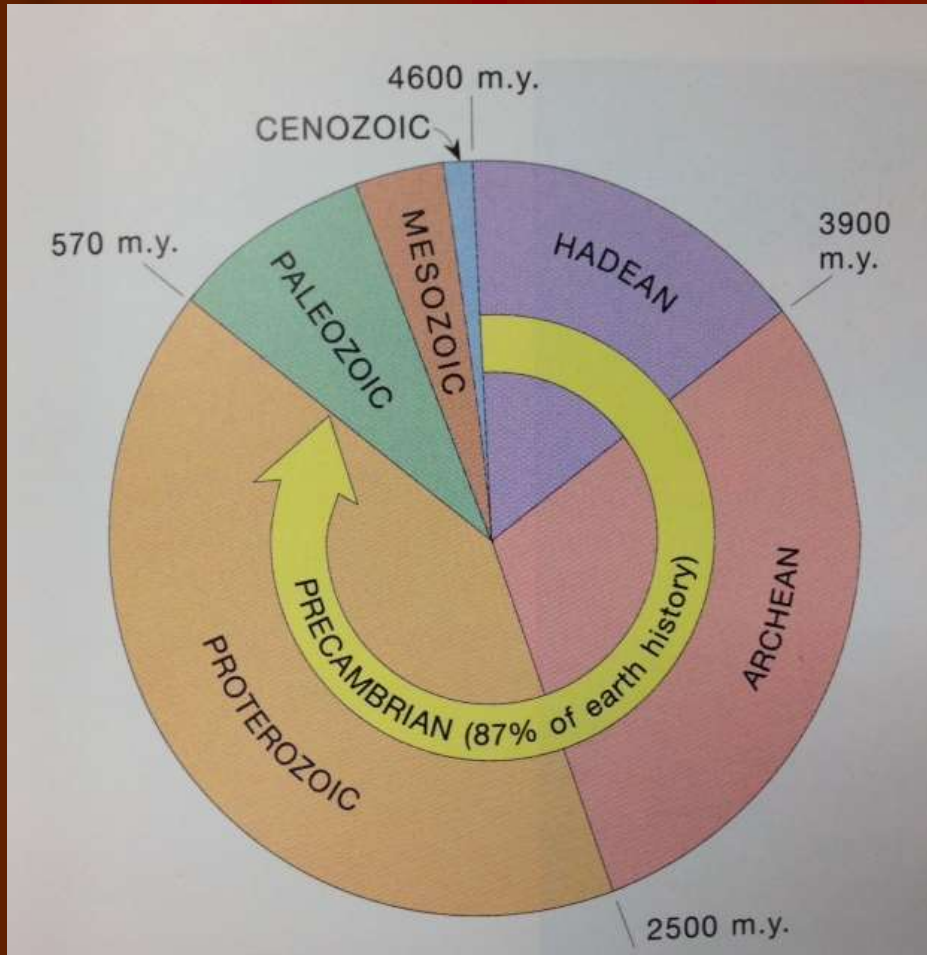


# The Geological Time Table

## 地質年代表

# Geological Time Table 地質年代表

Eon 宙, Era 代, Period 紀, Epoch 世, Age 期



宙 Eon	代 Era	紀 Period	百萬年 m.y.
顯生宙 Phanerozoic 複雜的多細胞生物大量出現的時代 An era when numerous complicated multicellular organisms appeared	新生代 Cenozoic 哺乳類時代 An era of mammals	第四紀 Quaternary 人類出現 Appearance of human beings	2.6
		第三紀 Tertiary 哺乳類繁盛 Boom of mammals	65
	中生代 Mesozoic 爬蟲類時代 An era of reptiles	白堊紀 Cretaceous 恐龍滅絕	145
		侏羅紀 Jurassic 恐龍繁盛 - 鳥類出現 Boom of dinosaurs and appearance of birds	201
		三疊紀 Triassic 爬蟲、恐龍、哺乳類出現 Appearance of reptiles, dinosaurs, mammals	251
	古生代 Paleozoic 魚類 - 兩棲類時代 An era of fish and amphibians	二疊紀 Permian 大滅絕 Extinction	299
		石炭紀 Carboniferous 兩棲類出現 Appearance of amphibians	359
		泥盆紀 Devonian 魚類出現 Appearance of fishes	419
		志留紀 Silurian	444
		奧陶紀 Ordovician	488
寒武紀 Cambrian	542		
元古宙 Proterozoic 單細胞生物演變為多細胞生物 Unicellular organisms developed into simple multicellular organisms			2500
太古宙 Archean 原始生命誕生 Birth of primitive lives			3850
冥古宙 Hadean 地球形成的初期階段 Early stages of the earth			4600



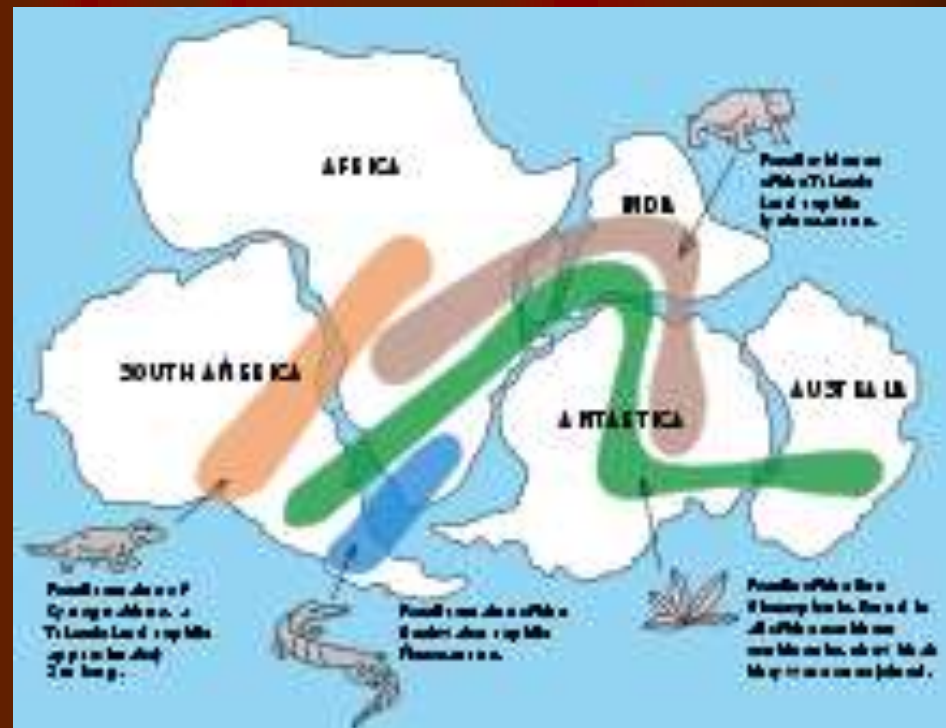
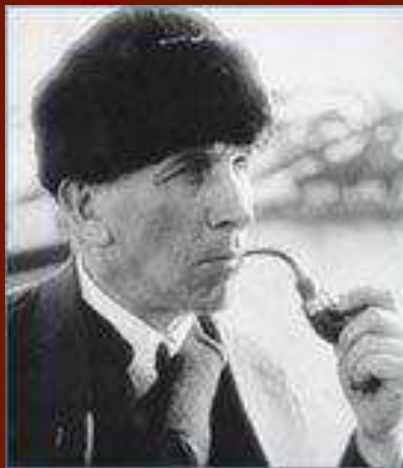
# The Earth is far from static : Continental Drift Theory & Plate Tectonic 大陸飄移說与板塊運動



# Continental Drift Theory by Alfred Wegener 1913

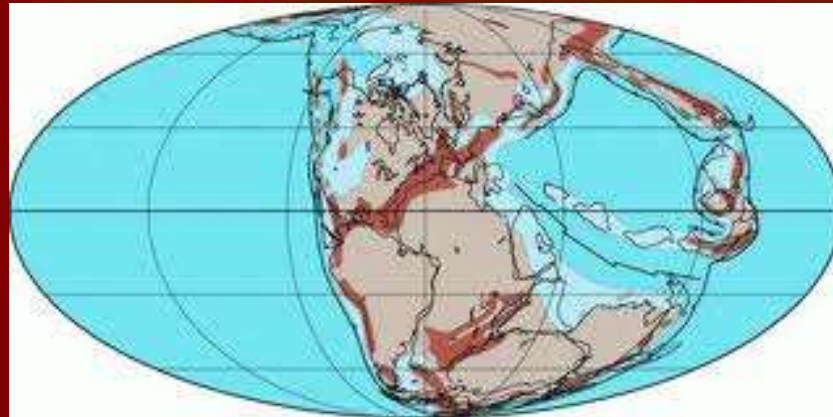
Basis 1 : matching outline of the continents

Basis 2 : similar distribution of animal & plant fossils in disconnected continents



# Continental Drift Theory by Alfred Wegener 1912

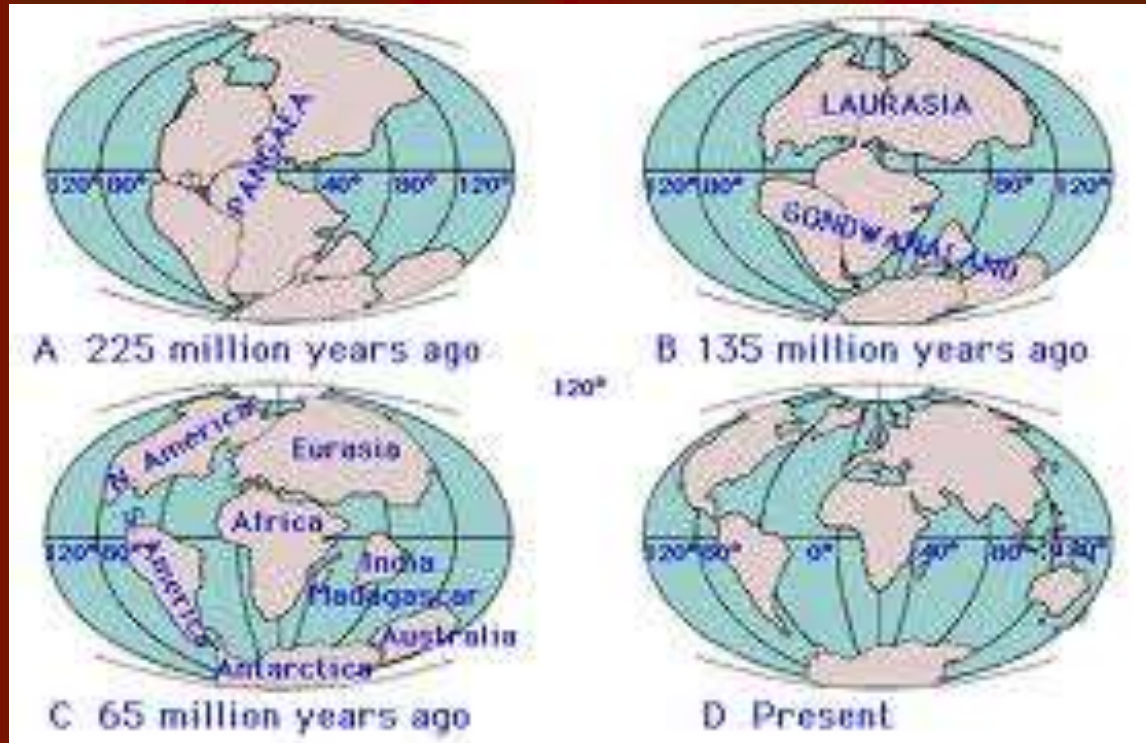
## Basis 3 : Similar geology



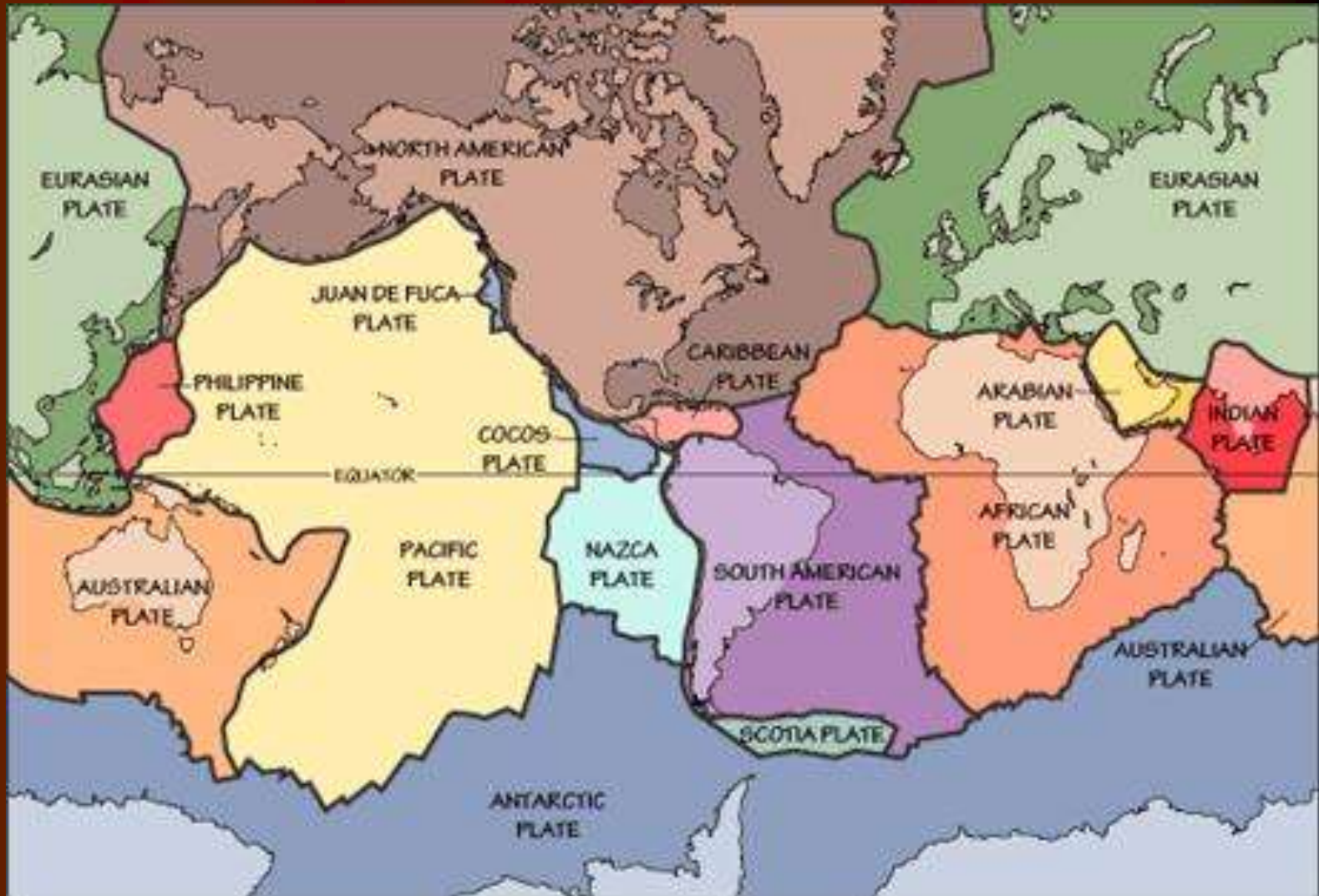
## Basis 4 : Evidence of glacial erosion



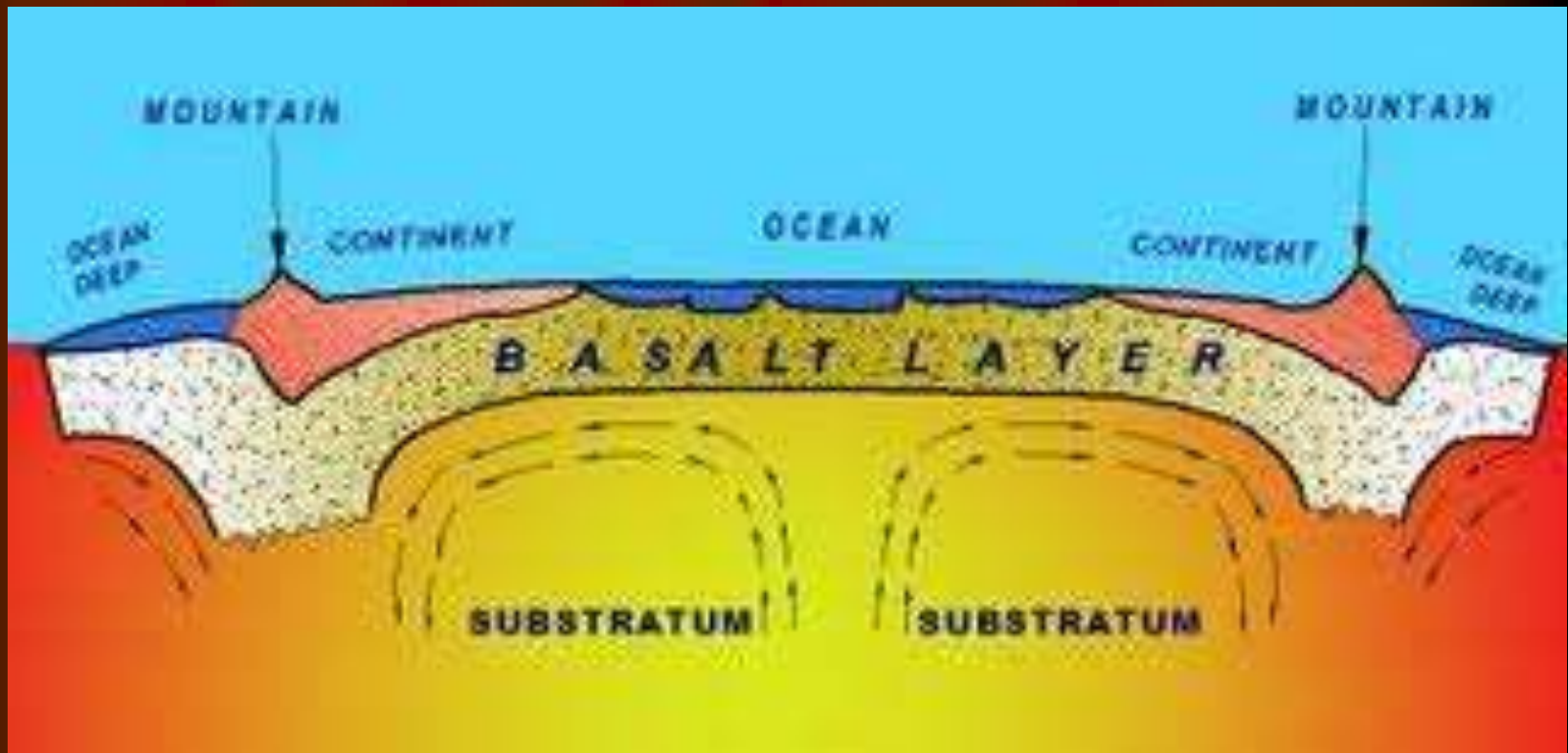
# Continental Drift did occur but actual crust structure is much more complex



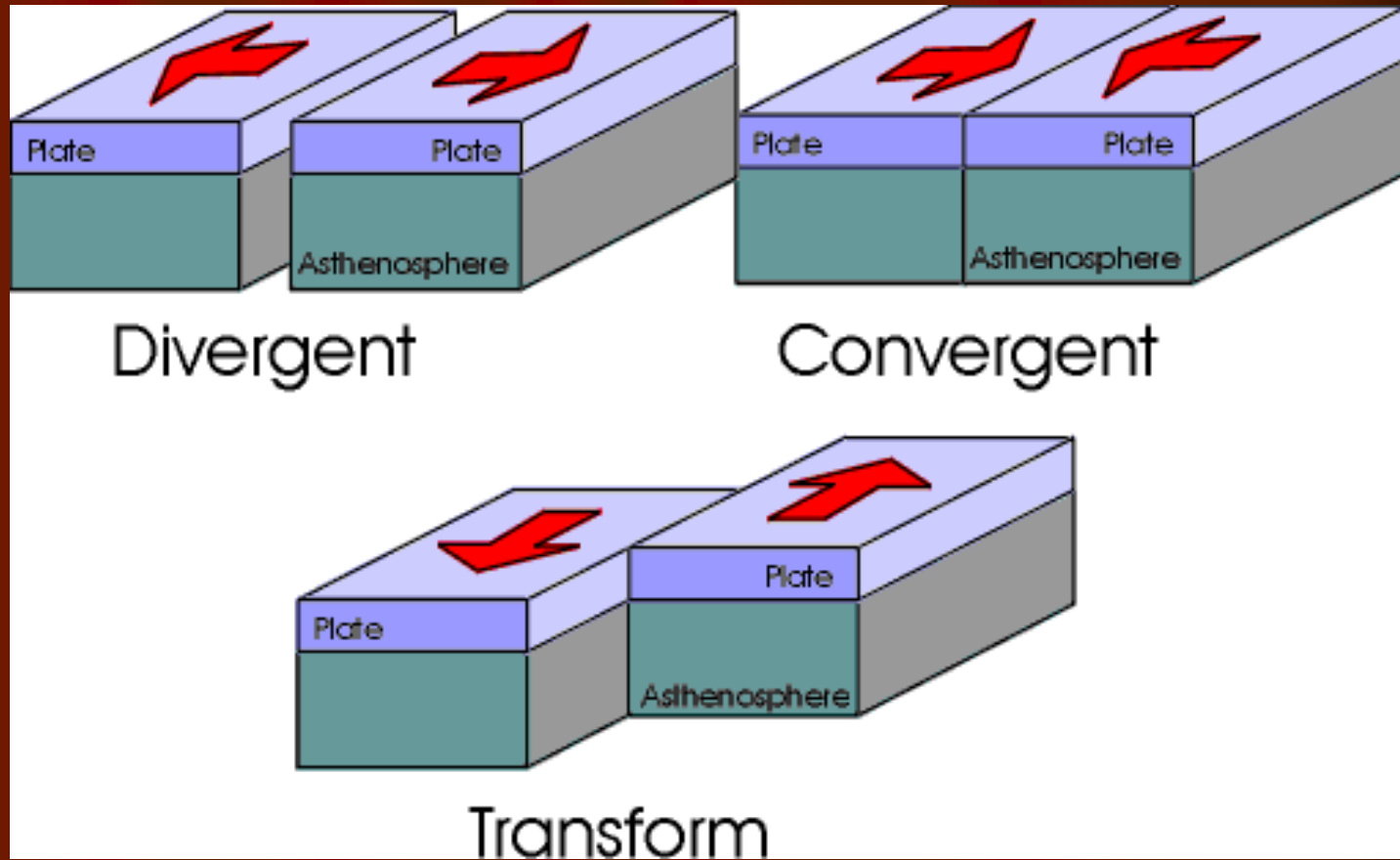
# Existing Plate Structure



# Forces behind Continental Drift & Plate Tectonic



# 3 main types of tectonic plate boundary (張裂, 聚合, 錯動)



# Direction of Plate movement



(a) © 2008 Addison Wesley Longman, Inc.



# Examples of tectonic boundary

## Divergent – Plate Creation

- Mid Atlantic Ridge
- East Africa Rift Valley

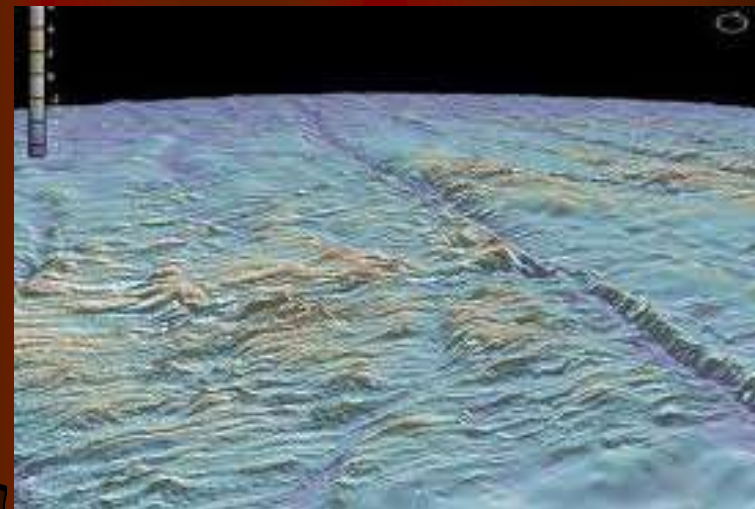
## Convergent – Plate destruction

- The Himalayas
- Szechuan Basin
- Japanese Island Arc
- Taiwan
- Cascade Mountain
- Andes Mountain

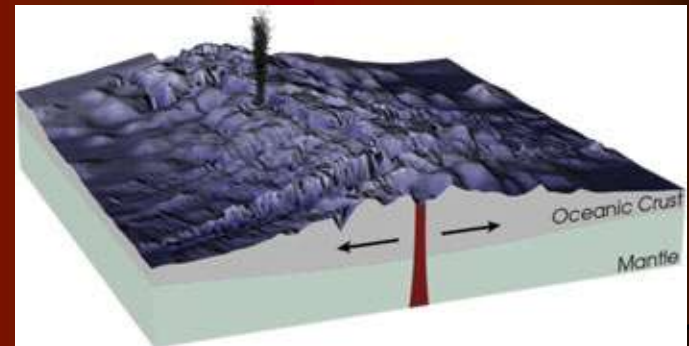
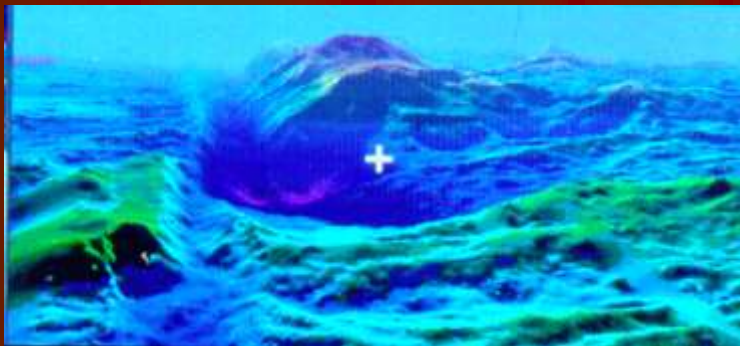
## Transform – Plate neutral

- St. Andreas Fault
- The Dead Sea Transform

# Divergent : The Mid Atlantic Ridge



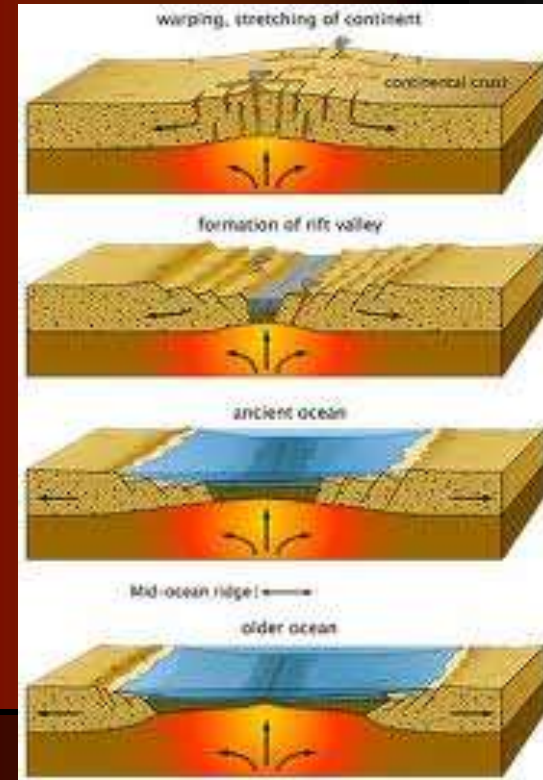
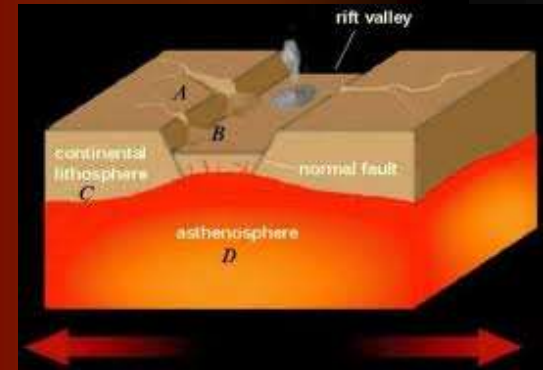
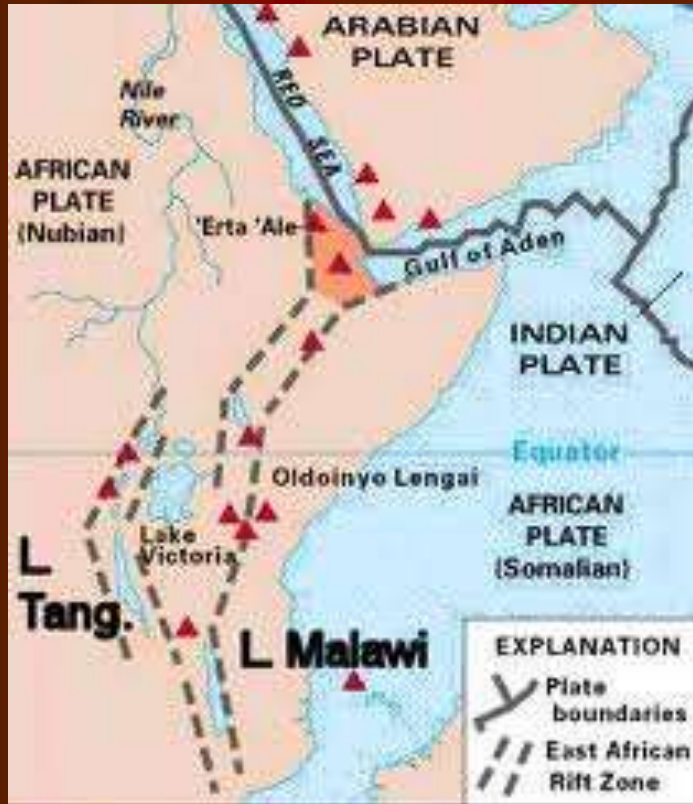
# Divergent :The Mid Atlantic Ridge & Hydrothermal Vents



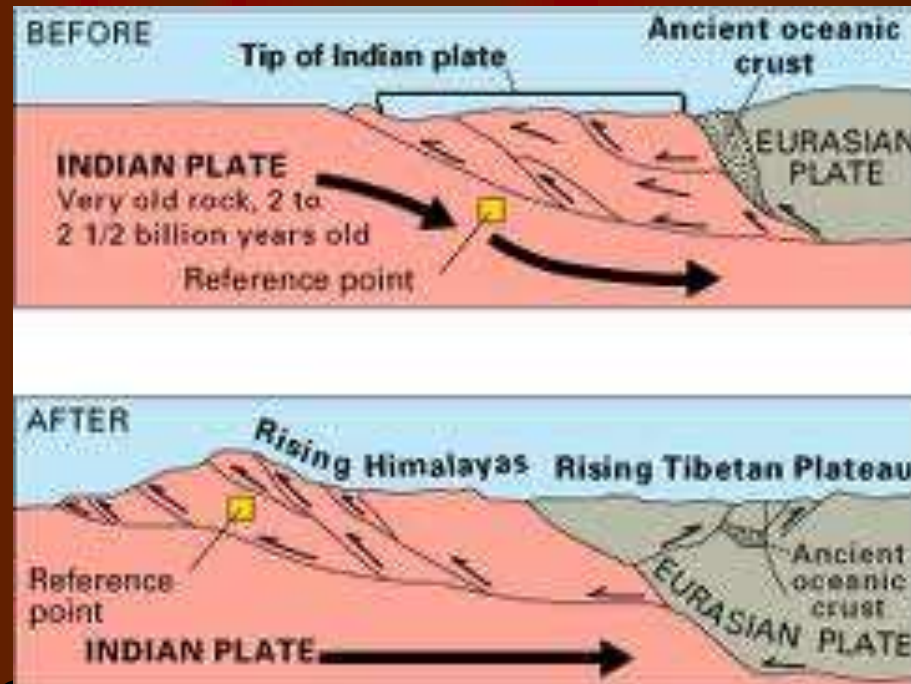
# Divergent :The Mid Atlantic Ridge over Iceland



# Divergent : The East Africa Rift Valley

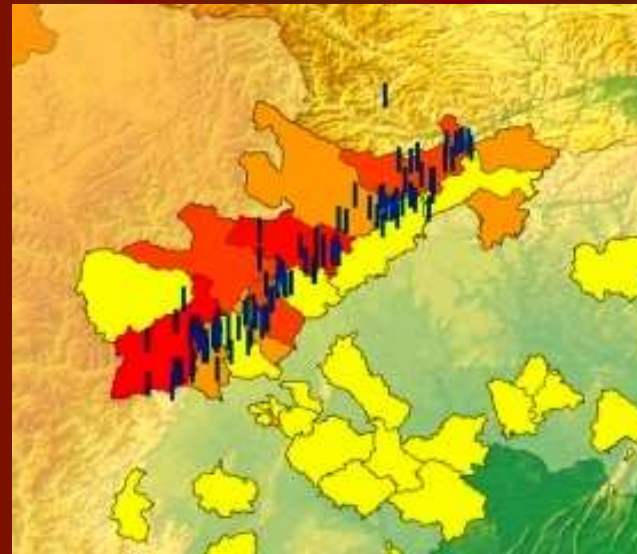


Convergent : the Himalaya was formed 40/50 mya when the Indian Plate collided with the Eurasia Plate & Subduction 俯冲 occurred

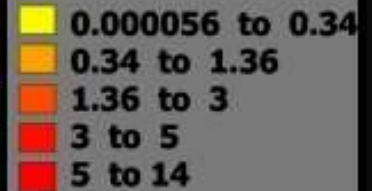


# Convergent -2003 Szechuan earthquake

( Collision between the India Plate & Eurasia Plate )

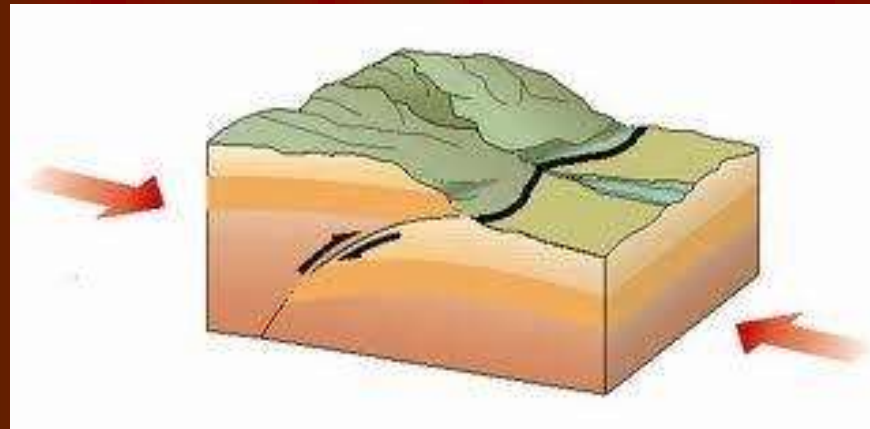


**Deaths as Percent of Population**



**Quake Epicenters**

| Earthquakes\_May12\_Jun03

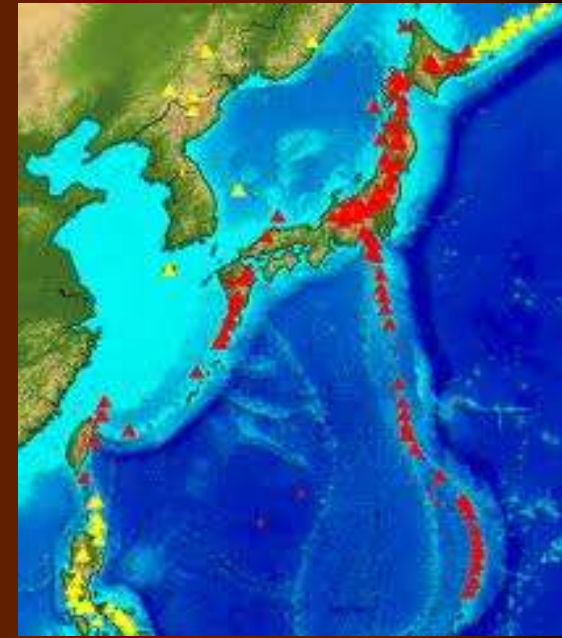
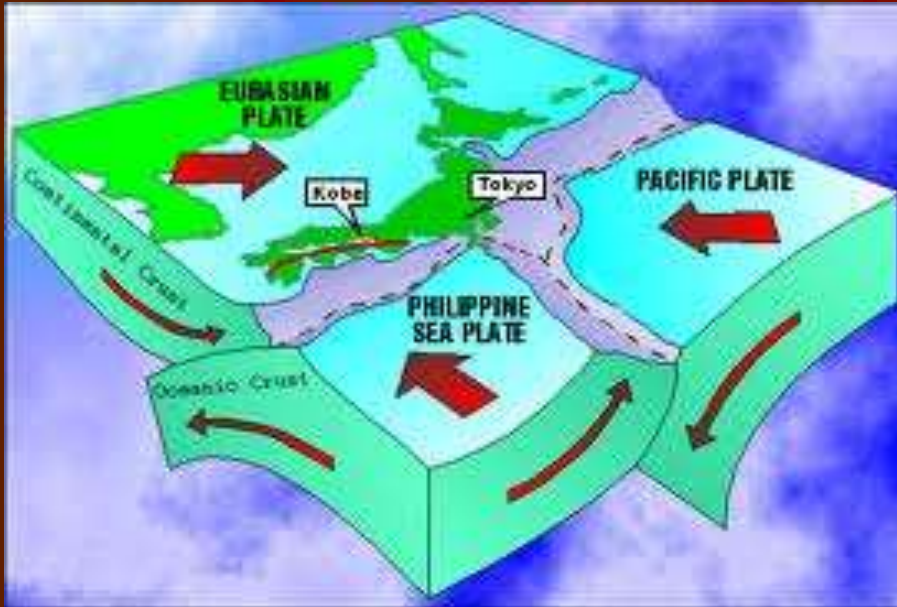


# Convergent -5.12.08 Wenchuan 汶川 earthquake ( R8.5 Yangtze Plate/Tsinghai Tibet Plate )

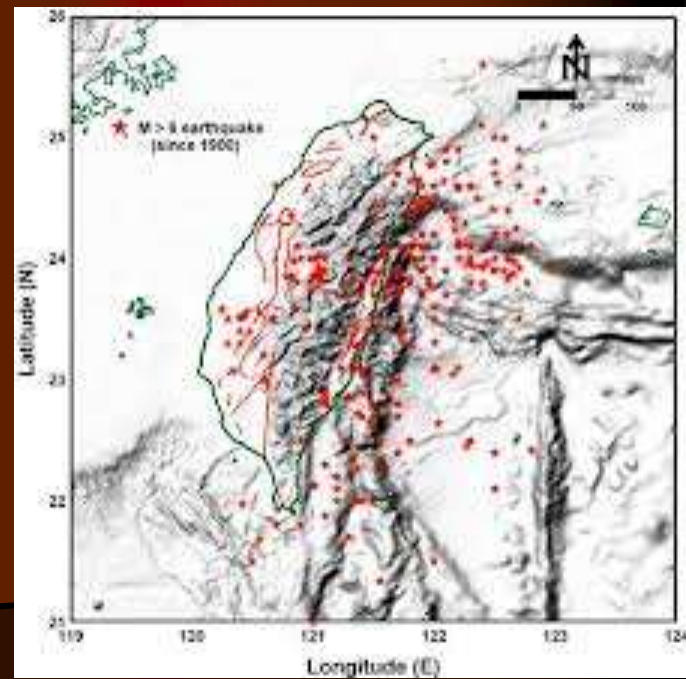
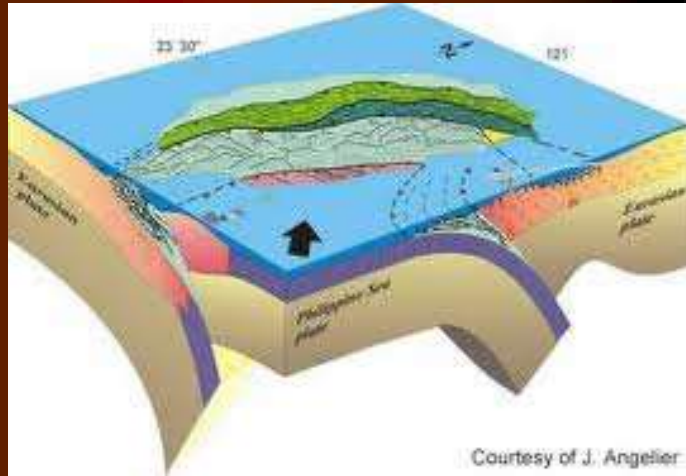
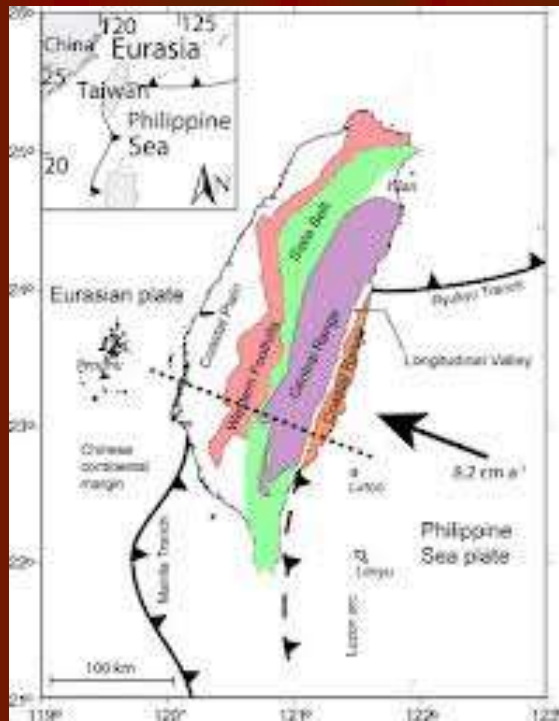




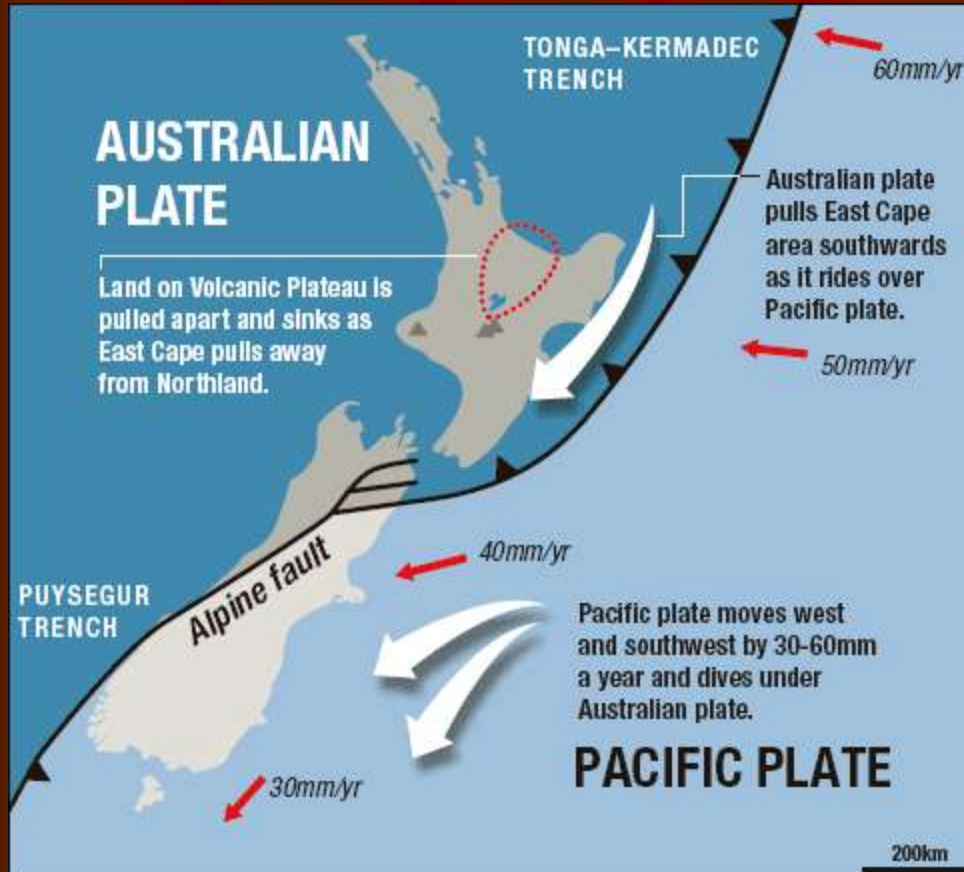
# Convergent : Japanese Island Arc



# Convergent : Taiwan (150 Mya to 12,000ya)

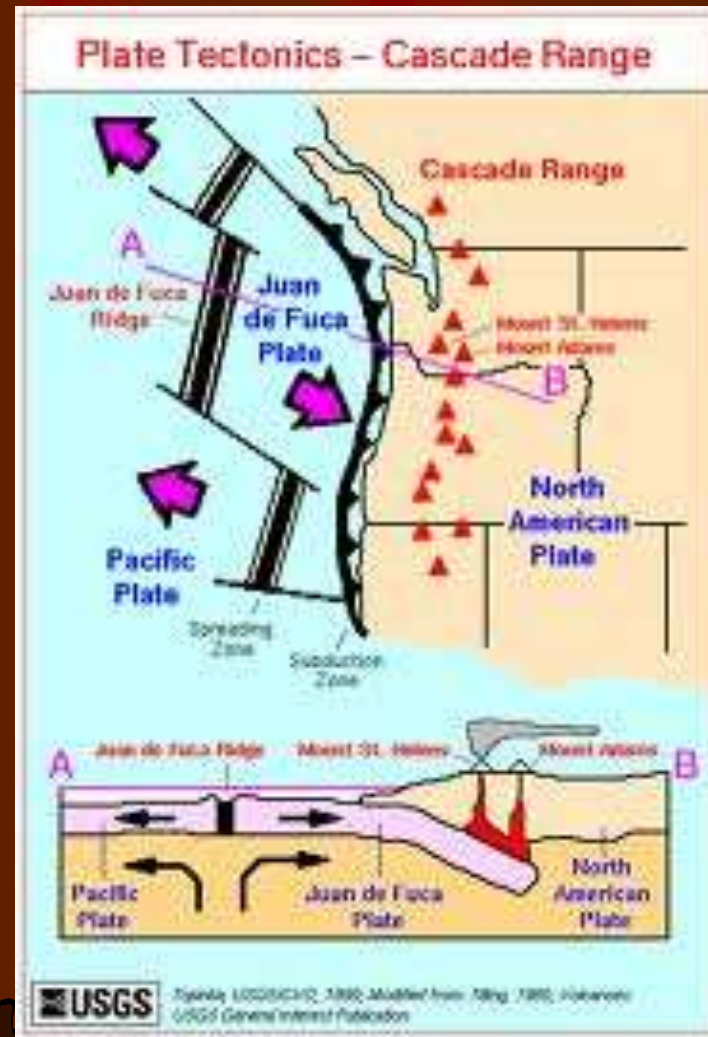


# Convergent : New Zealand

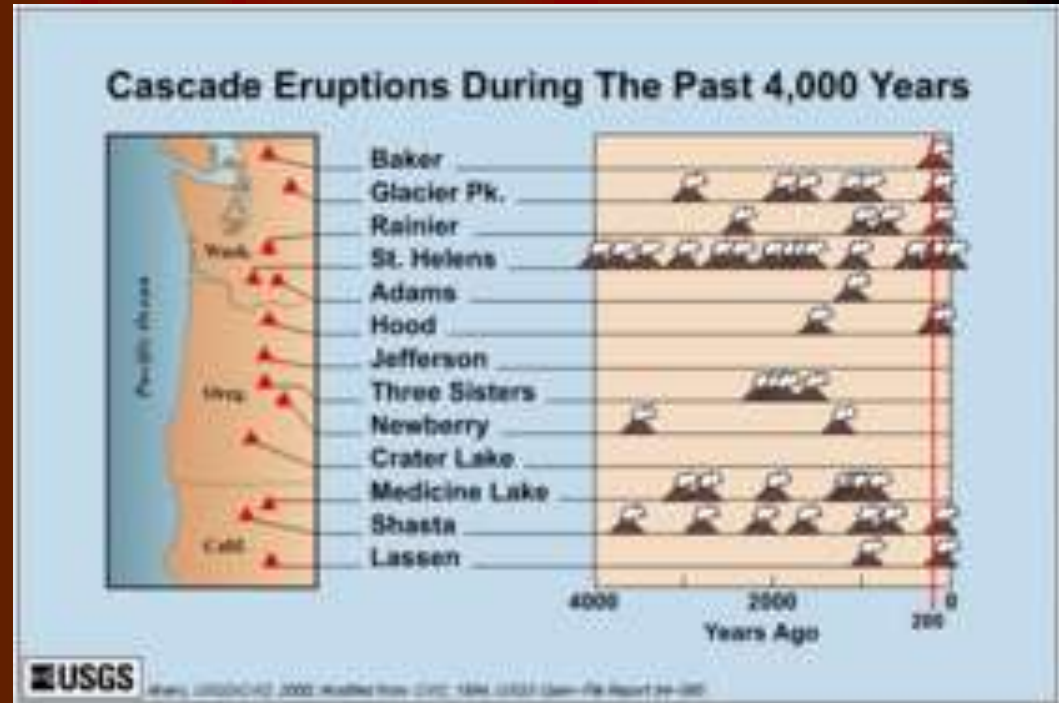


# Convergent : The Cascade Range

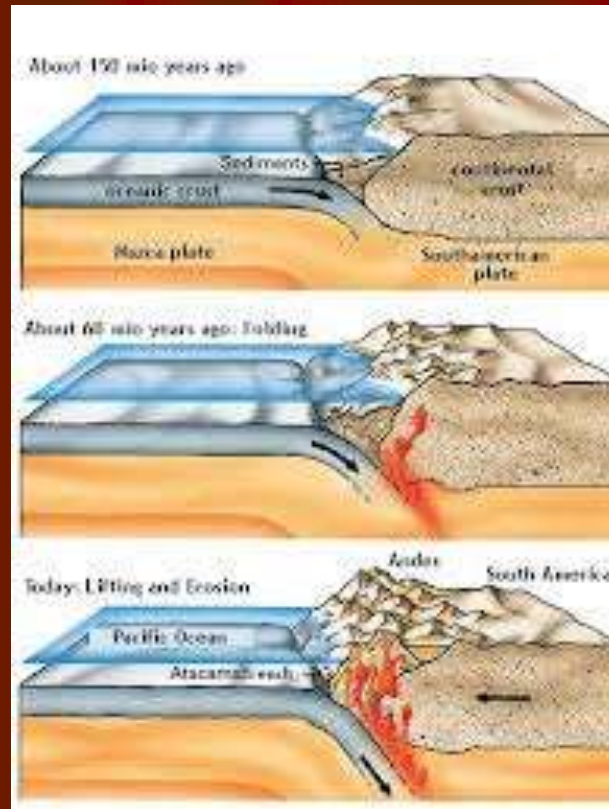
A chain of volcanoes formed by subduction of the Juan de Fuca plate under the North America Plate



# Convergent : The Cascade Range

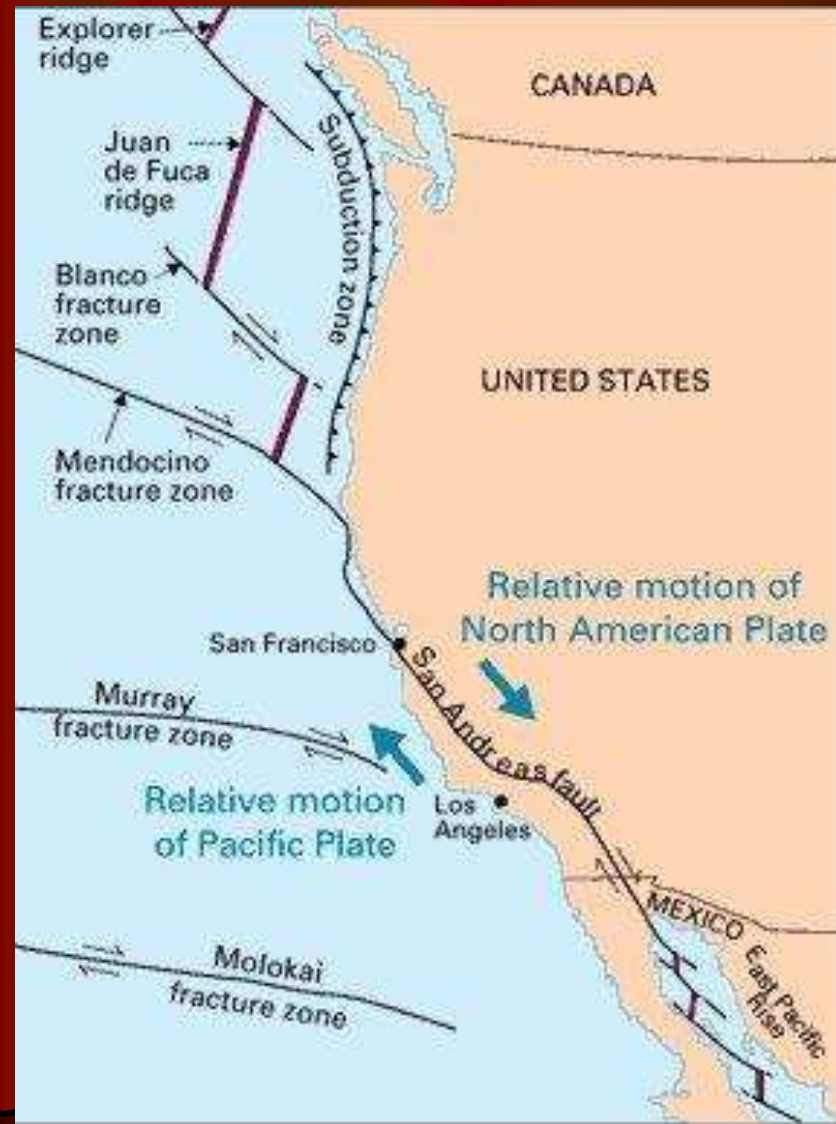


# Convergent : Andes Mountain formed in the Cretaceous (145 mya)

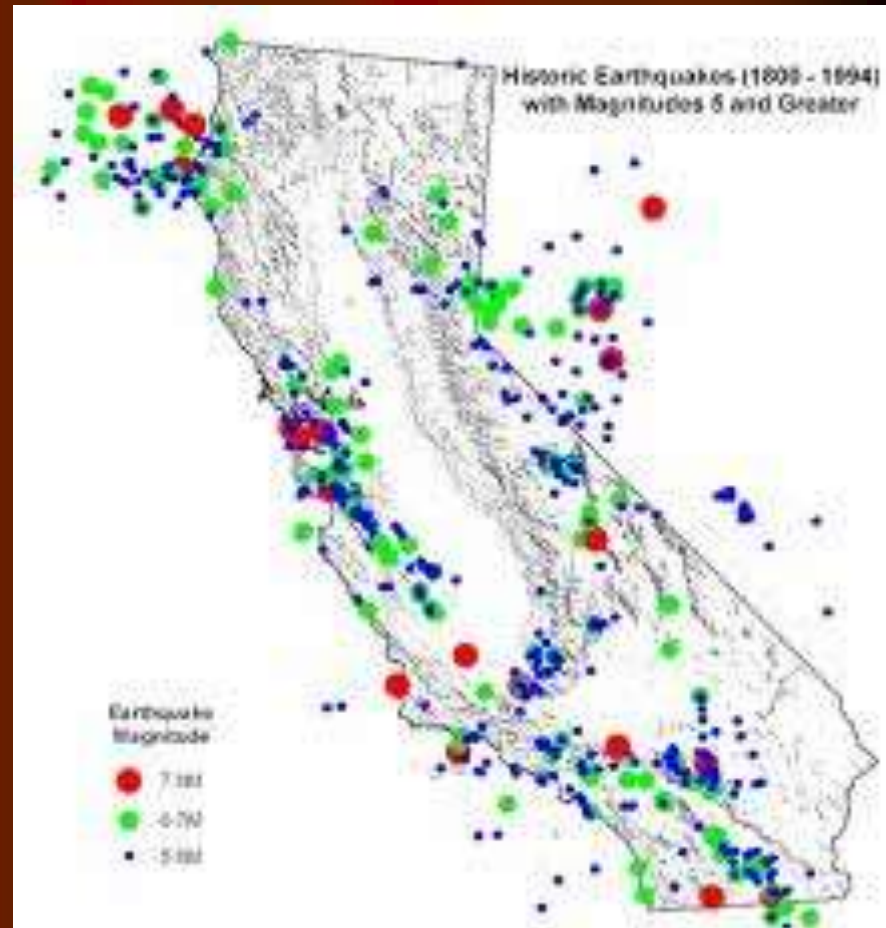
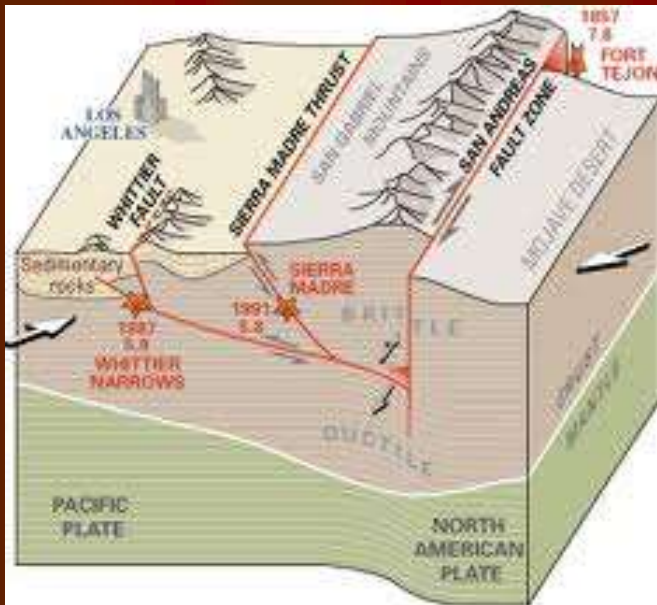


# Lateral slipping/Transform fault

St. Andreas Fault (30 Mya) 1,300 km long & at places tens of km wide



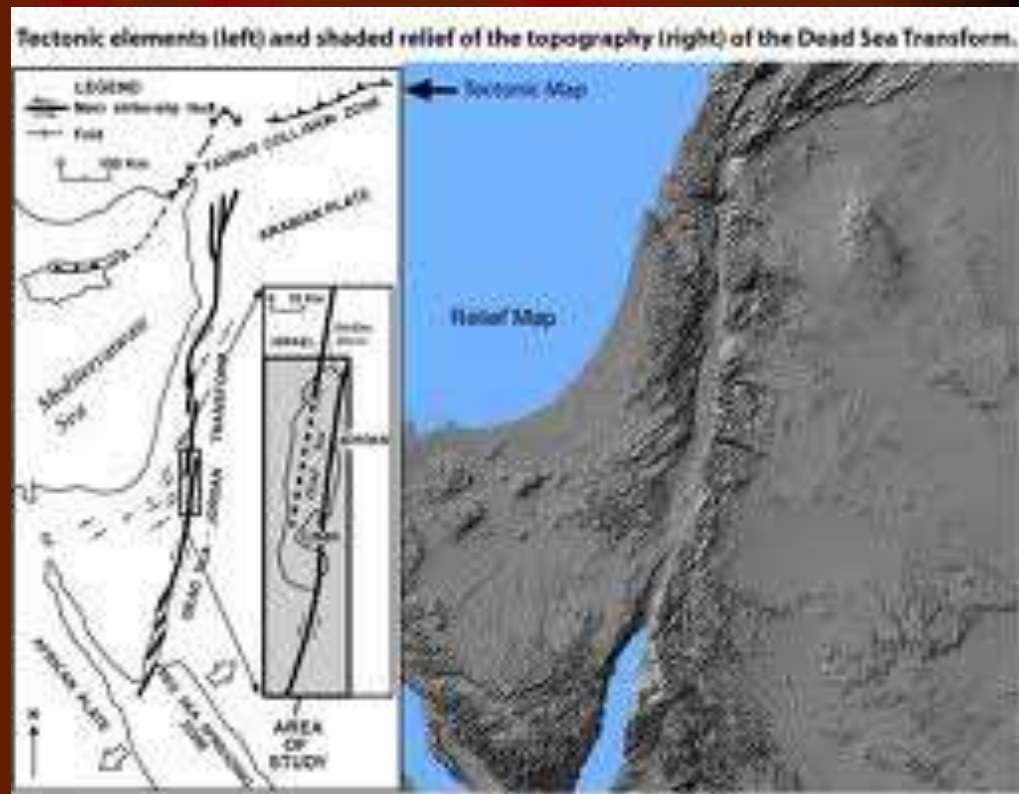
# Transform fault : St. Andreas Fault





# The Dead Sea Transform

- It is formed in the Miocene (23.8-5.3 mya ) by transform faults between the Africa Plate & the Arabian Plate
- 1,388 ft below sea level and 1,237 ft deep



# Related processes

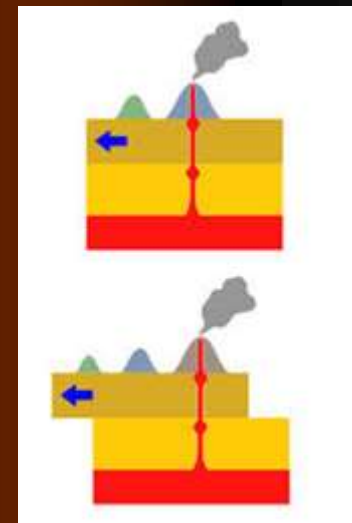
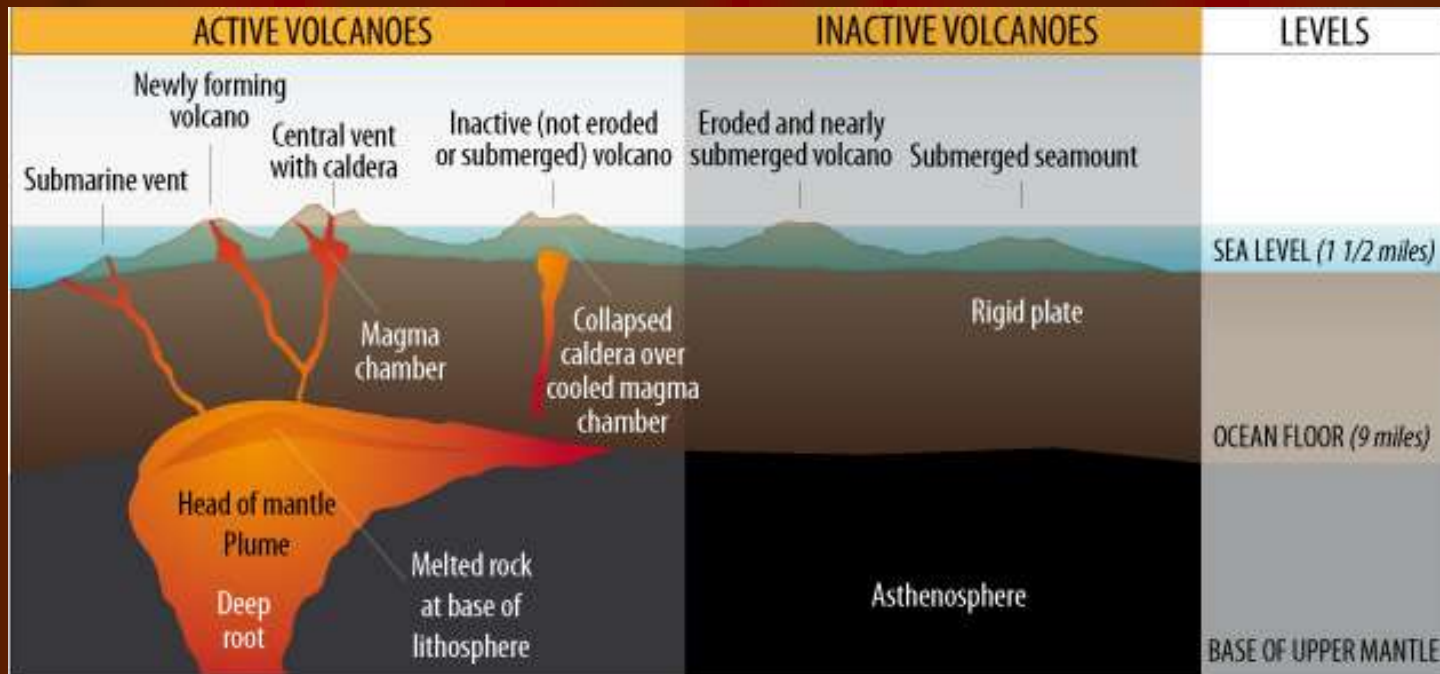
- Volcanism 火山活動
- Earthquakes / Tsunamis 地震与海嘯：  
average 800,000 earthquakes occurred each year
- Folding & faulting 褶皺與斷層
- Hydrothermal vents

# Location of active volcanoes 活火山分佈圖



# Volcanic Island Arc

Volcanic Island Arc is formed above a geological hot spot called a Mantle Plume. Example includes the Hawaii Islands ,the Galapagos, the Caribbean Islands & Kamchaka. Some islands still have active volcanos whilst others are dead as they moved further and further away from the hot spot by the force of plate tectonic



# Volcanic Island Arc

## The Galapagos Islands



## The Hawaii Islands



# Volcanic Island Arc

## The Caribbean Islands



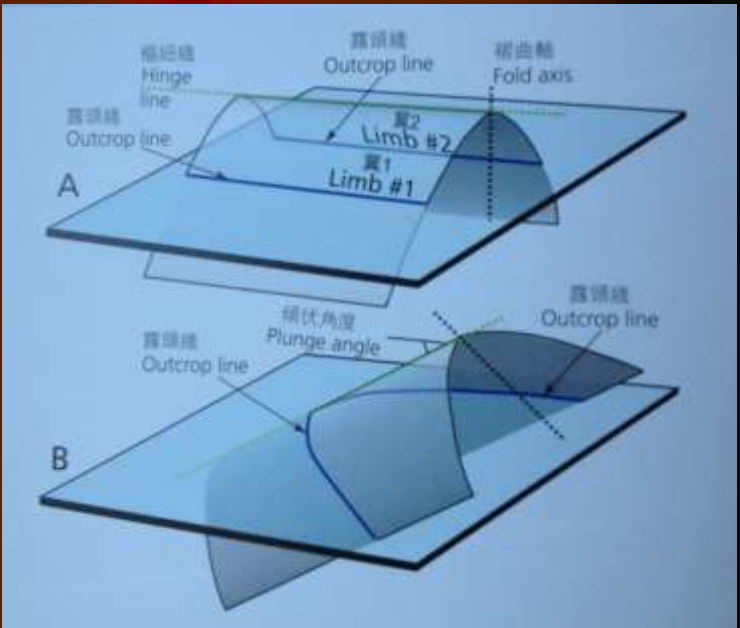
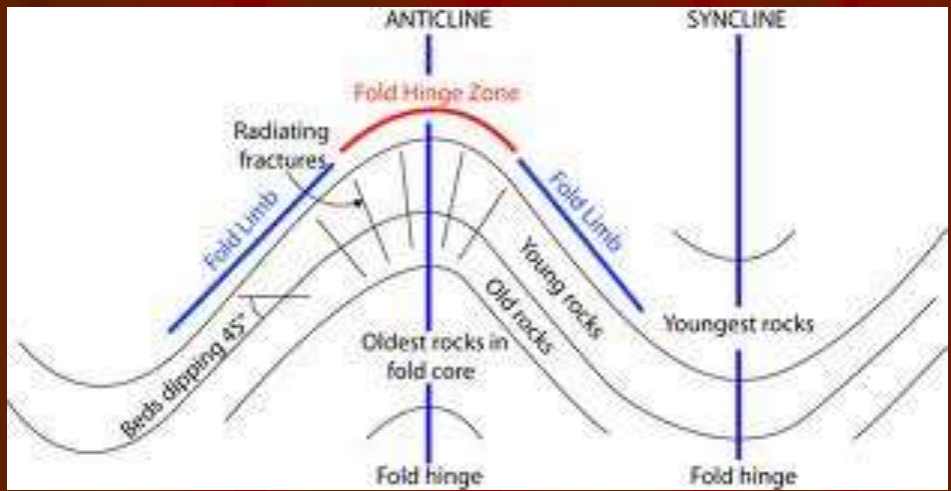
## The Kamchaka Islands



# Folding 褶皺

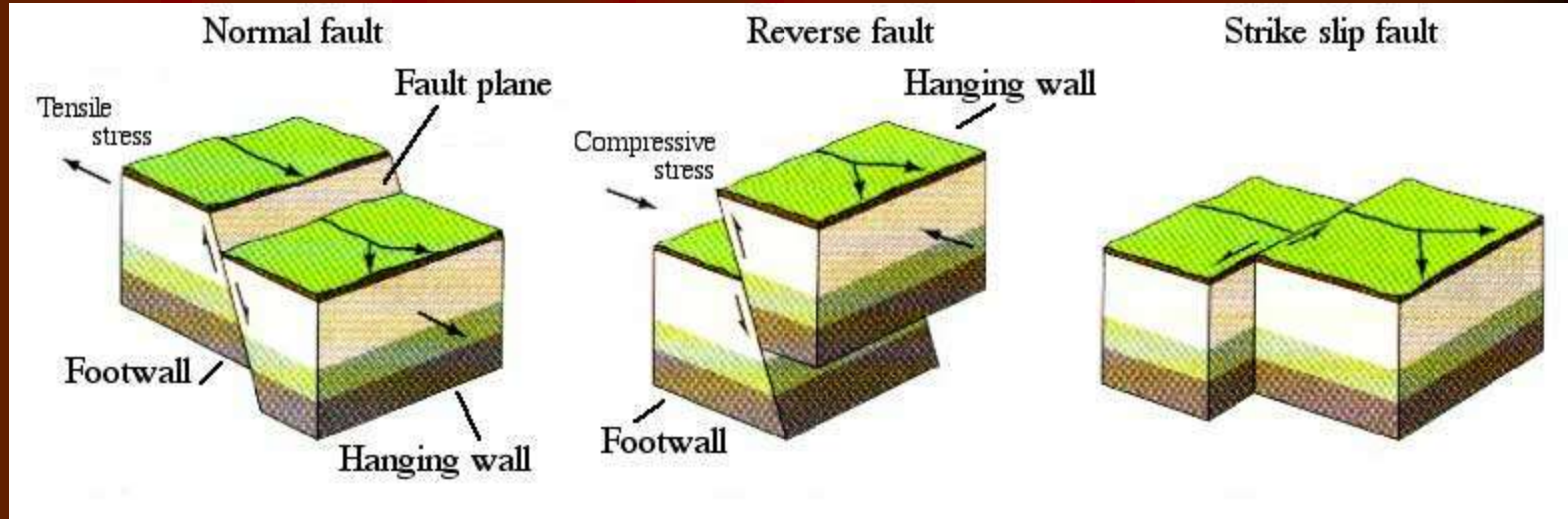


# Folding 褶皺





# Faulting 斷層

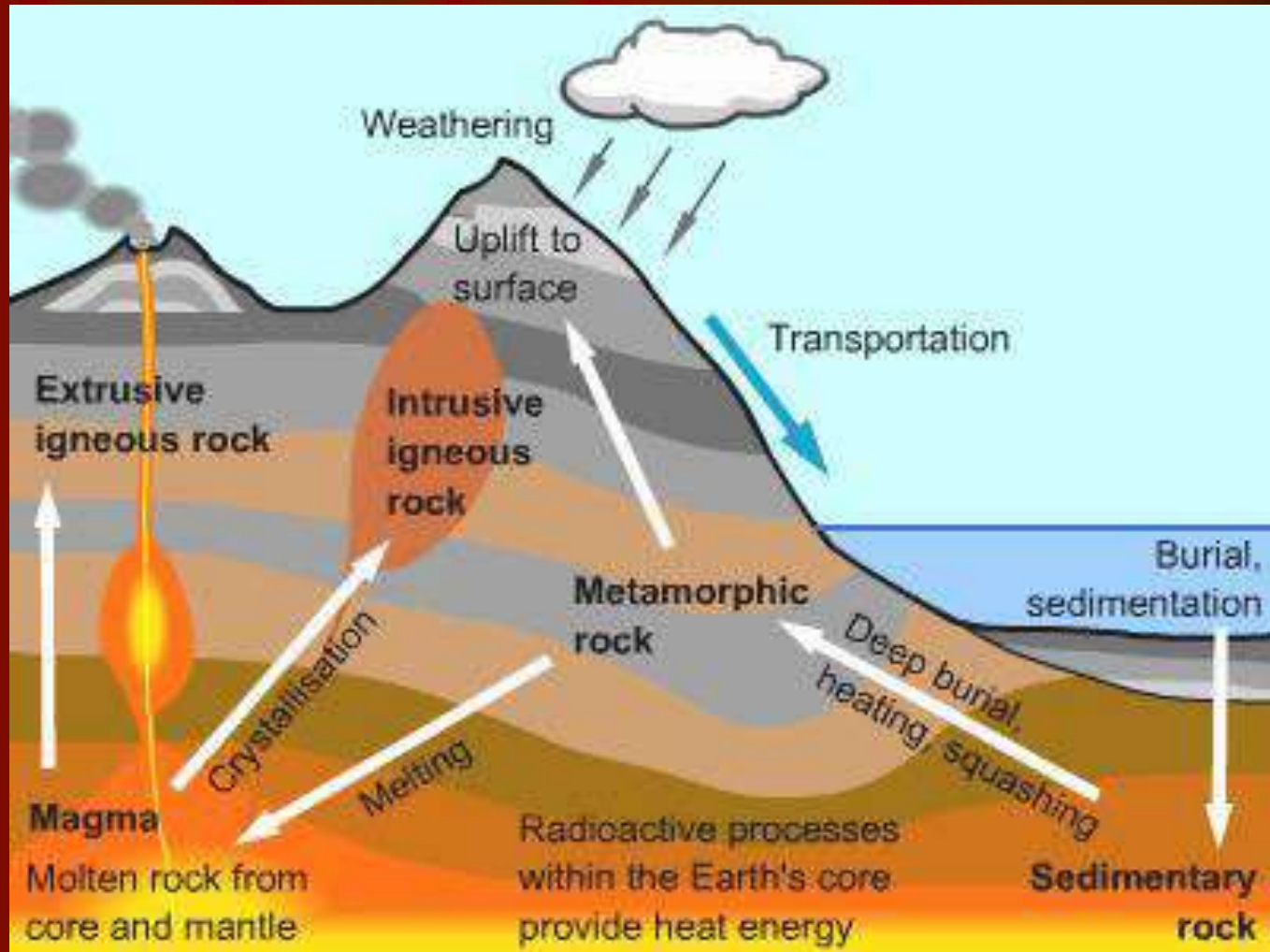


Rock Formation & related  
Geomorphology  
岩石與地貌

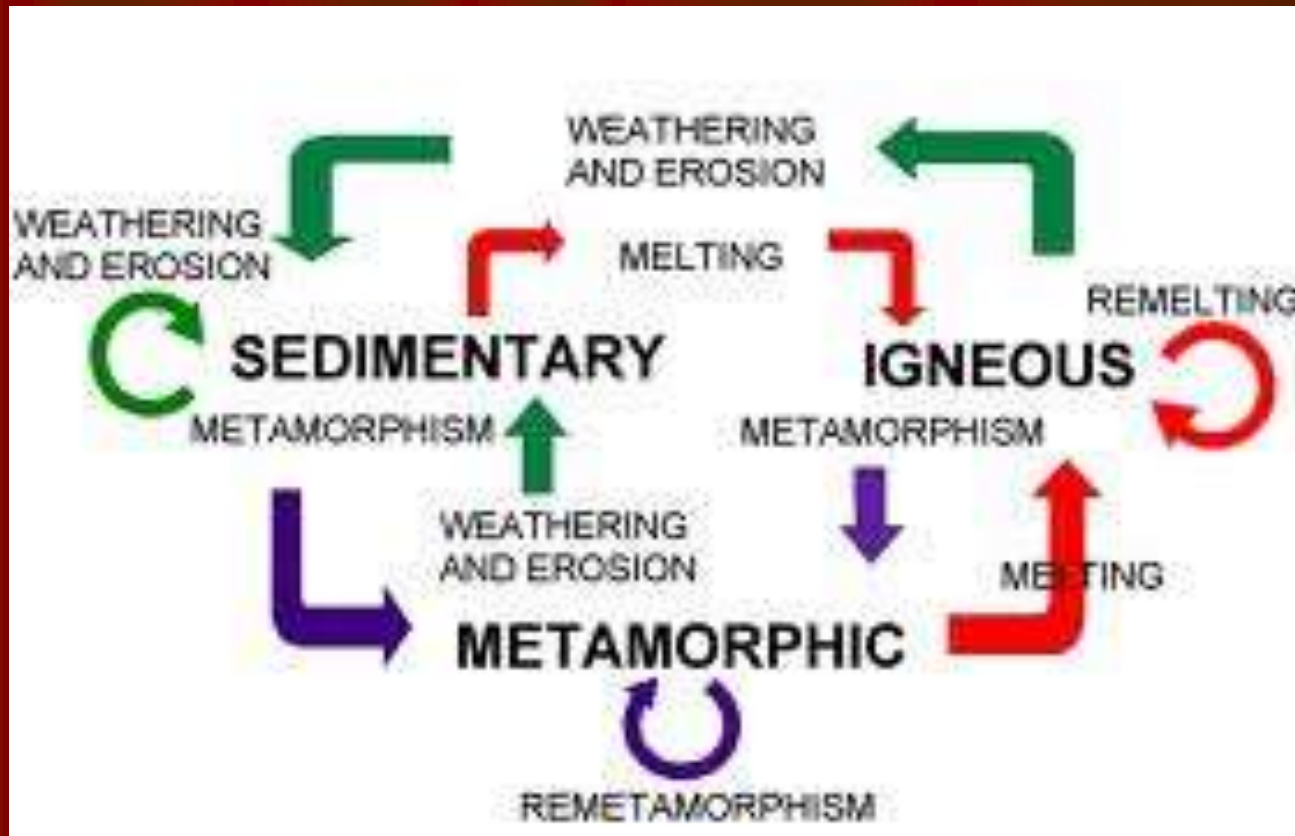
# Three types of rocks

- Igneous Rock (火成岩) – from magma 岩漿 (intrusive) or lava 溶岩 (extrusive) = “Primary Rock”
- Sedimentary Rock (沈積岩/水成岩) – weathered rock redeposited & hardened = “Secondary Rock”. About 70% of the surface rock is Sedimentary rock
- Metamorphic Rock (變質岩) – formed when Igneous or Sedimentary rock are recrystallized by heat & pressure associated with volcanic or tectonic activities

# Rock formation cycle 岩石循環圈



# Rock formation cycle



# Igneous Rock

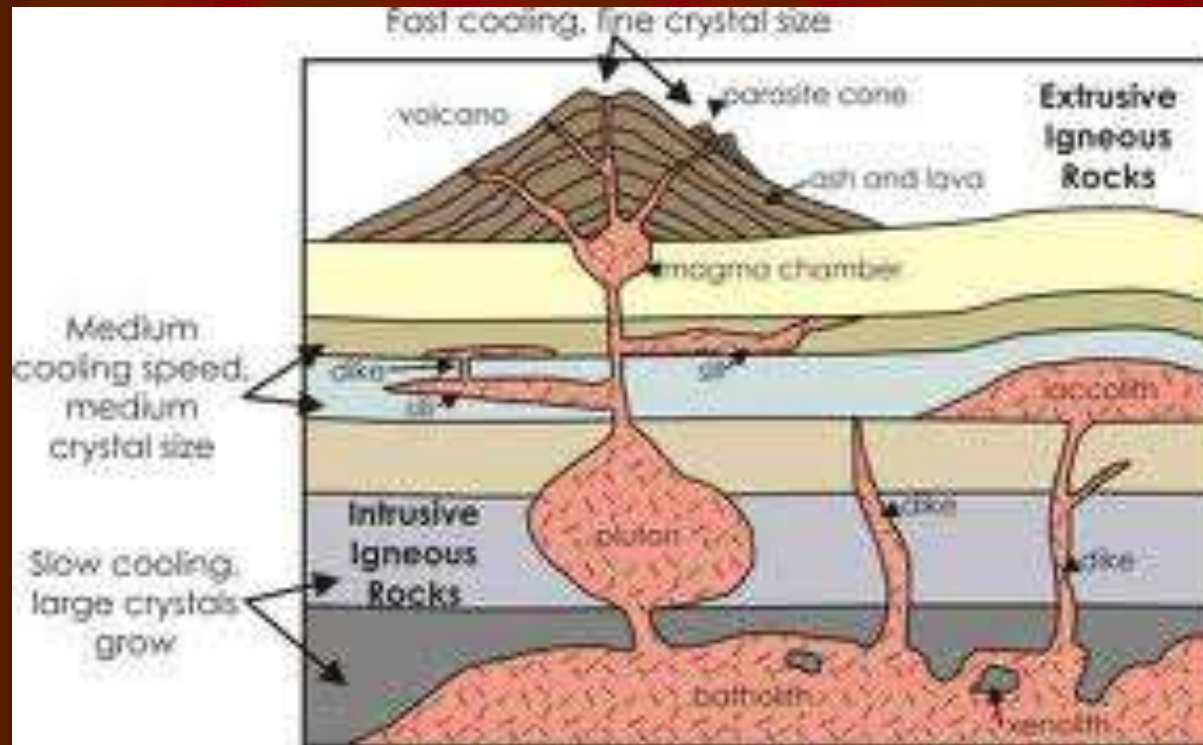
## 火成岩

# Igneous Rocks

## Intrusive (侵入性) & Extrusive (噴出性)

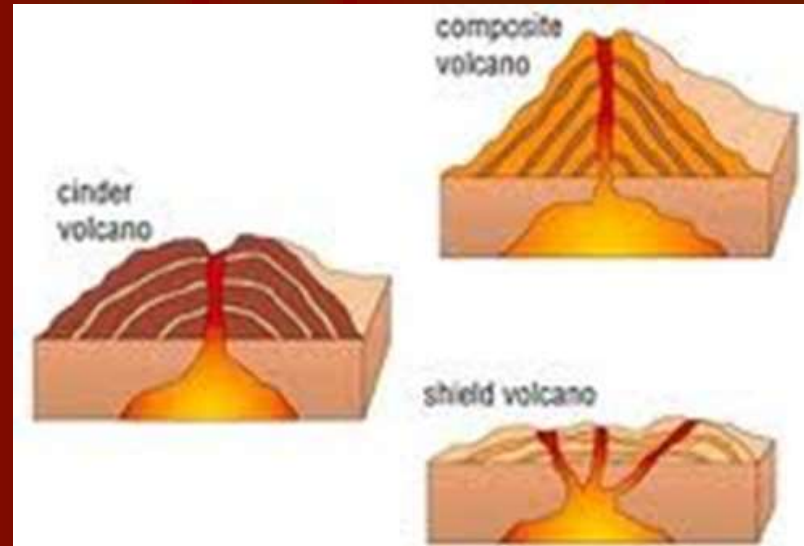
Intrusive: batholith 岩基, laccolith 岩盤, Pluton 岩体, dykes 岩牆/岩脈, sills 岩床

Extrusive: volcano 火山 & fissure flow



# Extrusive – Volcano & fissure vent

- Shield Volcano 盾狀火山 ( Mona Lua) , Cinder Volcano 火山渣錐 ( Paricutin) & Composite Volcano 複成火山 ( Fuji Yama )



- Fissure vent



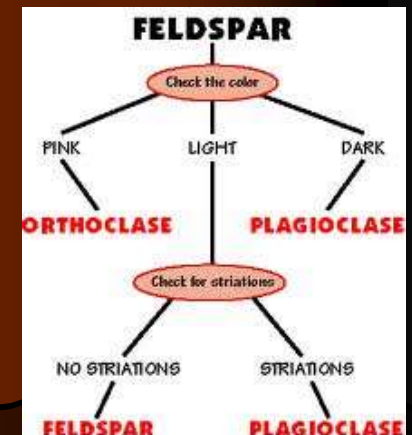
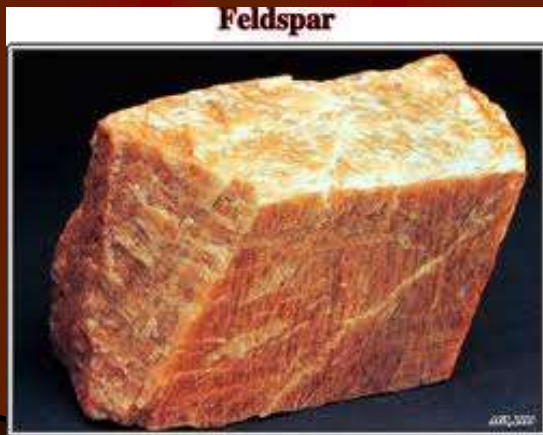


# Key Rock forming minerals 主要造岩礦物

- Quartz ( $\text{SiO}_2$ ) 石英



- Feldspar ( $\text{NaAlSi}_3\text{O}_8 - \text{CaAl}_2\text{Si}_2\text{O}_8$ ) 長石



- Micas (family of silicates – biotite & muscovite)

雲母



- Pyroxene (family of silicates) 輝石

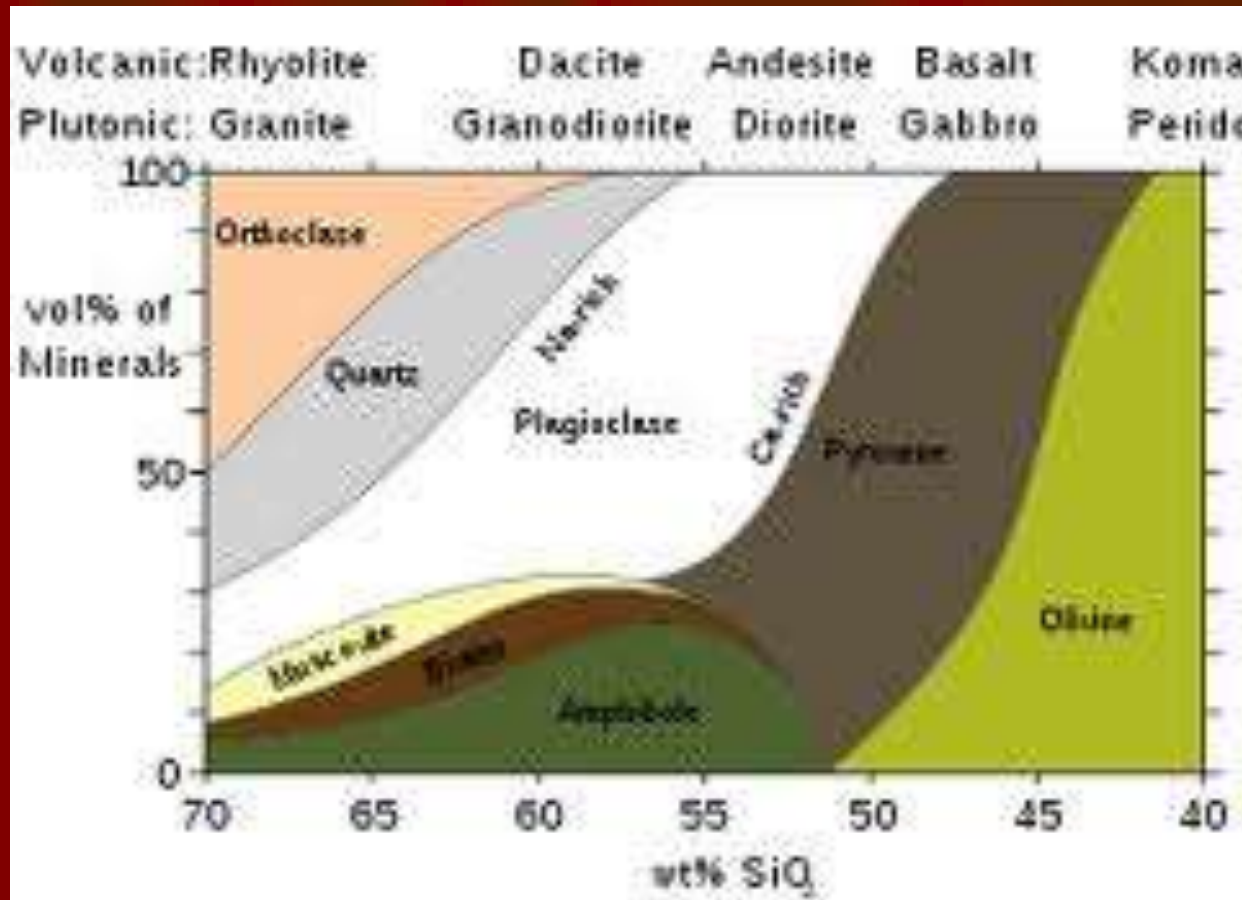


- Olivine (family of silicates) 橄欖石



# Composition of igneous Rocks

← Increased acidity/viscosity



# Classification of igneous Rocks



Increased acidity 酸性/viscosity 黏度

	Felsic (light color)	Intermediate	Mafic (dark color)	Ultramafic	
Texture	Coarse	Granite	Diorite	Gabbro	Peridotite
	fine	Rhyolite	Andesite	Basalt	
	Vesicular	Pumice		Scoria	
	Glassy	Obsidian			
<b>Minerals Present</b>					
	QUARTZ K-FELDSPAR NA-PLAG	NA-CA PLAG AMPHIBOLE	CA PLAG PYROXENE	PYROXENE OLIVINE	

# Intrusive Igneous Rocks

## 侵入性火成岩 (深成岩)

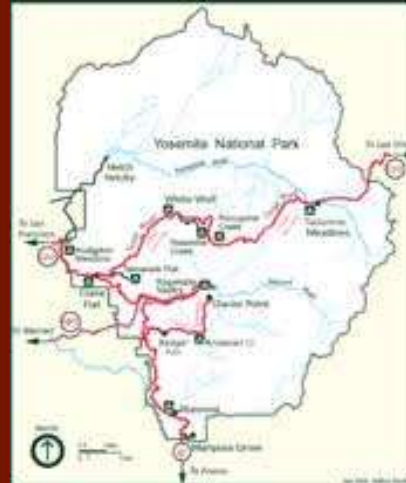
# Intrusive Igneous rock

granite 花崗岩, diorite 閃長岩, gabbro 輝長岩,  
peridotite 橄欖岩 & pegmatite 偉晶岩



# Typical granite landscape

Half Dome, Yosemite National Park formed 100 Mya



# Typical granite landscape

Huang Shan (黃山), Hua Shan (華山), Lion's Rock (獅子山)



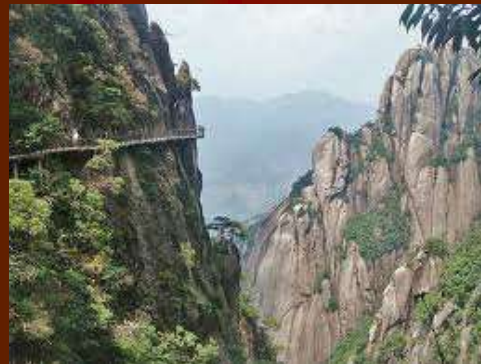


# Typical granite landscape

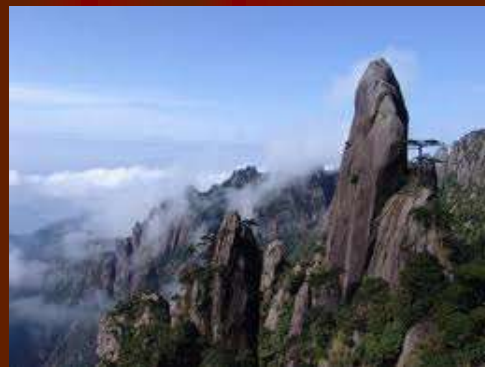
Song Shan (崧山)



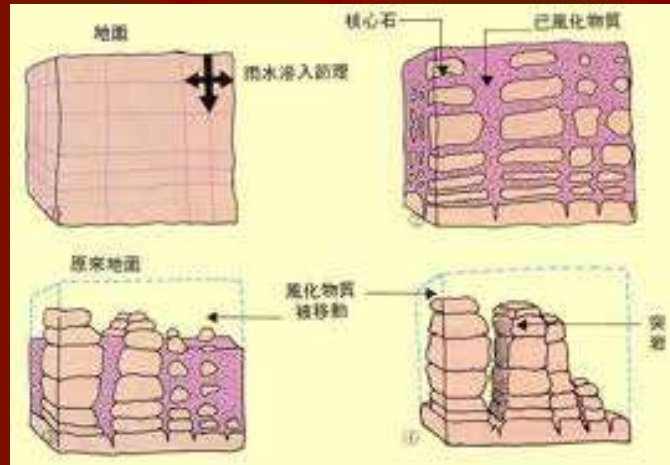
Sanqing Shan (三清山)



Lo Shan (嶗山)



# Tor formation 突石 in granite (飛來石, 望夫石, 姻緣石, 佛手石)



# Tor formation 突石 in granite

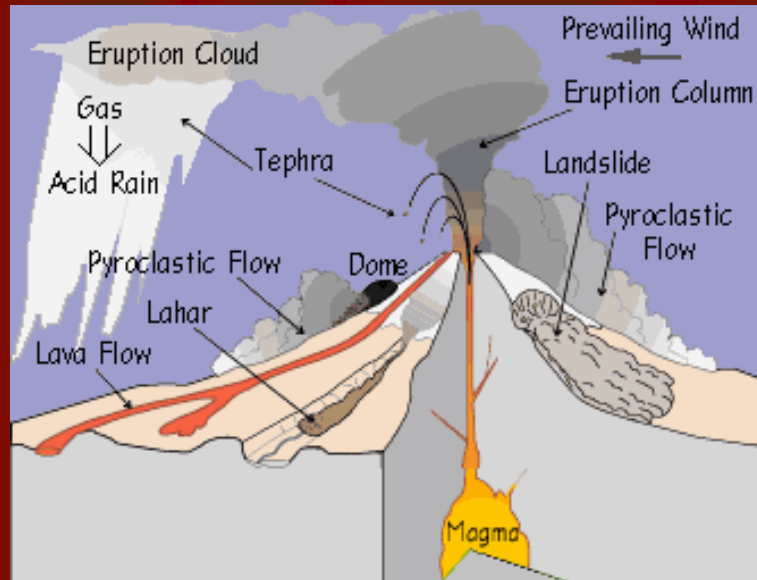
## Examples in Po Toi Islands



# Extrusive Igneous Rocks

## 噴出性火成岩

# Extrusive Igneous Rocks



# Lava fields 溶岩場 in Iceland & Hawaii



# Lava tubes 溶岩管 in Jiju Island 濟洲島 , S.Korea

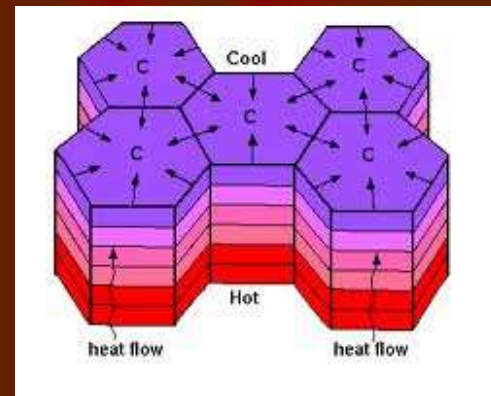


Extrusive igneous rocks – rhyolite 流紋岩, andesite 安山岩,  
basalt 玄武岩, vesicular basalt 多孔玄武岩, tuft 凝灰岩,  
obsidian 黑曜岩, pumice 浮石, scoria 火山渣



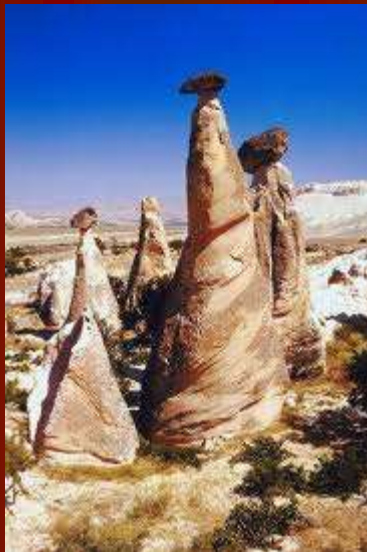


Columnar joints are usually formed by basalt eg. in USA (Devil's Tower), Ireland (Giant's courseway), Japan 北海道, Taiwan 澎湖 & S. Korea 濟洲. Those found in HK are composed by volcanic tuff



# Cappadocia Turkey

“Devils chimneys” are formed by hard basalt over soft volcanic ash



# “Black Gold” - volcanic ash soil is very fertile eg. Hawaii, Indonesia & Japan



# Sedimentary Rock

## 沉積岩

# Types of sedimentary rock

- Clastic 碎屑沉積 – rocks weathered into boulder, cobble, pebble, sand, silt, clay being redeposited in river mouth, lakes & shallow seas
- Biological 生物沉積 – formed from large quantities of living organism die & accumulated
- Chemical 化學沉積 – formed by chemical precipitation from solutions

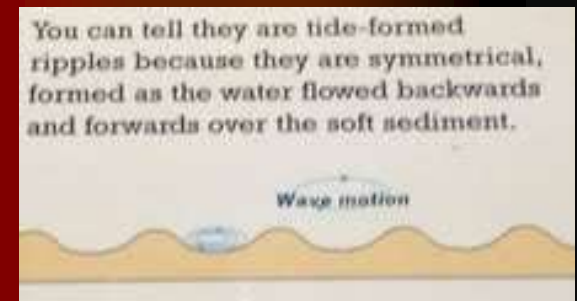
## Clastic Sedimentary rock

mudstone 泥岩, siltstone 粉砂岩, sandstone 砂岩, shale 頁岩,  
breccia 角礫岩, conglomerate 礫岩



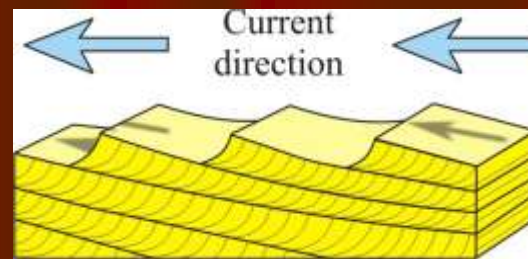
# Clastic Sedimentary rock

Desert deposit, lake deposit, beach deposit



# Beddings in Clastic Sedimentary Rock 層理

Features include horizontal bedding, graded bedding, cross bedding & Liesegang bedding. The latter are color banded sandstone believed to have been formed deep underground by rhythmic deposition of iron & manganese compounds from mineral rich water that once flowed within the rock





Other features : sandstone & shale layers/ ripple marks/ vortex structure 旋捲構造

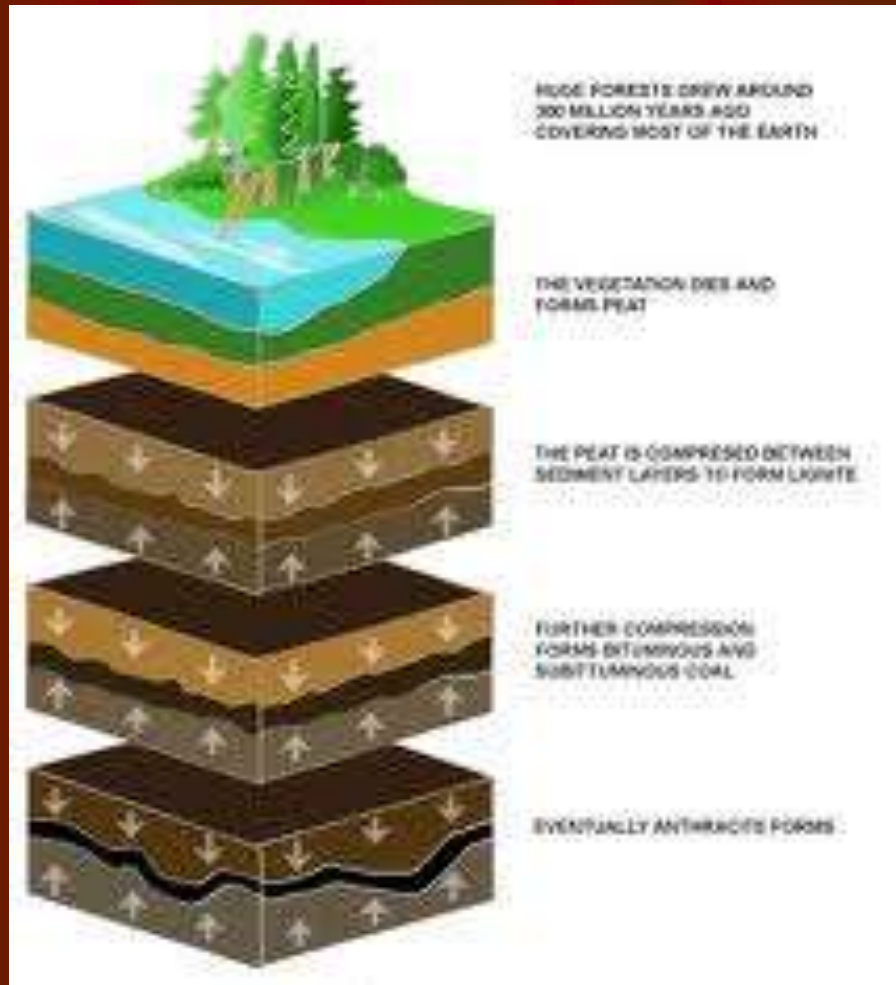


# Biological Sedimentary Rock – of marine organism

Limestone 石灰岩, chalk 白堊, Chert 燧石, Flint 黑燧石, Jasper 碧玉 & Chalcedony 玉髓



Biological Sedimentary rock – plant remains  
coal ( from peat 泥炭 to lignite 褐煤 to bituminous 煙煤 &  
anthracite 無煙煤 ) = “fossil fuel”



Chemical Sedimentary rock – Halite 石鹽/岩鹽 (rock salt),  
Gypsum 石膏, Tufa 泉華 & Travertine 石灰華



# Strata Sedimentary rock landscape

## The Grand Canyon

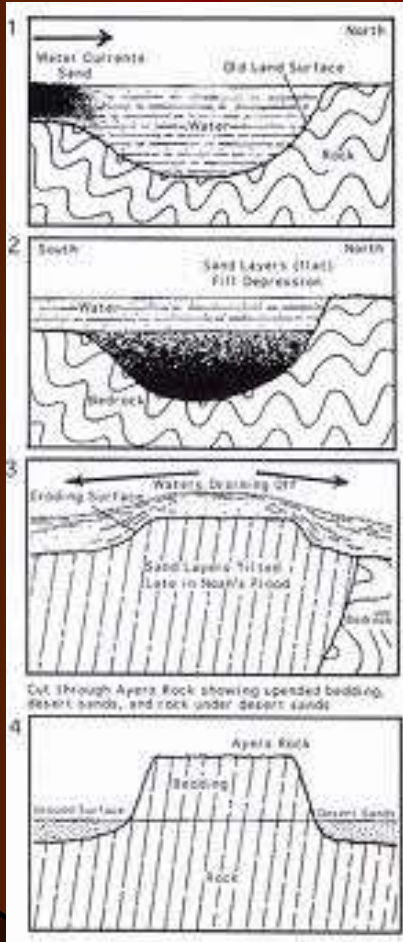


# Strata Sedimentary rock landscape The Grand Canyon/ Utah



# Uluru ( Ayer's Rock )

Composed of arkose 長石砂岩 & conglomerate which was later thrust vertically by tectonic movement



# Sedimentary rock landscape in China

Zheungjiajie, 張家界 – sandstone ( 75-95% quartz – grit stone )





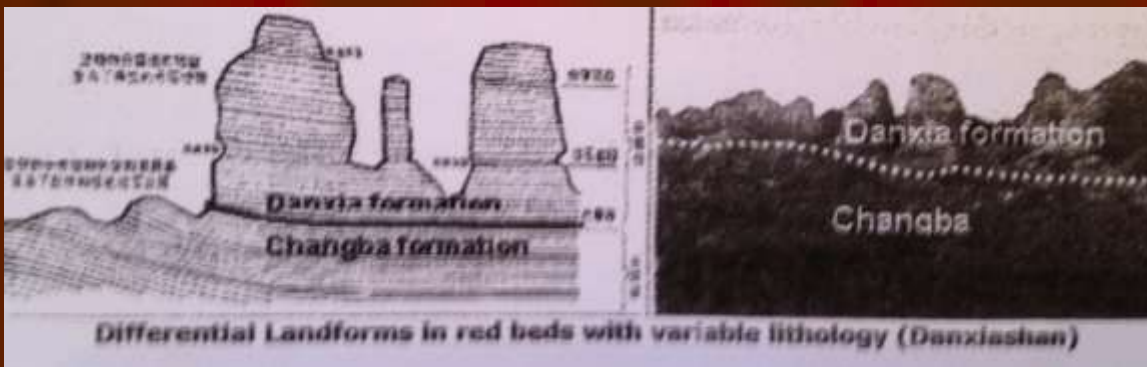
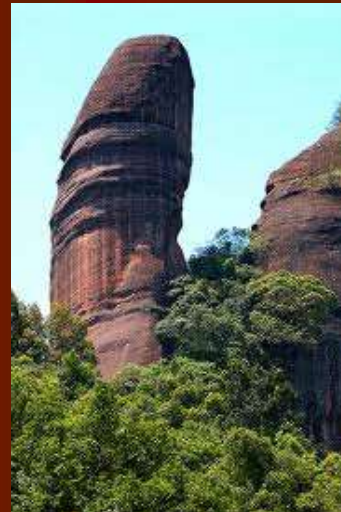
# Danxia landscape (丹霞地貌)

Refers to a special landscape formed in “Red Bed” composed of sedimentary rock. In China there are 780 Danxia landforms located in 7 major areas :

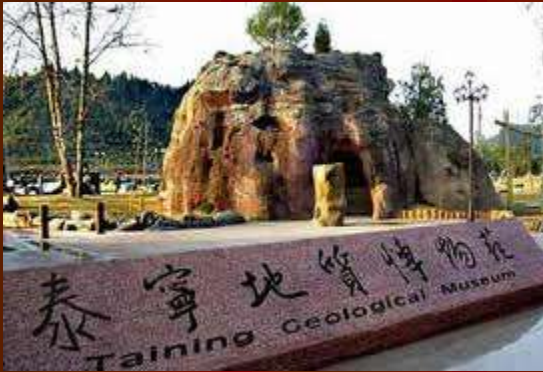
- Danxiashan 丹霞山 in Guangdong
- Taining 泰寧 in Fujian
- Langshan 諒山 in Hunan
- Longhushan 龍虎山 in Jiangxi
- Jianglangshan 江郎山 in Zhejiang
- Chishui 赤水 in Guizhou
- Zhangye 張掖 in Gansu



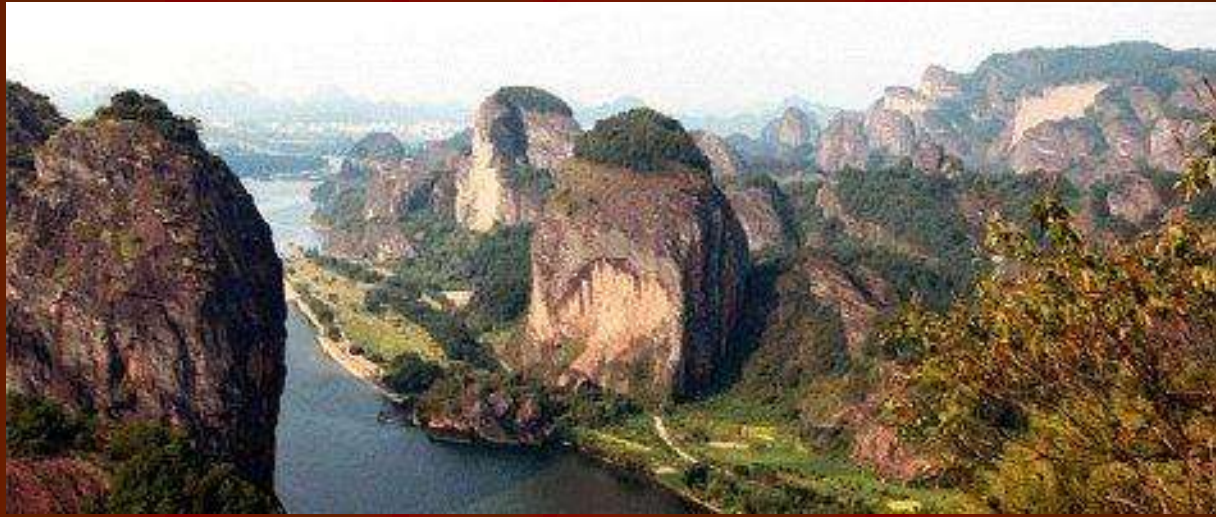
# Danxiashan 丹霞山 at Shaoguan



# Taining Danxia 泰寧丹霞 in Fujian



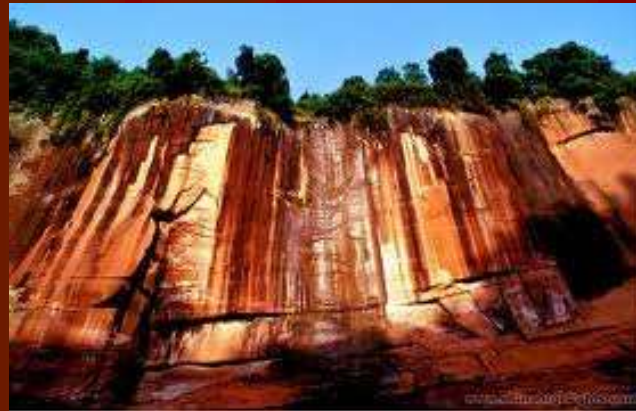
## Longhushan in Jiangxi 江西龍虎山



## Jianglangshan 浙江江郎山



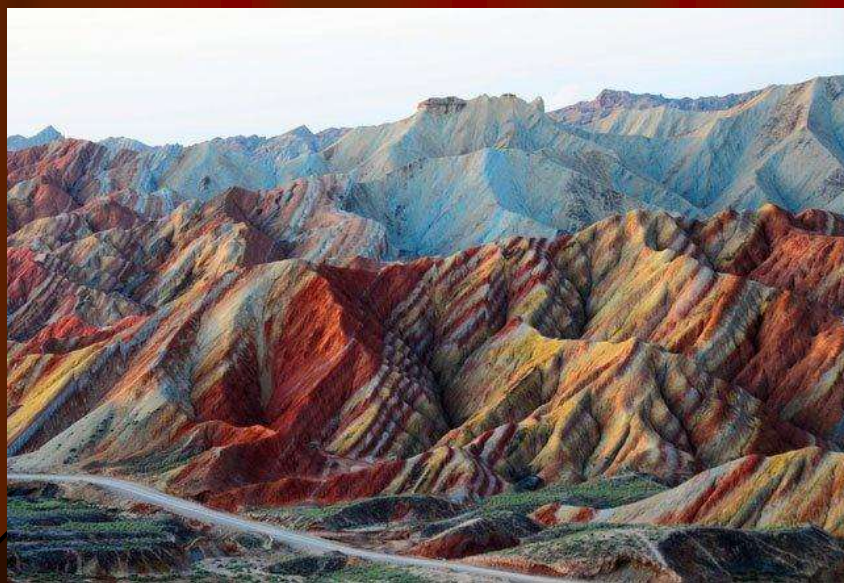
# Chishui 赤水 danxia in Guizhou 貴州



# Zhangyi Danxia 張掖 at Gansu 甘肅



© China Foto Press / Barcroft Media



© China Foto Press / Barcroft Media

# Zhangyi Danxia 張掖 at Gansu 甘肅



# Danxia landform in HK - Port Island sandstone

## 赤洲





## Other H.K. sedimentary rock landscape

Tung Ping Chau 東平洲, Ap Chau 鴨洲, Wong Chuk Kok  
黃竹角, Ma Shi Chau 馬屎洲



# Typical limestone landscape – Karst topography

(喀斯特地貌)

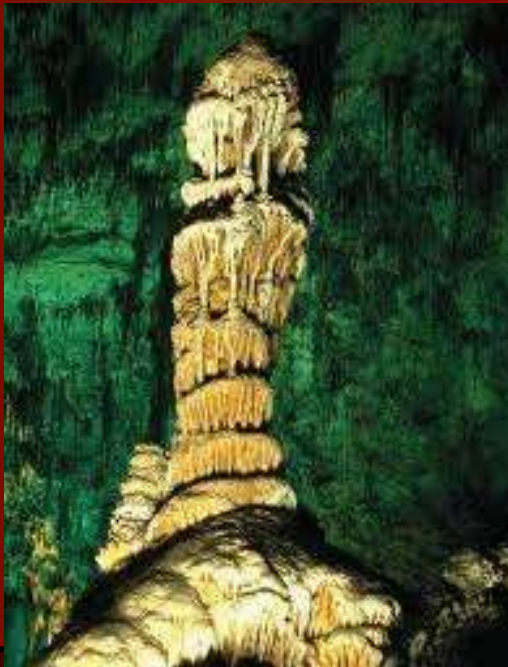
Guilin 桂林漓江, 肇慶七星岩, Halong Bay 越南下龍灣



# Surface features of Karst topography sink holes 溶洞, pinnacles 石林



Underground features of Karst topography – caves, stalactite 石鍾乳, stalagmite 石筍, pillars 石柱 & underground river system & lakes 地下水系



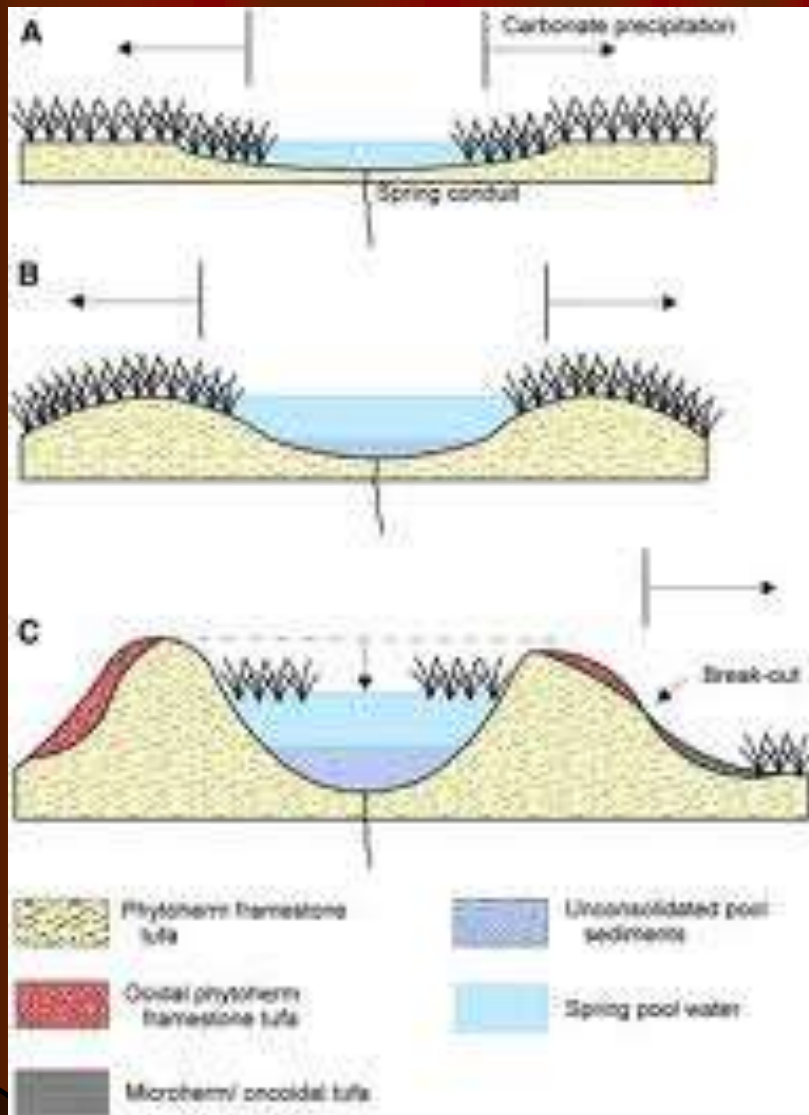
# Karst topography – tufa & travertine

Tufa 泉華 is  $\text{CaCO}_3$  deposited at ambient temperature.

Travertine 石灰華 is formed by rapid precipitation of calcium carbonate in hot spring



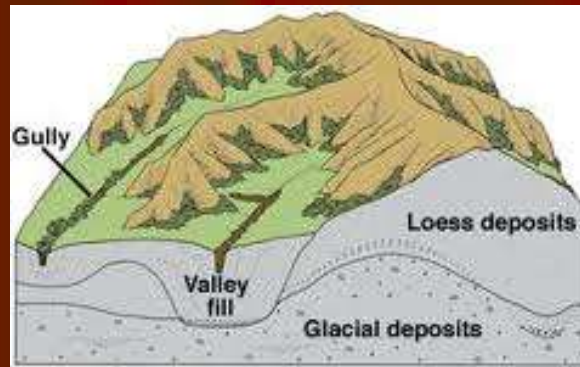
# Tufa Pools 泉華池



# Tufa deposits & tufa pool – Huanglong (黃龍)



# Loess Plateau (黄土高原)

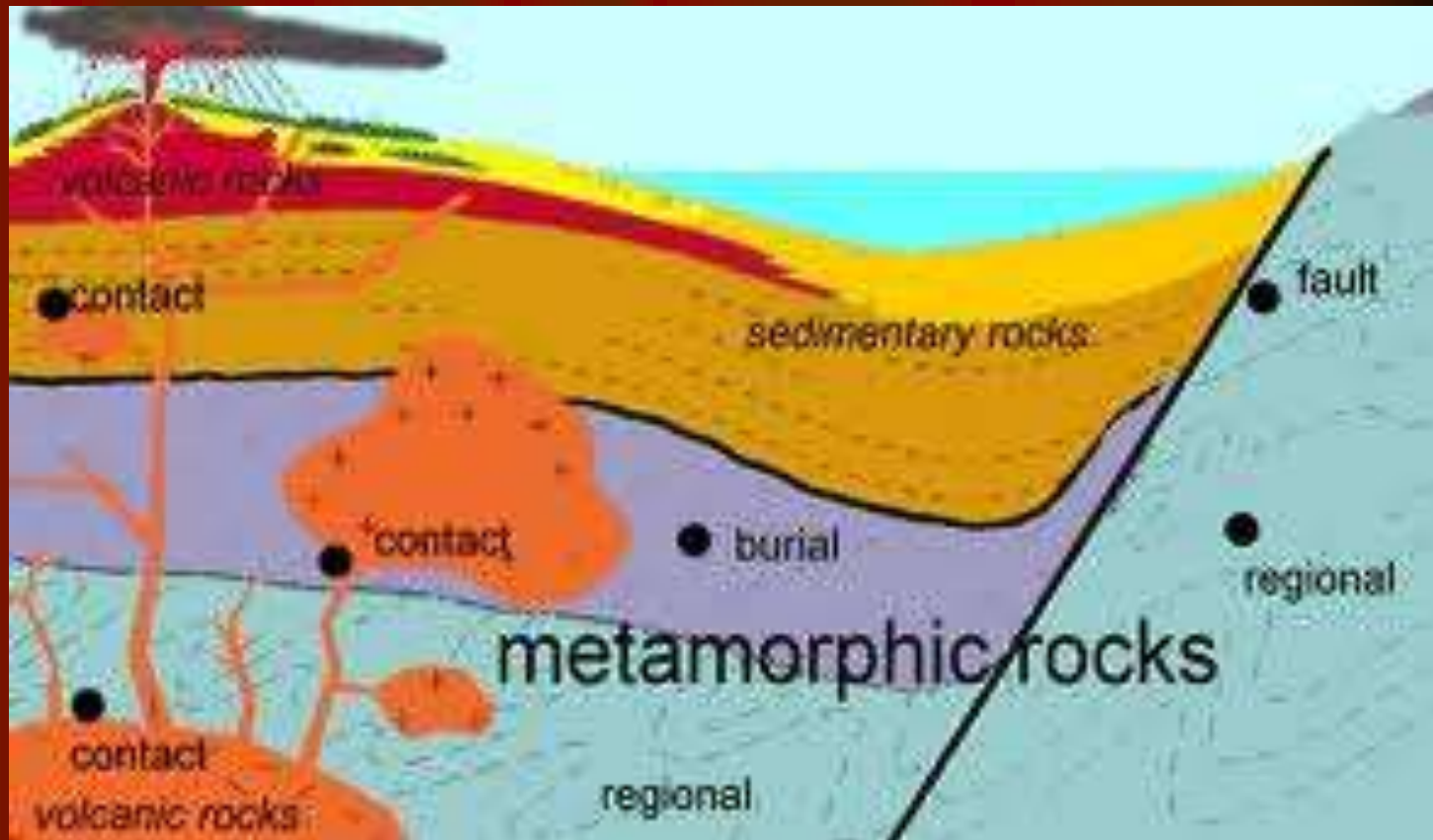




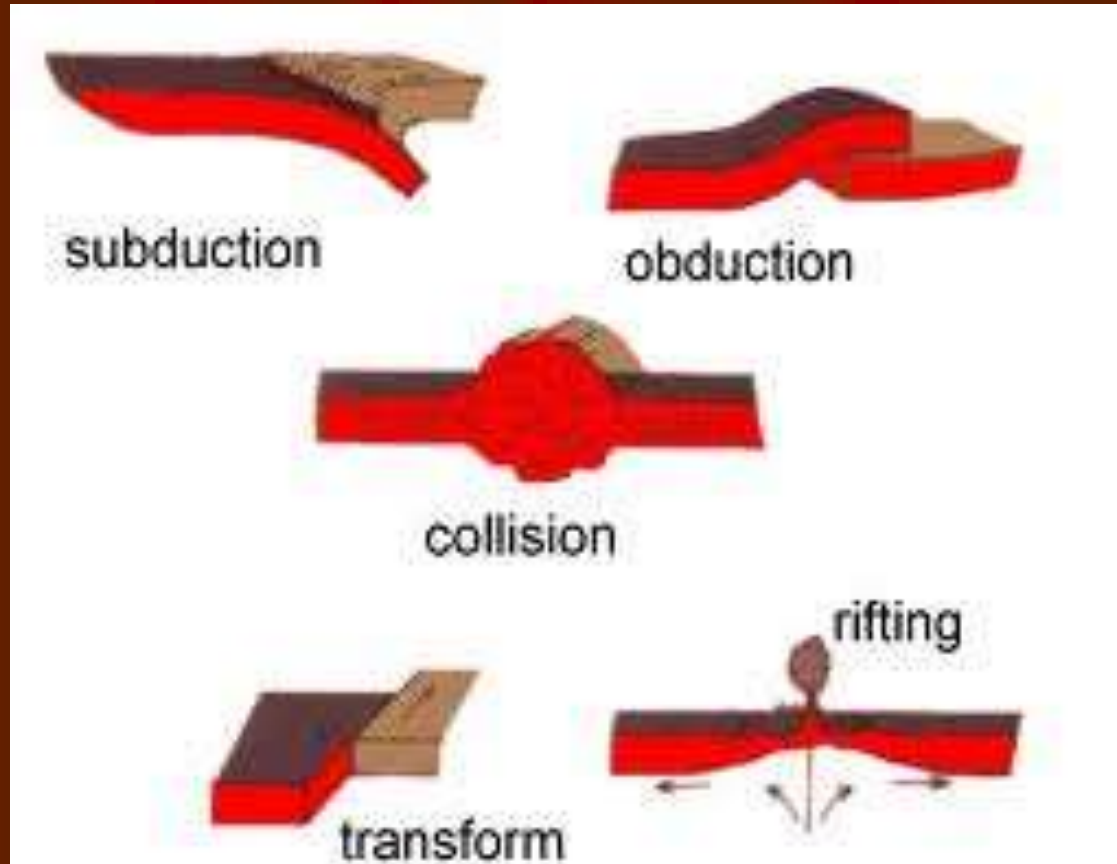
# Metamorphic rocks

## 變質岩

# Metamorphism – heat, pressure & fluid ( Contact, Dynamic, Regional )

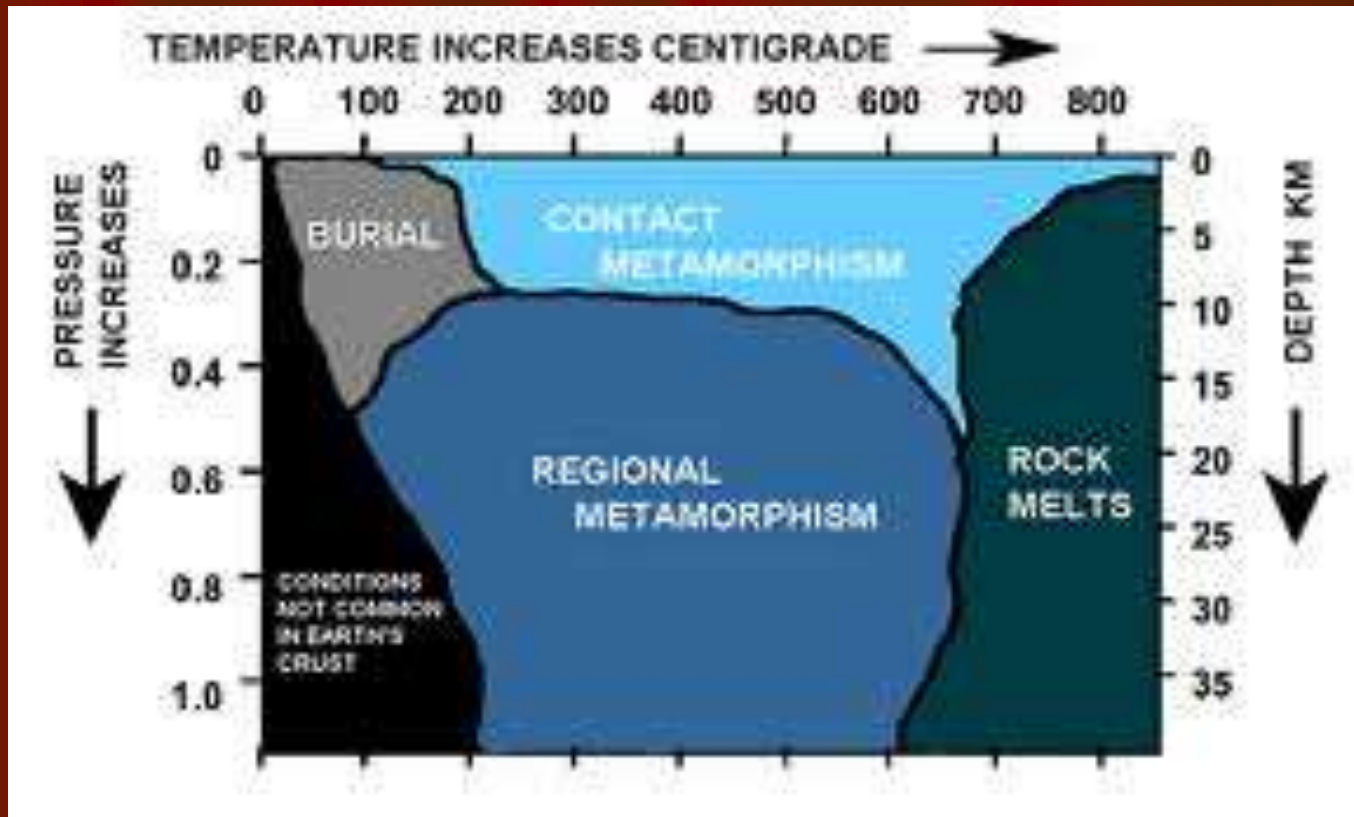


# Metamorphic rock transformation



# Metamorphism – heat, pressure & fluid

( Contact - volcanic, Dynamic – folds/fault, Regional – plate tectonic )



# Metamorphic rock

- Shale to slate 板岩



- Tuft to schist 片岩



- Sandstone to quartzite 石英岩



# Metamorphic rock

- Limestone to marble 大理石/雲石



- Granite to Gneiss 片麻岩



# Marble mining in North Italy



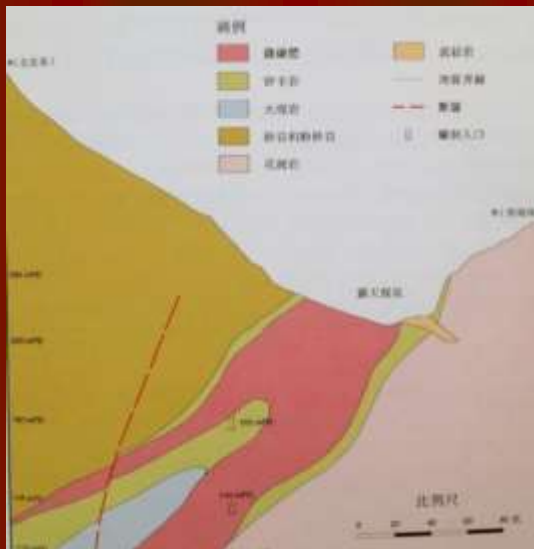
# Intrusion & Metamorphism rock often associate with mineral & gem deposits





# Ma On Shan Iron Mine

Magnetite 磁鐵礦 & hematite 赤鐵礦 formed by skarnization 矽卡岩化

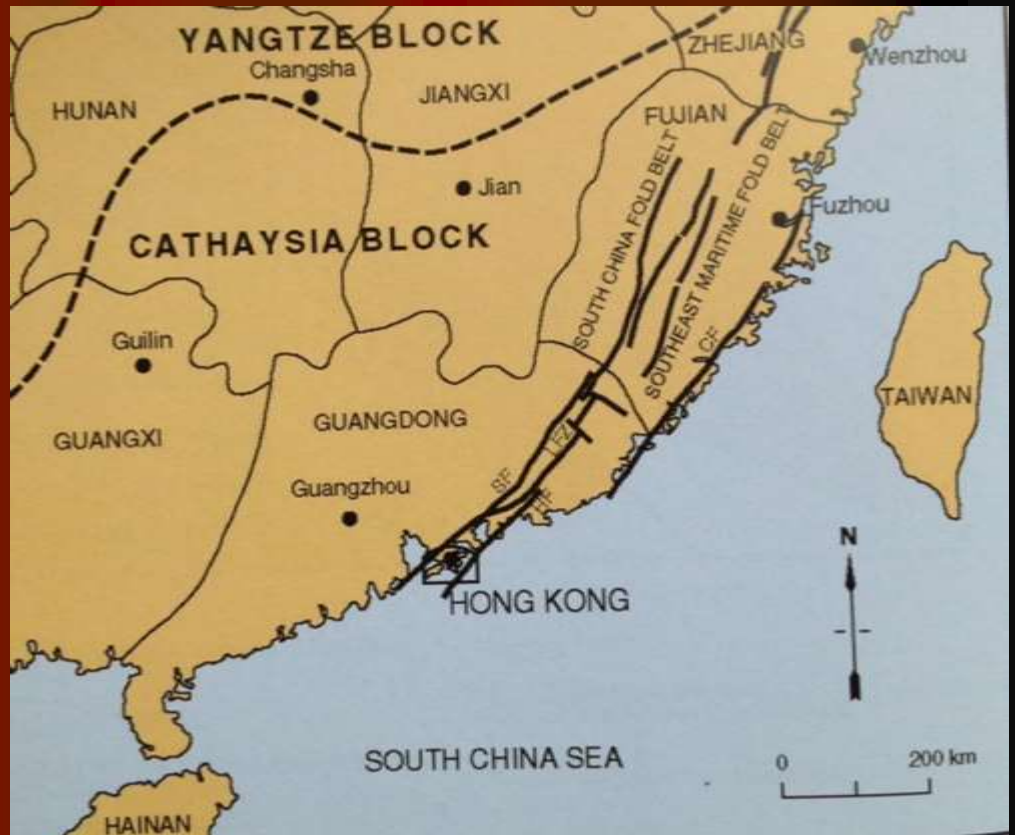


# The Geology of HK

## 香港地質

# Southeastern China Geology

## North China Block, Yangtze Block, Cathaysia Block



# Simplified Geological Map of HK

60% Extrusive, 30% Intrusive, 7% Sedimentary,  
3% Metamorphic



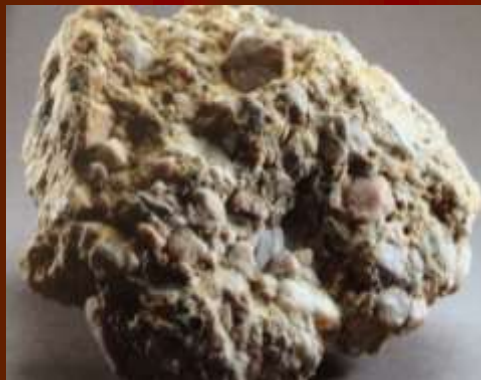
# Major structural features in HK

Predominated by 3 sets of fault of which the Lai Chi Kok – Tolo Channel Fault Zone which starts at Lai Chi Kok & passes through Sha Tin along the north coast of Tolo Channel to Bluff head is most representative cutting HK into 2 halves & probably linked with the Linhuashan Fault Zone in China



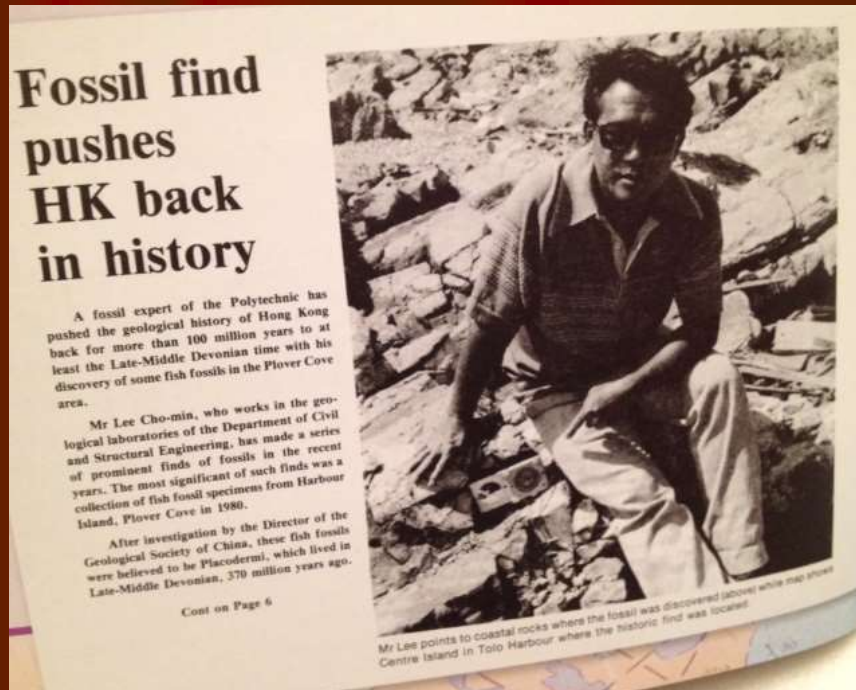
## H.K. Geology – Sedimentary Rocks

- Devonian (410 – 360 Mya) 泥盤紀 : Sediments from rivers and their deltas deposited in HK region forming the oldest rocks of the Bluff Head Formation 黃竹角咀組 composing of conglomerates & sandstone

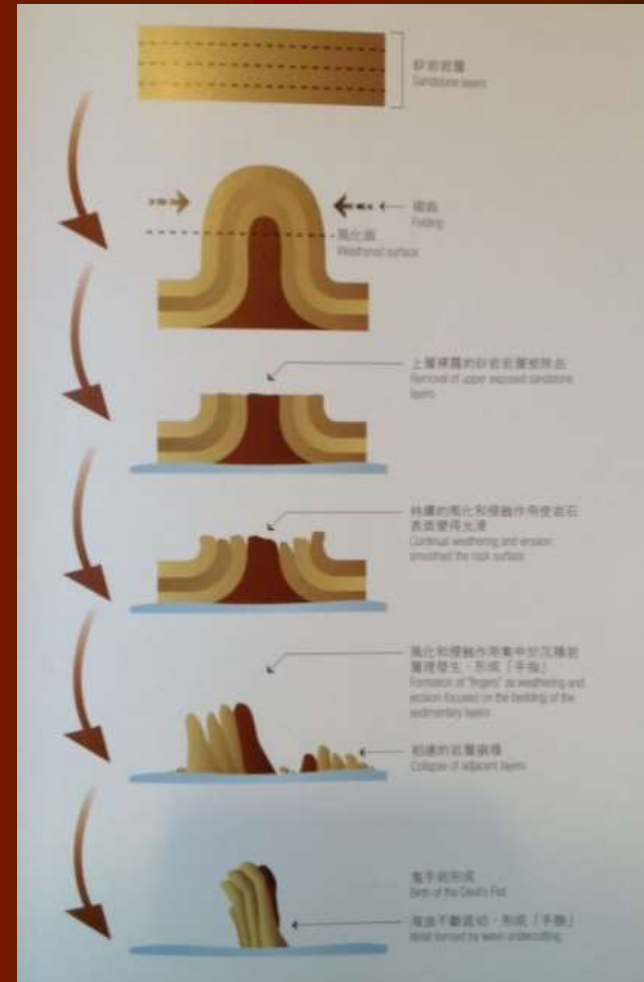


# *Bothriolepis* (Devonia) 溝鱗魚

- Dr. C.M.Lee 李作明教授 discovered this fossil in Plover Cove in 1980 dated to be Devonian (410 Mya)



# Devil's Fist at Wong Chuk Kok Tsui (Bluff Head)





## H.K. Geology – Sedimentary Rocks

- Carboniferous ( 360 - 299 Mya ) 石炭紀 : Warm & shallow sea environment. With sea level falling coastal marshes turned into forest. Earth movement later led to metamorphism

The Yuen long Formation marble is buried beneath the sediment of Yuen Long Plain.

The Ma On Shan iron ore was hosted in skarn formed by the alteration of marble by igneous intrusion



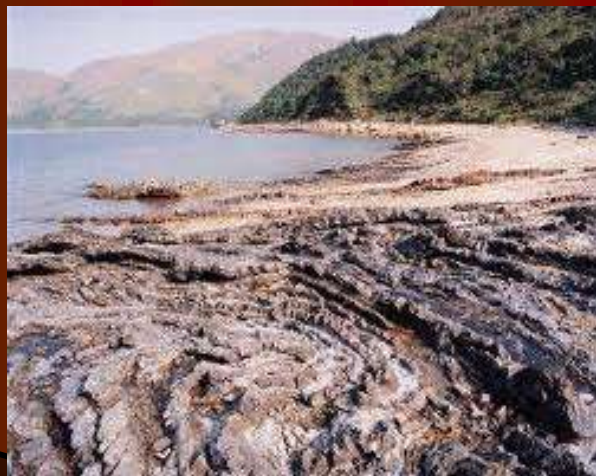
The Lok Ma Chau Formation at 340 Mya contains quartzite & graphite schist but also with no outcrop



## H.K. Geology – Sedimentary Rocks

- Permian ( 300 – 250 Mya ) 二疊紀 : Area covered by a shallow sea with lots of sand, silt & mud brought down by rivers which also buried marine animal & coral with some being fossilized.

Typical rocks of the Tolo Harbour Formation 大埔海組 & A Chau Formation 丫洲組 including siltstone, mudstone & sandstone are found in Ma Shi Chau 馬屎洲 & A Chau 丫洲 which are commonly deformed by slump folding



- Triassic 三疊紀

No record

- Early Jurassic 早侏羅紀 ( 200 – 190 Mya ) : Tolo Channel Formation 赤門組 fossil bearing siltstone exposed at Shan Chung, Tai Tong & Fung Wong Wat



- Middle Jurassic 中侏羅紀 ( 190 – 180 Mya ) : Tai O Formation 大澳組 – sedimentary



## HK RED BEDS

Extensive Red Bed basins located in Guangdong Province including those found in HK as Pat Sin Lang Formation, Port Island Formation, Kat O Formation & Ping Chau Formation 香港丹霞



- Early Cretaceous ( 147 Mya) : Pat Sin Lang Formation  
八仙嶺組 of conglomerate, sandstone & siltstone



- Late Cretaceous ( around 100 Mya ) : Port Island Formation 赤洲組 & Kat O Formation 吉澳組  
Port Island Formation





# Port Island 赤洲

## "Red Beds"

### conglomerate & sandstone





Tertiary ( 66 – 2.6 Mya ) :

Kat O Formation : the “Red Beds” of the Paleogene ( 66 – 23 Mya ) are located at Crooked Island & Ap Chau 吉澳, 鴨洲 - breccia, conglomerate, sandstone, siltstone



- Tertiary 第三紀

Ping Chau Formation ( 平洲組 ) – sedimentary, formed 0.5 Mya, the youngest rock formation in HK comprising mainly of thin layers of siltstone 粉砂岩 & mudstone 泥岩



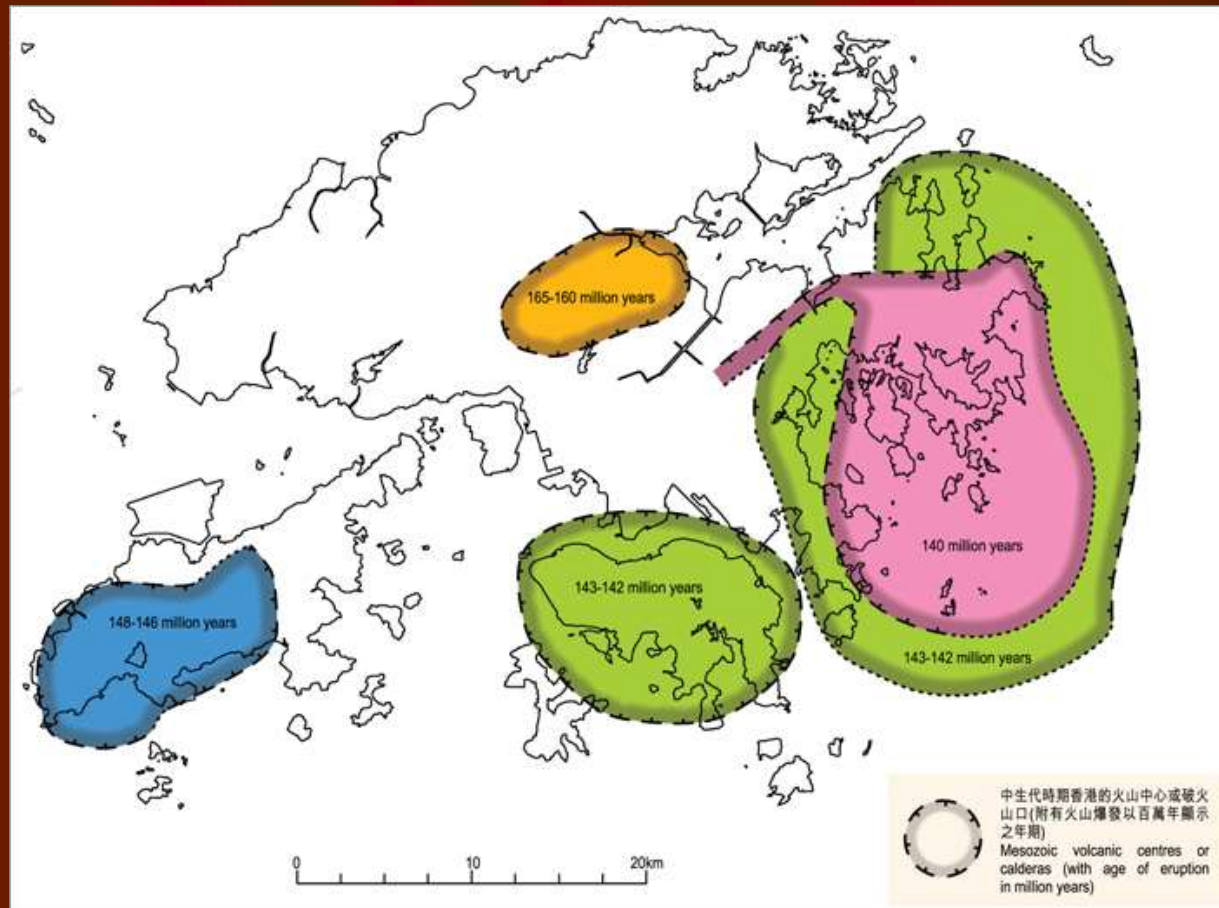
## H.K. Geology

- Quaternary ( 2.6 Mya to present ) : The Ice Age led to lowering of sea level. Down by as much as 120 m at the peak. Sea level rised again after the ice retreated & formed HK's present Ria coast 谷灣海岸 line with up to 260 islets. About 14% of HK's land surface is covered with Quaternary deposits greater than 2 meters thick



# H.K. Geology – Volcanic Rocks

No record until the Mesozoic 中生代 which experienced very active volcanic activities



## H.K. Geology – Volcanic Rocks

- Jurassic Volcanic Rocks 侏羅紀火山岩 ( 200 – 190 Mya)

Tuen Mun Formation – andesite lava



Shing Mun Formation

Tai Mo Shan Formation

Yim Tin Tsai Formation – volcanic bomb in tuff



# H.K. Geology – Volcanic Rocks

- Jurassic Volcanic Rocks 侏羅紀火山岩 ( 200 – 190 Mya)
- Chert beds – Repulse Bay Group at Lai Chee Chong

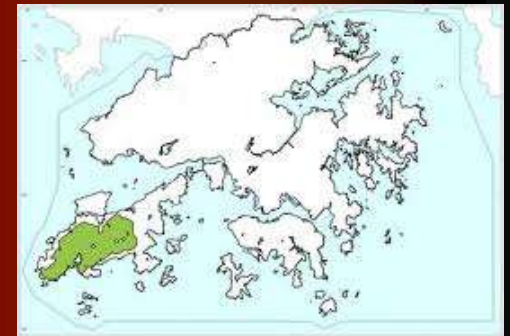


## H.K. Geology

- Middle Jurassic Tsuen Wan Volcanic Group ( 164 – 160 Mya ) – coarse ash crystal tuff & tuff breccia



- Lantau Volcanic Group - Granite



## H.K. Geology – Volcanic Rocks

- Late Jurassic Lantau Volcanic Group ( 148 – 146 Mya ) – rhyolite lava, tuff & volcanoclastic rocks
- Late Jurassic Needle Hill fine grained granite



- Late Jurassic Lantau Dyke Swarm – Feldsparphyric rhyolite





- Cretaceous Volcanic Rocks 白堊紀火山岩 ( 147 – 66 Mya)

Sai Lau Kong Formation

Lantau Volcanic Group

Lai Chi Chong Formation

Long Harbour Formation

Mount Davis Formation

Ngo Mei Chau Formation

Ap Lei Chau Formation

Che Kwu Shan Formation

Mang Kung Uk Formation

Pang Long Wan Formation

Clear Water Bay Formation

High Island Formation

- Early Cretaceous ( 141 - 140 mya) : Kau Sai Chau Volcanic Group 滘西洲火山岩群 – rhyolitic lava and tuff including the hexagonal columns of High Island Formation



# High island Formation : gigantic caldera 巨破火山口



# Eagle's Beak Rock 鷹嘴石 in Tung Lung Chau (東龍島) formed by compressed pumice (浮石)



## Hong Kong Geology – Plutonic Rocks

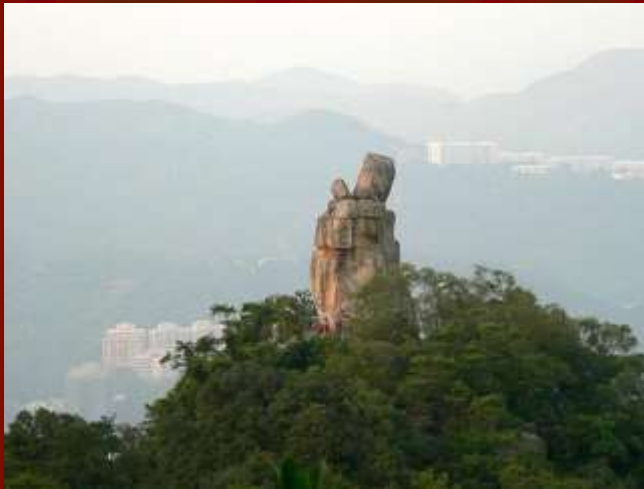
- Jurassic (205 – 144 mya) :  
Lamma suite (南丫島)/Kwai chung (葵涌) suite –  
granitic



## Hong Kong Geology – Plutonic Rocks

- Cretaceous ( 135 Mya ) :

Lion Rock/Cheung Chau Suite - Granite Plutons



# Quartz Monzonite 石英二長岩

It is an intrusive igneous rock containing approximately equal amounts of plagioclase feldspar & alkali feldspar. Quartz Monzonite in Sharp Island is formed by intrusion in Clear Water Bay Formation around 140 Mya ( Cretaceous )

Result of exfoliation 頁狀剝落 (菠蘿包) - 橋嘴洲



# H.K. Geology

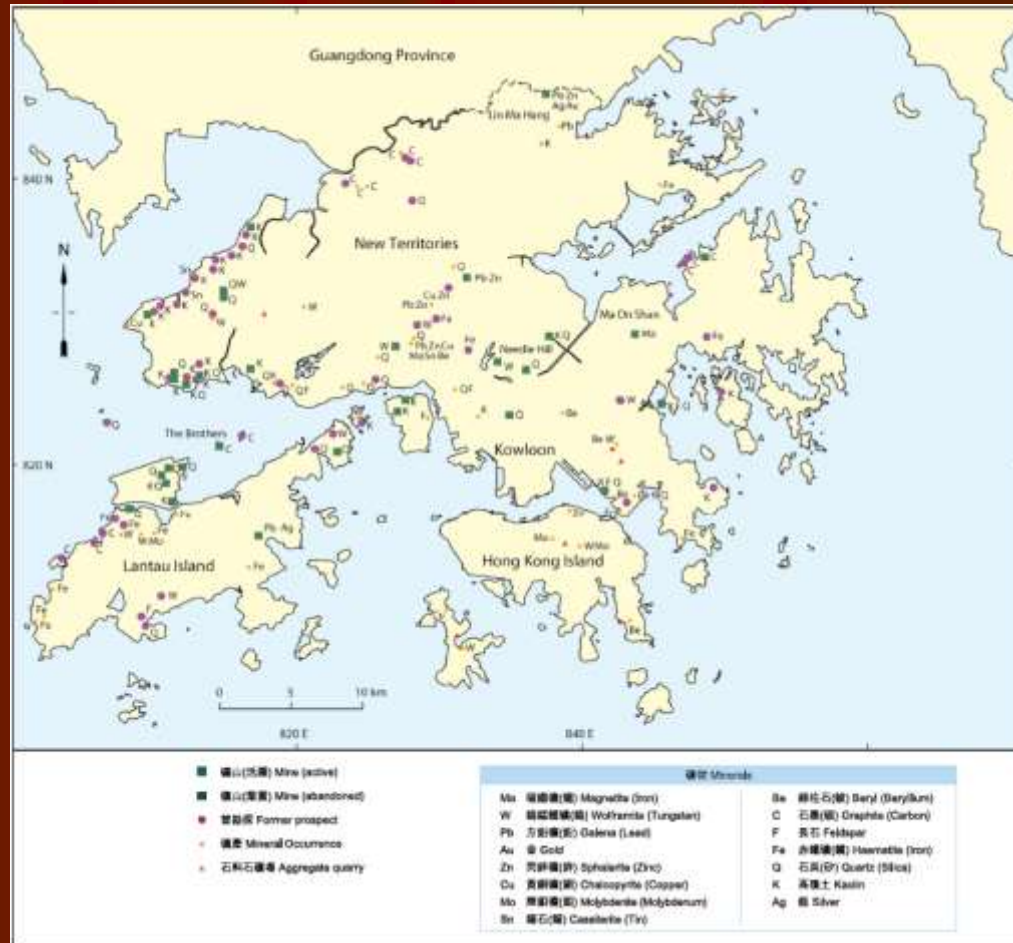
Dolerite dykes 粒玄岩(輝綠岩)脈, Quaternary at Castle Peak power station





# H.K.Minerals 香港礦產

Apart from granite, currently there is no mining activity in HK



# H.K.Minerals

- Iron 鐵 : magnetite:  
Ma On Shan 馬鞍山



- Lead 鉛 : galena : Lin  
Ma Hang 蓮麻坑



# H.K. Minerals

- Wolframite 鎢：  
Needle Hill 針山



- Graphite 石墨：West  
Brother Island 磨刀



# H.K.Minerals

- Molybdenite 鉬：  
Needle Hill 針山

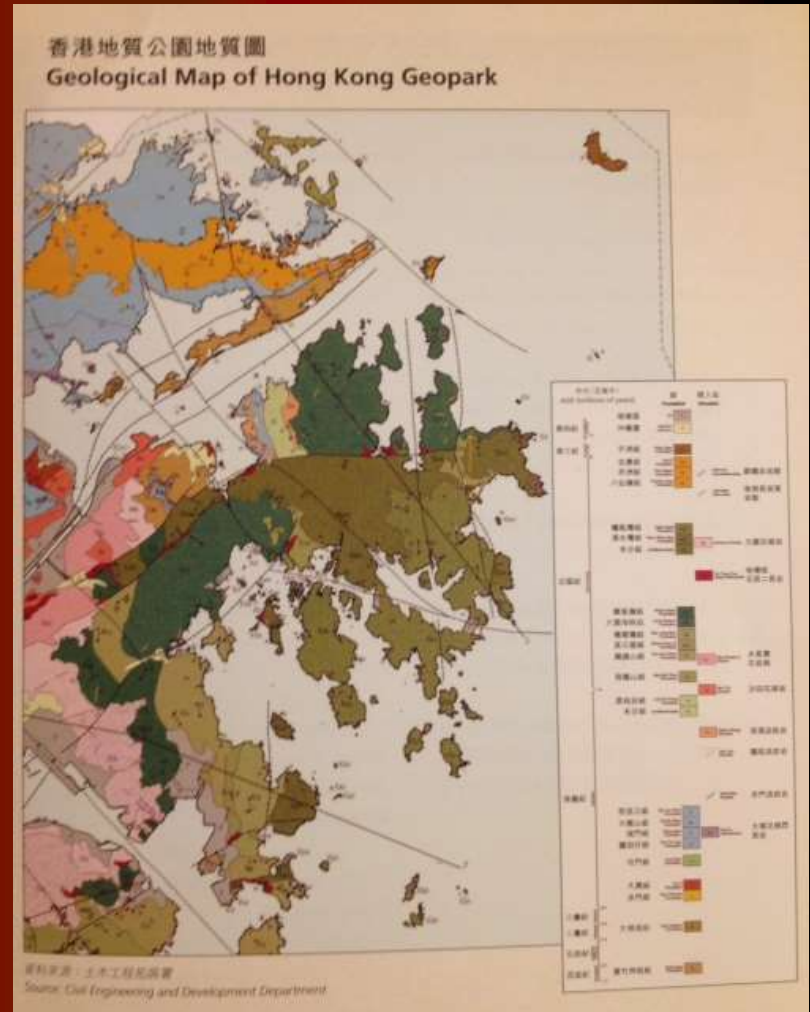


- Kaolin 高嶺土：Cha  
Kwo Ling, Chek Lap  
Kok



# The Geoparks of HK

## 香港地質公園



# Geological Museum in HK

- HKU Stephen Hui Geological Museum : Monday to Friday 1300 – 1800
- Bank of China – The Living Earth exhibition: Closing September 2013
- H K Museum of History Tsim Sha Tsui & Shatin
- Rock Garden at Lion's Nature Education Center, Saikung



**The end**