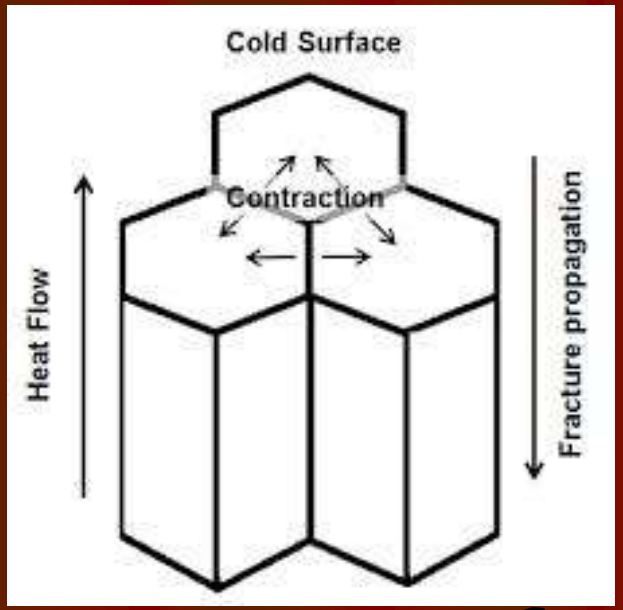
Columnar Joints
柱狀節理

vw2014

Definition

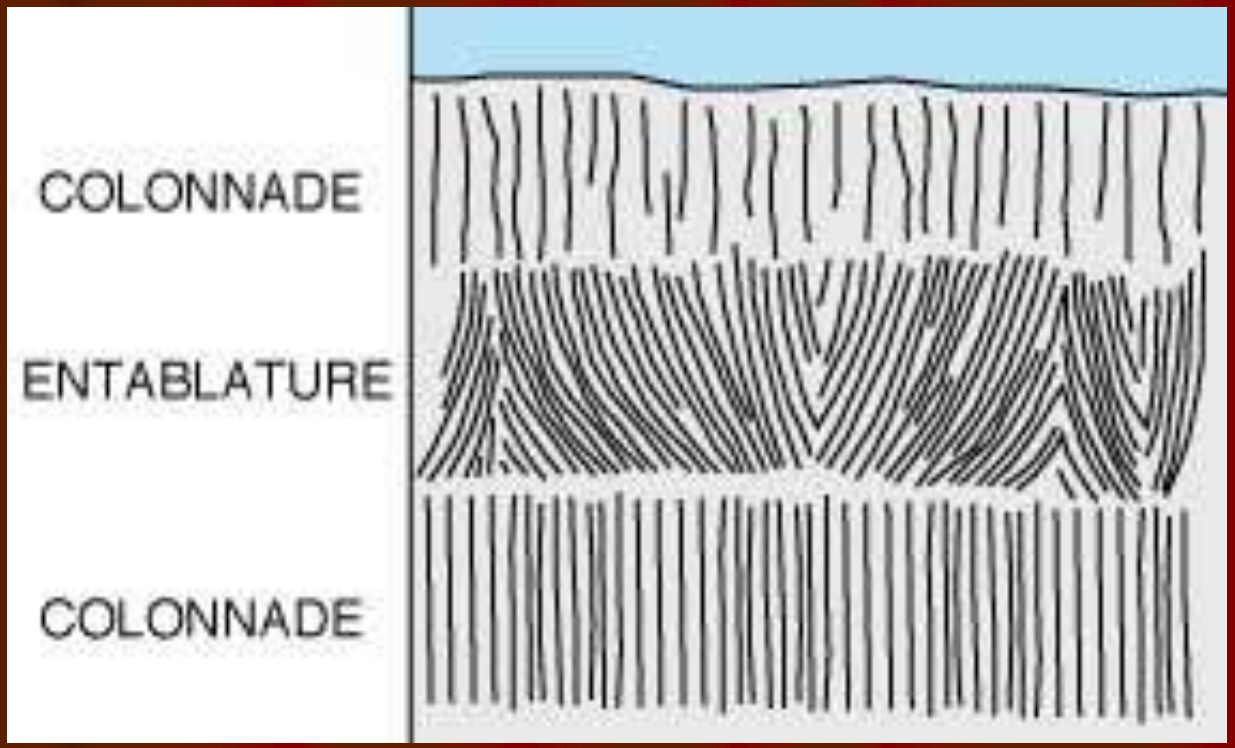
Columnar Joints are defined as parallel prismatic columns 平行棱柱 formed in intrusive & extrusive igneous rocks such as lava flow, volcanic ash, sills, dykes due to uneven cooling. They can vary from having 3 to 12 sides but hexagonal columns are most common.



Terminology

COLONNADE : straight & regular columns

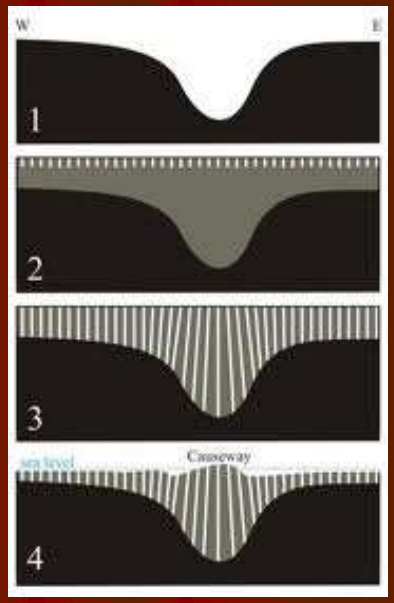
ENTABLATURE : irregular (curved) & fractured columns



World famous sites

1. Giant's Causeway

Columnar joint was first made famous by the basaltic columns located in the "Giant's Causeway" in North Ireland 巨人堤道 - 50,000 columns with diameter of 0.5 m



Giant's causeway Ireland







Giant's causeway Ireland






The folklore is about two giants one living in Ireland & the other in Scotland each wanted to eliminate the other via the causeway

2. Fingals Cave Staffa Island

The "home" of the Scottish giant !

3. Columnar Joints in Iceland

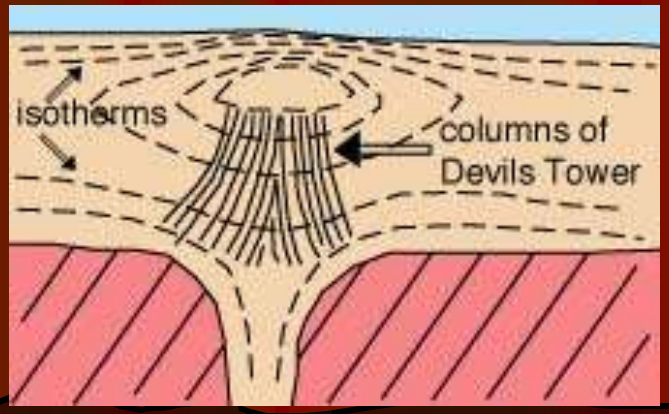
formed by basalt can be found in many locations eg. at the Jokulsargljufur National Park as well as at Reyniddrangur Beach






4. Columnar joints at Devil's Tower/Bear Tower, Wyoming

Rising 386m above the surrounding terrain, it is a laccolith of phonolite porphyry formed 65 Ma. The story of the 3 Indian princesses escaped bears claws



5. Devil's postpile, California

Formed by basalt being deposited in a 9 by 18 miles depression

6."Organ Pipes" located south of Twyfelfontein Namibia

Vertical basalt slaps formed 125 ma when the super continent Gondwana separated Africa from South America

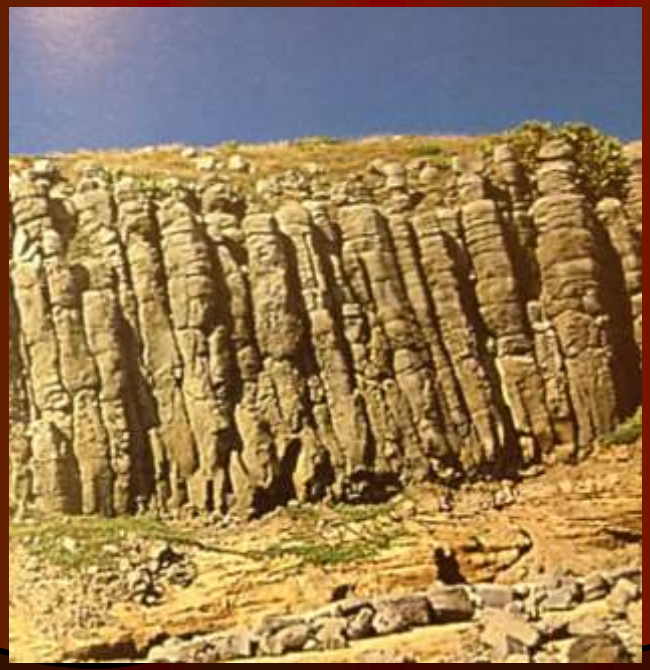
7. Dolerite 粗粒玄武岩 "Organ Pipes" in Tasmania

Formed in the Jurassic 160 Ma by mafic magma (less than 55% silicate) cooled a few hundred meters below the earth's surface

8. Basalt columnar joints in Jungman, Jeju Island
濟洲島大浦洞, S. Korea

9. Basalt columnar joints in Peng Hu Island 澎湖島桶盤嶼

Taiwan 14 Ma, 300 pillars diameter 1.5 m, height 20m. Island visited by the HK Geological Society in May 23-27,2014



Peng Hu Island

Peng Hu Island





Peng Hu Island

Peng Hu Island

10. Columnar joints in Shen Yan 山陰, W. Honshu Japan basalt columns

11. Columnar joints in Genbudo, Hyogo Japan
basalt columns in 5 caves 兵庫縣青龍洞

12. Columnar joints in Takachihokyo, Kyushu, Japan

九洲宮崎高千穂峡 all basalt

13. Columnar joints in Tsumekizaki Japan - basalt

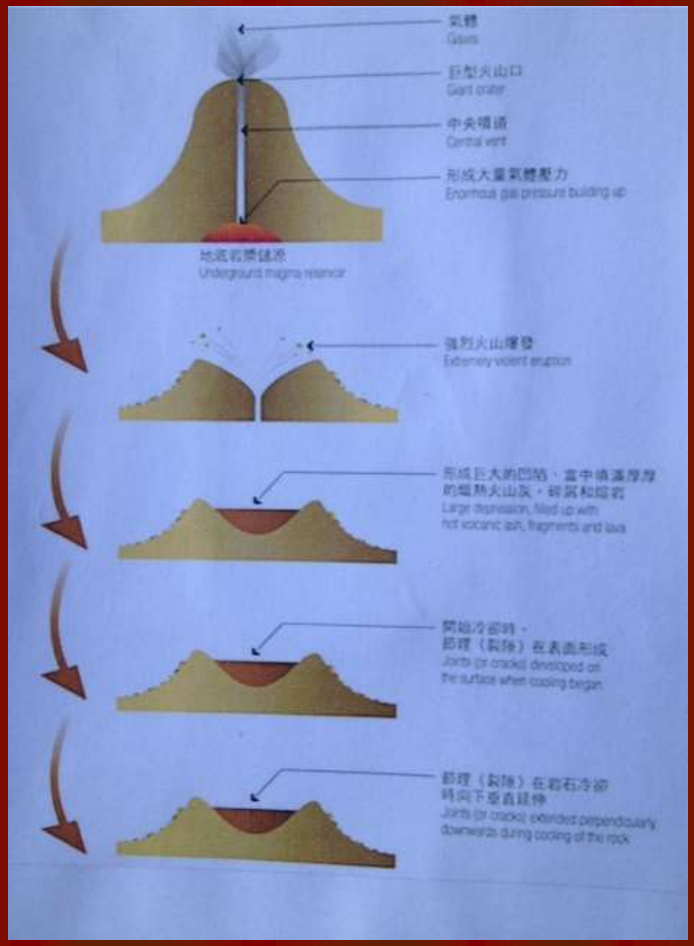
14. The High Island Formation in HK

Characteristic of HK's columnar joints

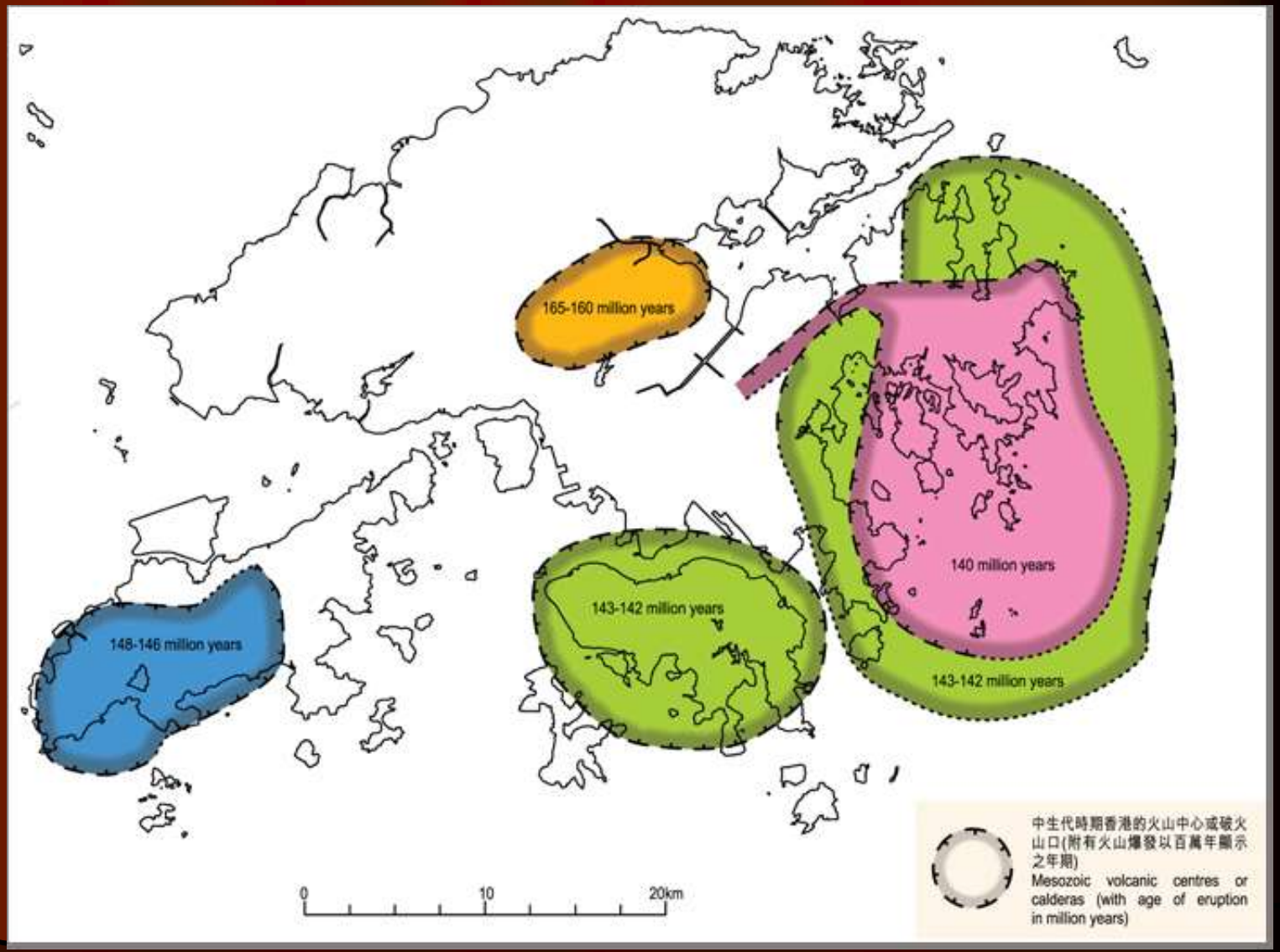
- Size wise it is huge – 200,000 columns with diameter between 1 to 3 m & 30 m in height

- Most hexagonal columns in the world were formed by Basalt. The columns in HK were formed during Early Cretaceous (140 Ma) by hardened volcanic ash in a caldera some 20 km in radius. The rock so formed is called Rhyolitic Ash Tuff 流紋質凝灰岩 which is acidic

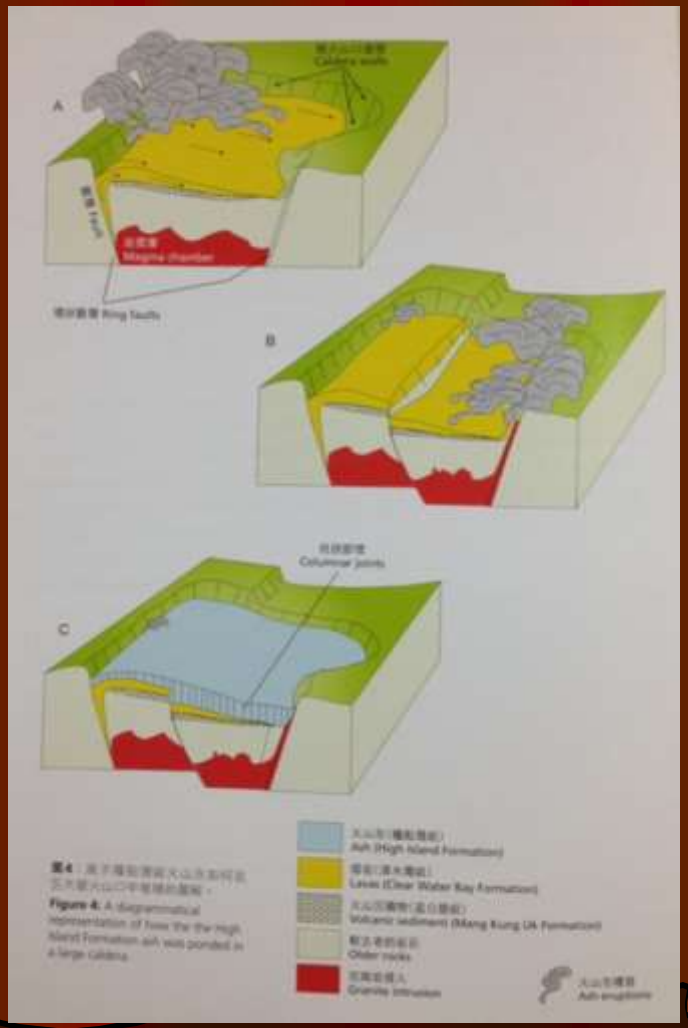
Formation of the columns – the ash is estimated to be at least 400 m thick



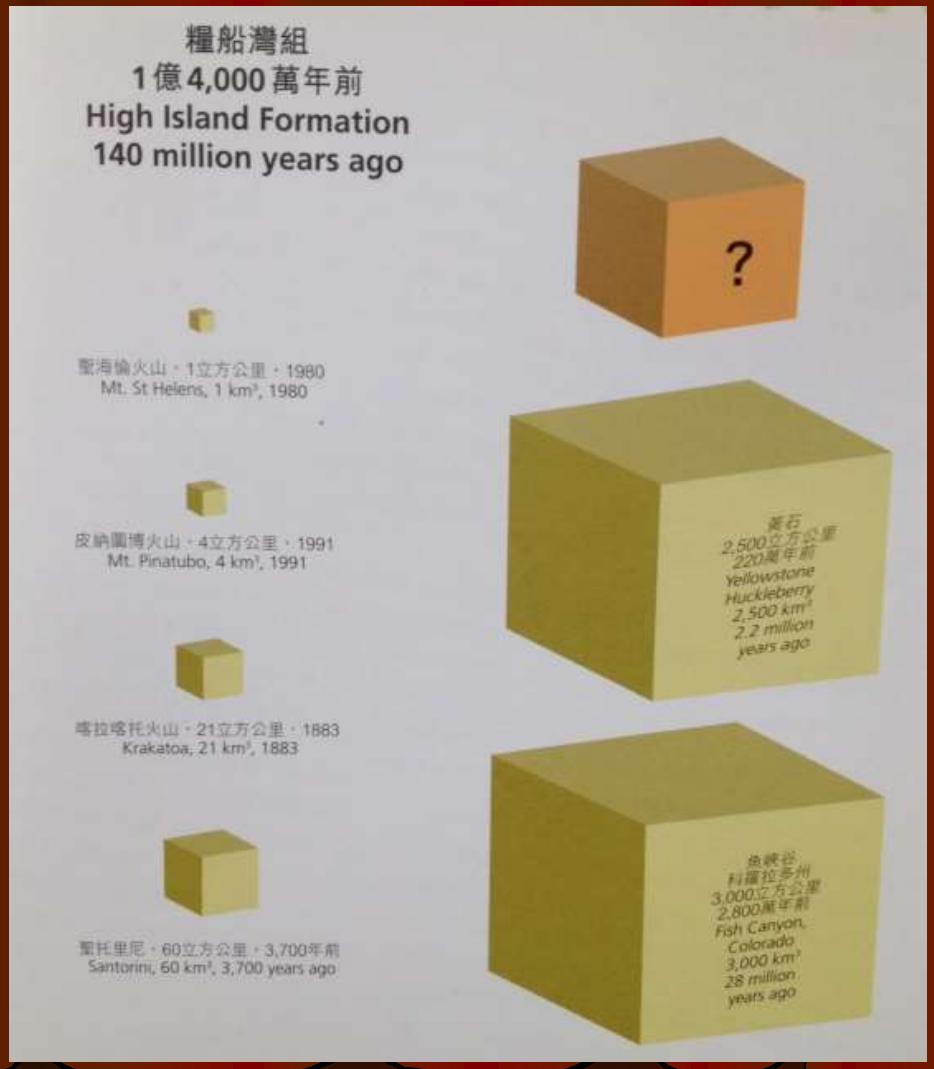
Mesozoic (250-65 Ma) volcanic activities in HK



A huge ancient caldera 20 km in diameter formed 140 Ma filled with volcanic ashes later solidified into rhyolitic ash tuff covering an area of 100 km2 & up to 400 m thick

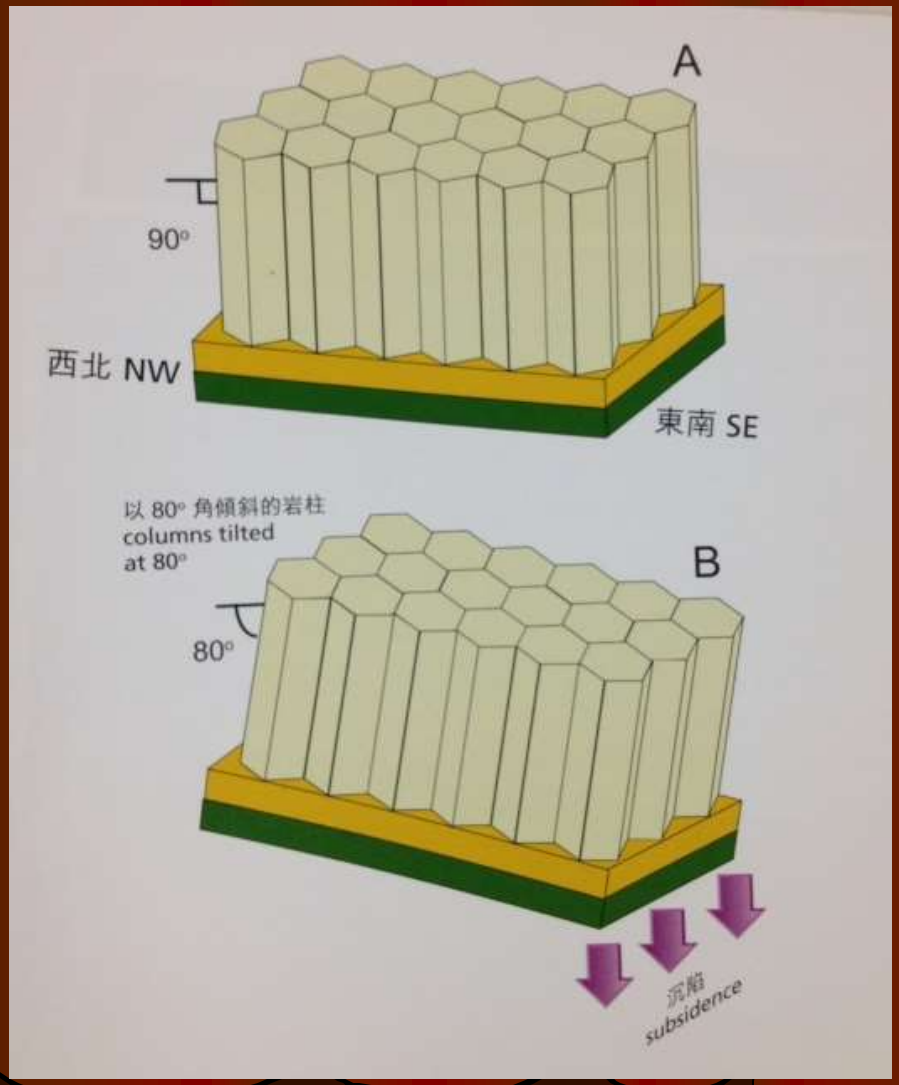


Estimated eruption volume



- 1. Mt. St. Helen : 1 km3/ 1980
- 2. Mt. Pinatubo : 4 km3/ 1991
- 3. Krakatoa : 21 km3/ 1883
- 4. Santorini : 60 km3/ 3,700 ya
- 5. **High Island** : 400km2 ?/ 140 Ma
- 6. Yellowstone : 2,500 km3/ 2.2 Ma
- 7. Fish Canyon : 3,000 km3/ 28 Ma

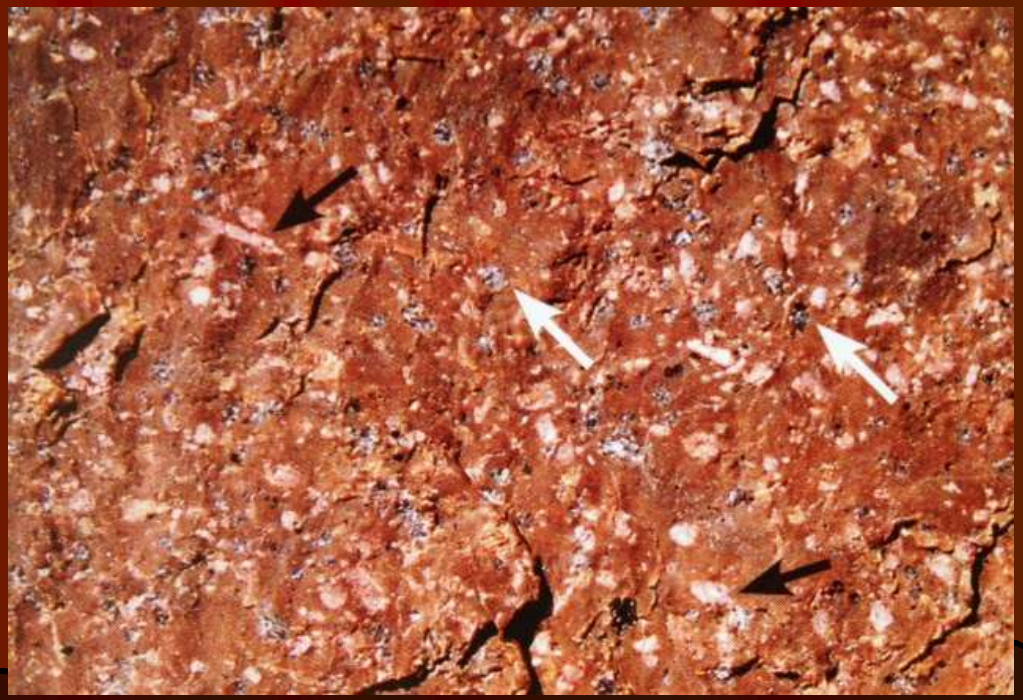
Some of the columns are tilted towards the NW

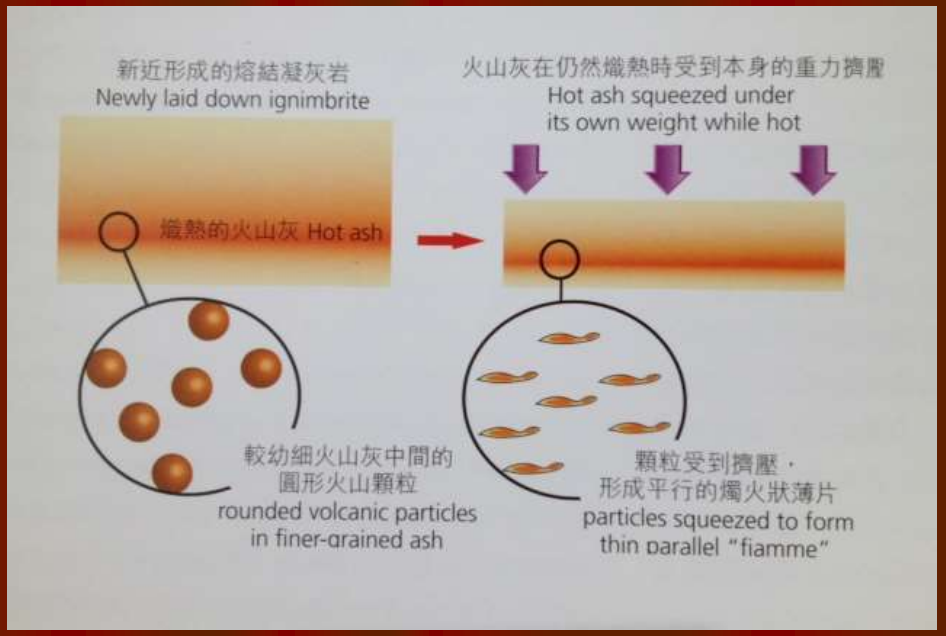


The Rock

- The rock is described as a crystal bearing, welded, fine grained vitric (glassy) tuff 細粒玻屑凝灰岩 belonging to the High Island Formation 糧船灣組 Kau Sai Chau Volcanic Group 滘西洲火山岩群

- White arrows show quartz 石英, black arrows feldspar 鉀長石 surrounded by crystals that are too small for the naked eye to recognize

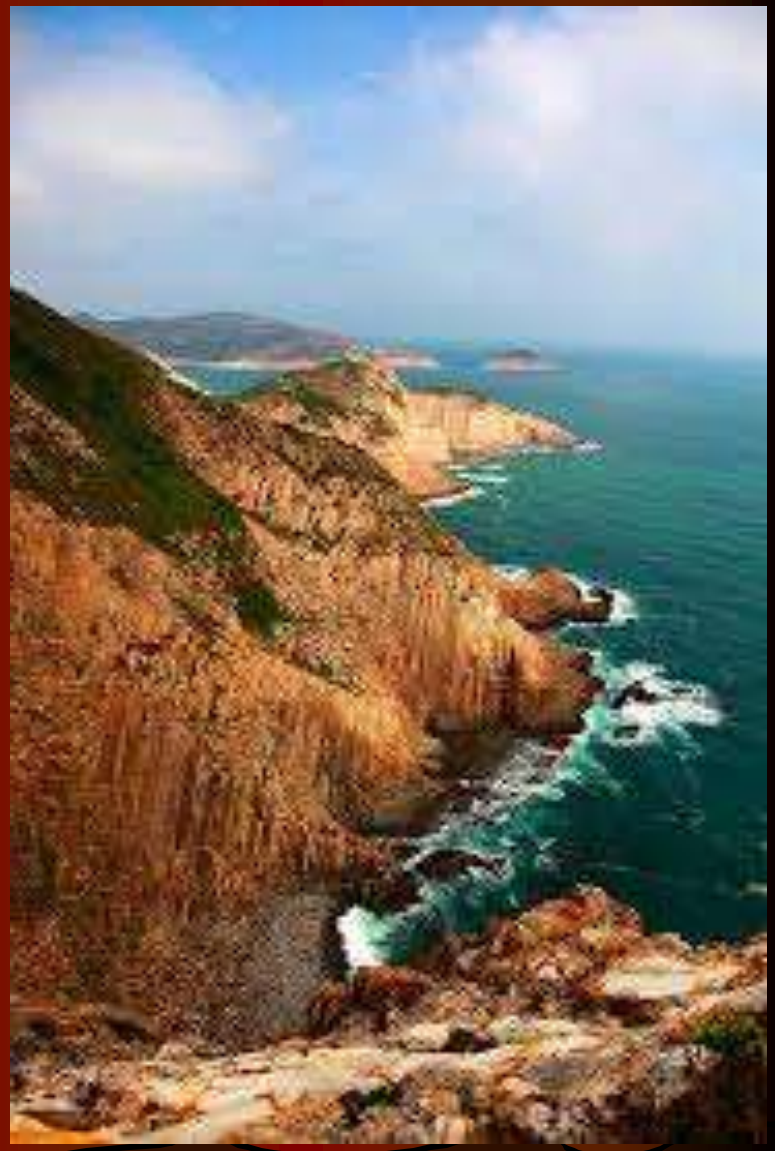



新近形成的熔結凝灰岩
Newly laid down ignimbrite
火山灰在仍然熾熱時受到本身的重力擠壓
Hot ash squeezed under
its own weight while hot
熾熱的火山灰 Hot ash
較幼細火山灰中間的
圓形火山顆粒
rounded volcanic particles
in finer-grained ash
顆粒受到擠壓，
形成平行的燭火狀薄片
particles squeezed to form
thin parallel "fiamme"

What to see at the East Dam

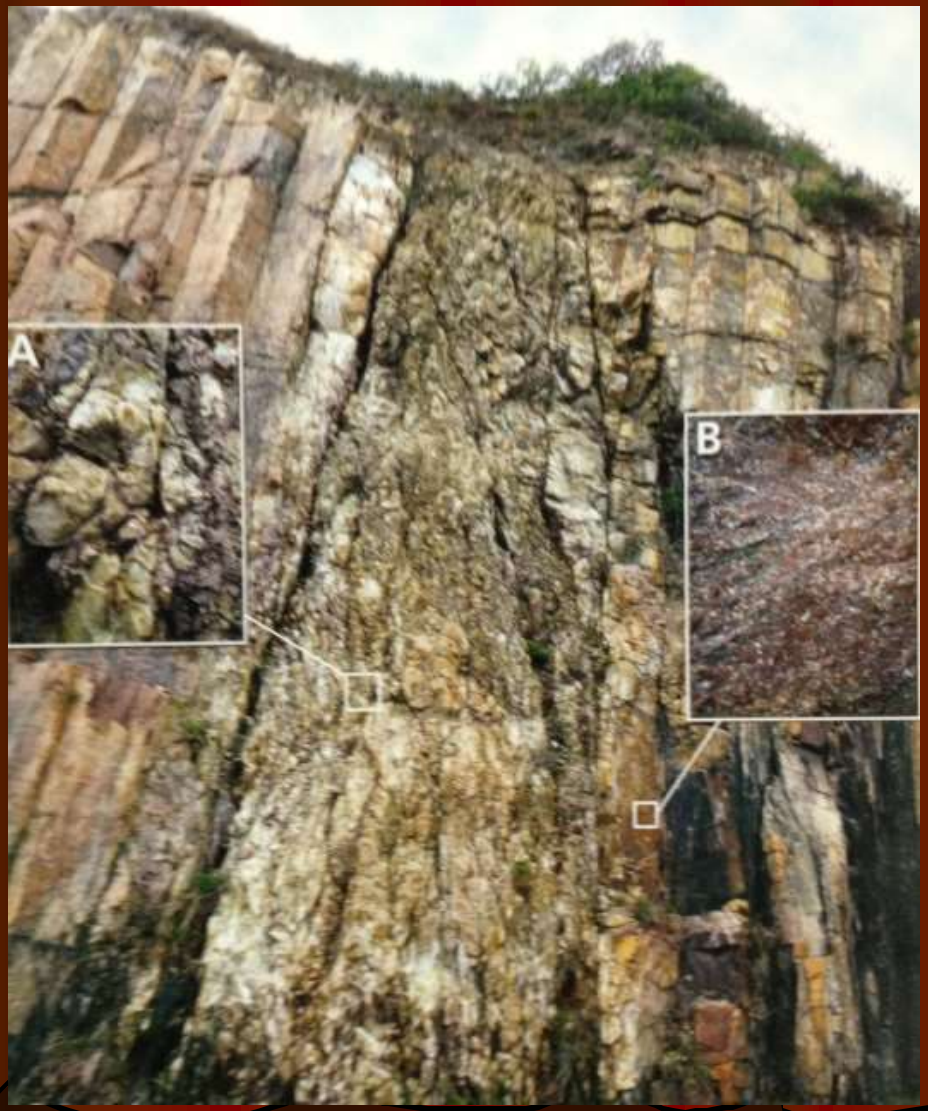
E6 : High Island Coastal view near Fa Shan 花山 note tilted Columns

High Island Coastal view



E7 : The East Dam Columnar Joints

E7 : columns crushed by a fault



- A : Broken rock at the disrupted columns by the fault
- B : Normal rock face at the undisrupted columns

E7 : Bended columns being intruded by a dark gray basaltic dyke

E7 : Tilted columns near the basalt dyke

E7 : Sea Cave below the main dam, careful when entering

The East Dam

Columnar joints at the edge of the reservoir next to the pathway leading towards Long Kai 浪茄

E8 : The “Heart of Hong Kong”

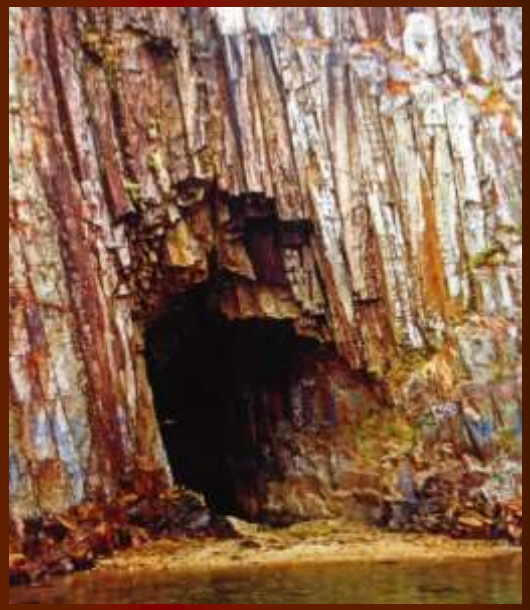
E9：Po Pin Chau 破邊洲 – a classic stack

E9 : other views of Po Pin Chau

Surrounding Islands – The Ung Kong Group 甕江群島 (Bluff Island 沙塘口山, Basalt Island 火石洲, Wang Chau 橫洲, Town Island 伙頭墳洲) & Nine Pin Island Group 果洲群島

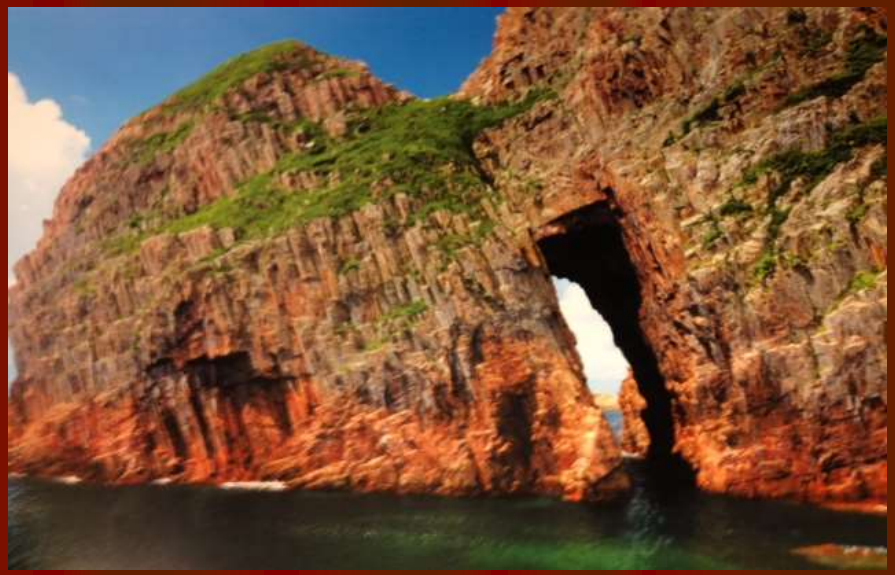
Bluff Island 沙塘口山 also known as Ung Kong Cha 甕缸洲

Bluff Island 沙塘口山/ Ung Kong Cha 甕缸洲

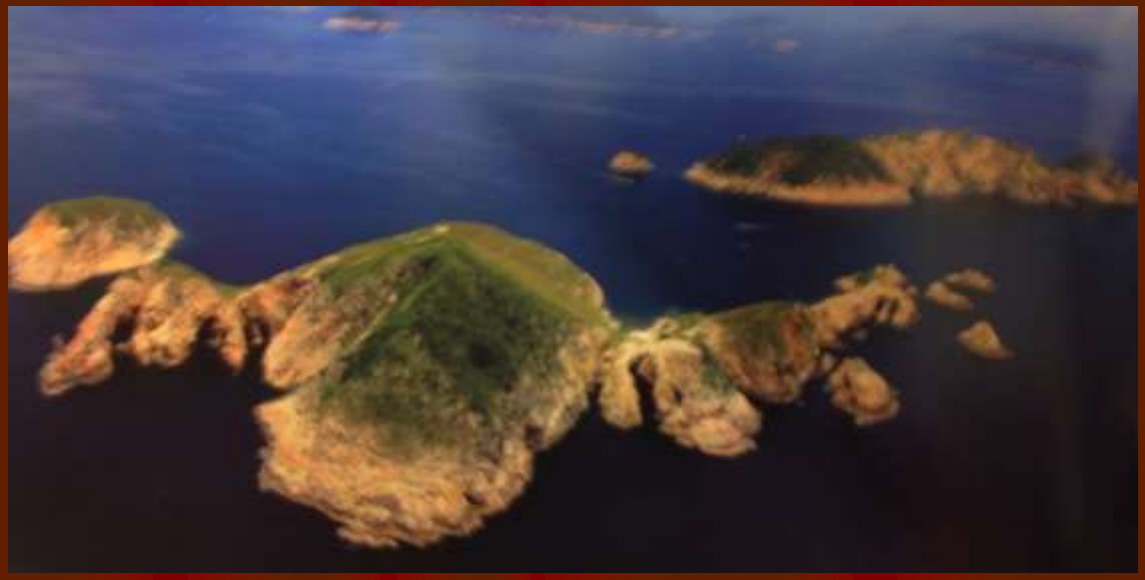


Wang Chau 橫洲/ Hole Island- called " Little Taiwan" due to the shape of the cave which resembles the shape of Taiwan

Basalt island 火石洲 - 關刀大洞



Ninepin Group 果洲群島



Ninepin Group 果洲群島



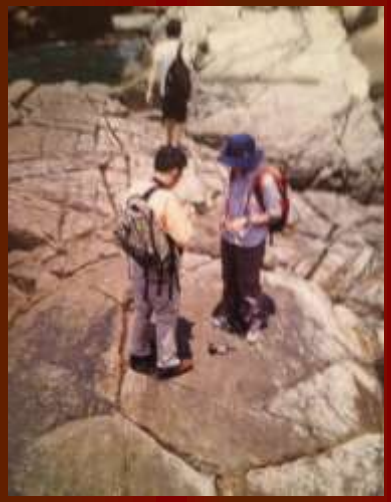


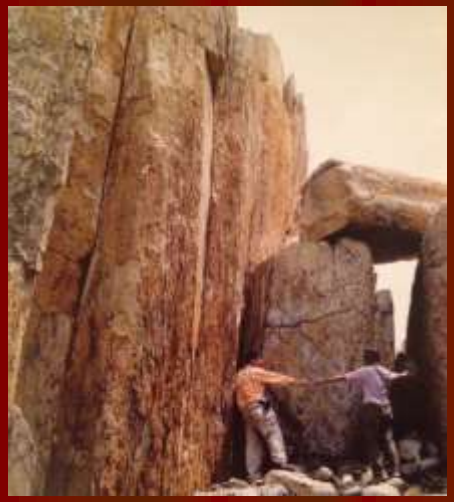



Ninepin Group 果洲群島

Ninepin Island : the famous “spiral staircase”

Ninepin Island : coffin rock !





The End