

香港超級火山

Hong Kong's
Supervolcano



土木工程拓展署
土力工程處
Geotechnical Engineering Office
Civil Engineering and
Development Department

內容 Contents

普通火山和超級火山的分別

Difference between a Volcano and a Supervolcano

P.2-5

香港超級火山是如何被發現?

How was Hong Kong's Supervolcano Discovered then?

P.6-7

香港岩石分佈

Distribution of Rocks in Hong Kong

P.8-9

超級火山噴發和相關岩石形成的過程

Supervolcanic Eruption and Associated Rock Forming Processes

P.10-17



小朋友，有沒有想過
香港曾經有過超級火山呢？
Little kid, have you ever imagined
there was a supervolcano
in Hong Kong before?

哇！究竟火山在哪裡？
火山噴發是怎樣呢？
Wow! Where's the volcano?
How did it erupt?



讓我們一起了解更多香港超級火山的故事。
Let's find out more about the story of
Hong Kong's Supervolcano.

普通火山和 超級火山的分別

Difference between
a Volcano and a Supervolcano

超級火山是噴發規模極大的火山，
其猛烈程度會以火山爆發指數(VEI)來劃分。

A supervolcano is a volcano associated
with a massive-scale eruption. The magnitude
of a volcanic eruption is classified
by using the Volcanic Explosivity Index (VEI).

超級火山屬於最高級別的第8級噴發，
其噴發物體積超過1,000立方公里。

Supervolcanoes have a VEI of 8, which means
over 1,000 km³ of materials are being erupted.

火山爆發指數 Volcanic Explosivity Index

火山爆發指數(VEI)共分8級，其中一個準則
是以噴發物體積來劃分。VEI每上升一級，
代表噴發物體積大10倍。

One of the criteria for assessing the VEI is based
on the volume of ejected materials. There
are eight levels, each level denoting
ten times the volume.





普通火山和 超級火山的分別

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Lv1
> 0.0001 km³



Lv2
> 0.001 km³



Lv3
> 0.01 km³



Lv4
> 0.1 km³



Lv5
> 1 km³



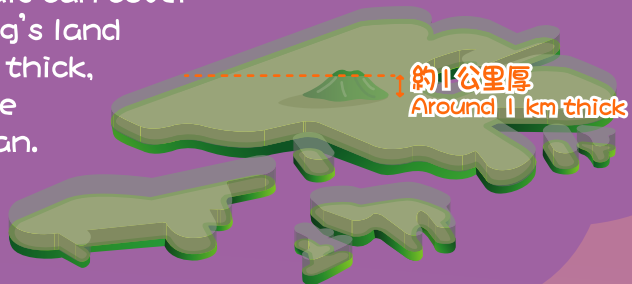
Lv6
> 10 km³



Lv7
> 100 km³

這些噴發物足以覆蓋整個香港陸地面積，
厚度約1公里，和大帽山的高度相若。

The ejected materials can cover
the whole Hong Kong's land
area of around 1 km thick,
corresponding to the
height of Tai Mo Shan.



超級火山噴發通常每一萬至
十萬年才發生一次。世界各地
都有超級火山的足跡。

The frequency of supervolcanic eruptions
is only about once every 10,000 to
100,000 years. The footprint of
supervolcanoes straddles across our planet.





香港超級火山是如何被發現?

How was Hong Kong's Supervolcano Discovered then?

地質學家多年來進行實地考察、收集地質數據、進行實驗室工作，並繪製地質圖。

Geologists have spent many years conducting fieldwork, collecting geological data, carrying out laboratory work and producing geological maps.

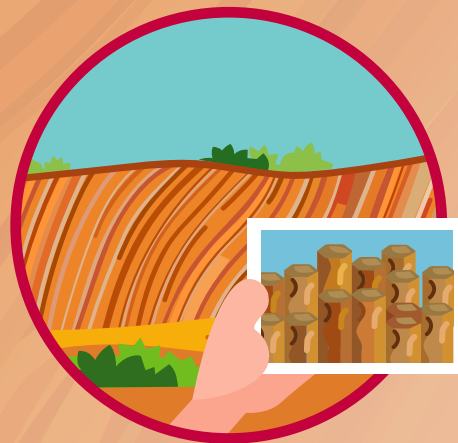


實地考察

Fieldwork

收集岩石樣本，觀察礦物和岩理。

Collecting rock samples to observe minerals and rock texture.



收集地質數據

Collection of Geological Data

透過筆錄和繪圖，從而整合岩石分佈的資料。

Consolidation of information on distribution of rock types by taking field notes and making sketches.

實驗室工作

Laboratory Work

在顯微鏡下進行岩性分析，透過放射性年齡測定法，鑑定岩石的年齡。

Conducting analysis of rock composition under microscope and determining the age of the rocks by radiometric dating.



繪製地質圖

Production of Geological Maps

繪製地質圖，將各種不同的地質資料，例如岩石分佈，透過圖像展示出來。

Producing geological maps as visual representations of geological information, such as the distribution of rock types.

香港岩石分佈

Distribution of Rocks in Hong Kong

香港大約百分之八十五土地面積的岩石都是由岩漿冷卻和凝固而成的火成岩，其中火山岩佔大約百分之五十，花崗岩類則佔大約百分之三十五。

Igneous rocks, which were formed through cooling and solidification of magma, account for about 85% of Hong Kong's land area. Around 50% of the igneous rocks are volcanic rocks, and 35% are granitic rocks.

圖例 Legend

-  火山岩 Volcanic Rocks (50%)
-  花崗岩類 Granitic Rocks (35%)
-  其他岩石 Other Rocks (15%)



資料區 Box

花崗岩類與火山岩的分別

Granitic Rocks vs Volcanic Rocks

花崗岩類是岩漿在地球深處冷卻而形成的。岩漿上升期間被困，導致冷卻過程非常緩慢，讓礦物有足夠時間凝固，結成體積相對較大的晶體。

火山岩是當岩漿向上湧出噴發，並在地面冷卻而形成。噴出的岩漿暴露於溫度較低的地面，其冷卻及凝固速度相對較快，因而形成體積相對較小的晶體，甚至沒有晶體。

Granitic rocks are formed deep within the Earth as the magma cools down. The rising magma is trapped where it cools very slowly. Slow cooling allows sufficient time for individual minerals to grow and form relatively large crystals.

Volcanic rocks are formed when magma is erupted at the Earth's surface. The erupted magma cools and solidifies relatively quickly when it is exposed to the ground surface of cooler temperature, resulting in formation of relatively small crystals or even no crystals.

進一步研究之下，地質學家發現香港東面的火成岩跟超級火山噴發有關。

Through further studies, geologists discovered that the igneous rocks in eastern Hong Kong were related to supervolcanic eruption.

香港的超級火山噴發時間估計在一億四千萬年前。

Hong Kong's supervolcanic eruption took place around 140 million years ago.

超級火山噴發和 相關岩石形成的過程

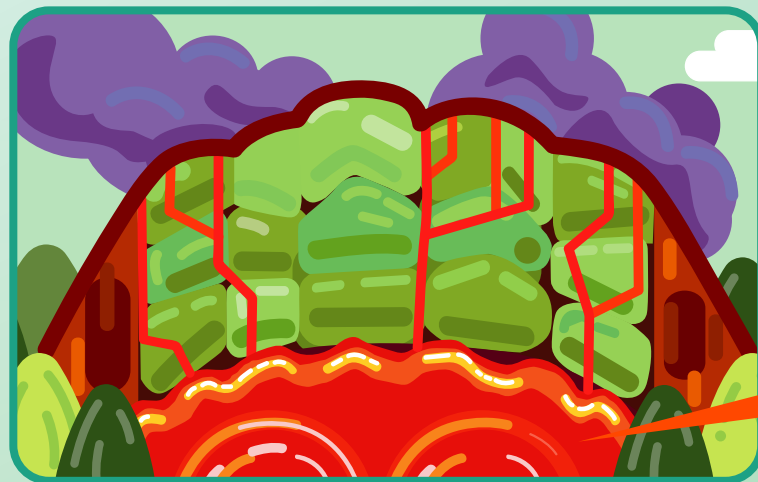
Supervolcanic Eruption and Associated Rock Forming Processes



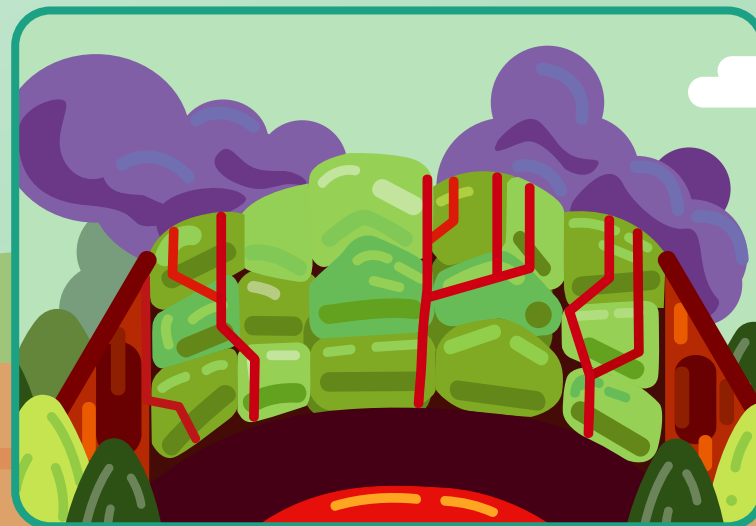
這麼大的超級火山現在
到哪裡去了？
Where is the supervolcano now?



小朋友，讓我們一起用透視鏡
看看超級火山裡面的情況！
Little kid, let's find out what's inside
the supervolcano through the lens!

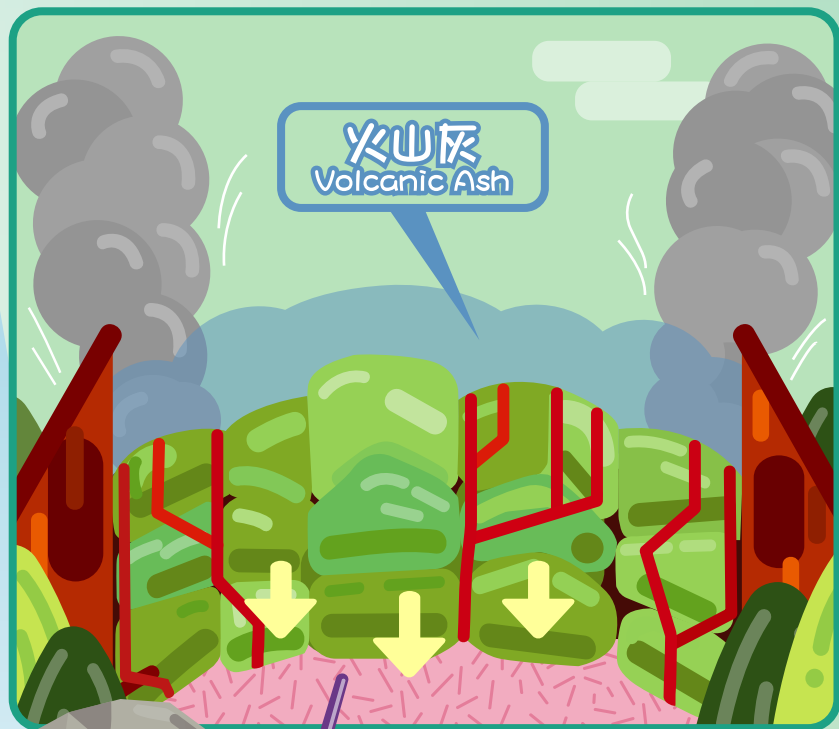


岩浆
Magma



這次超級火山噴發後，火山底部沒有了
岩漿的支撐。

After the supervolcanic eruption, the base of the
supervolcano was no longer supported with the
magma chamber emptied.



火山灰
Volcanic Ash



火山頂部崩塌，形成了破火山口。
The top part of the supervolcano collapsed, forming a caldera.



火山岩
Volcanic Rocks

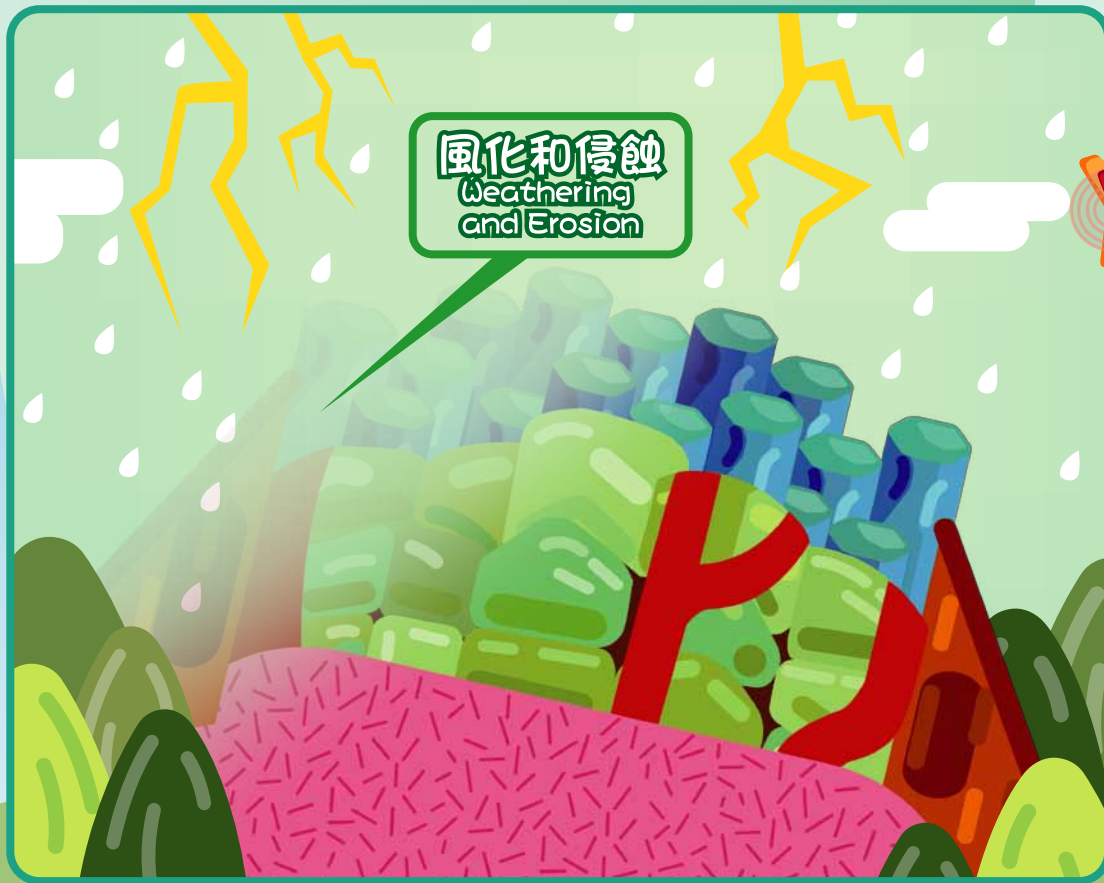
火山岩
(六角岩柱)
Volcanic Rocks
(Hexagonal
Rock Columns)

岩牆
Dyke

花崗岩類
Granitic Rocks

破火山口頂部有火山岩，底部有花崗岩類。

The top part of the caldera consists of volcanic rocks, while the base consists of granitic rocks.

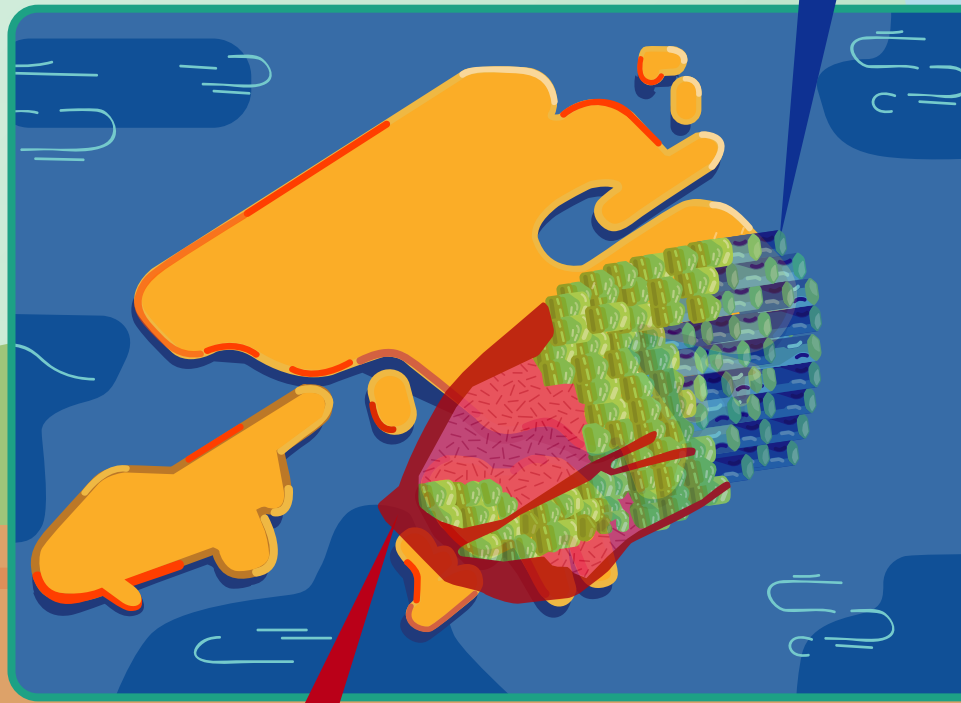


風化和侵蝕
Weathering
and Erosion



從上空俯瞰超級火山，
是不是很壯觀呢？
The supervolcano looks
magnificent when viewed
from the sky! Isn't it?

破火山口頂部
Top of the Caldera



破火山口底部
Base of the Caldera

受地殼運動影響而傾斜，經歷長年風化和侵蝕後，
破火山口的結構便跟現時香港東面的岩石分佈符合了。
The present distribution of the rocks in eastern Hong Kong
fits well with the configuration of a caldera as it underwent
tilting associated with tectonic activities, as well as years
and years of weathering and erosion.

雖然完整的超級火山結構已經不復再現，但我們仍然可以透過香港超級火山的遺跡，例如西貢萬宜水庫一帶的六角岩柱，去了解香港過去的火山活動。

Although the structure of Hong Kong's supervolcano is no longer intact, we can still understand the previous volcanic activities in Hong Kong through the remnants of the supervolcano, such as the magnificent hexagonal rock columns around High Island Reservoir of Sai Kung.

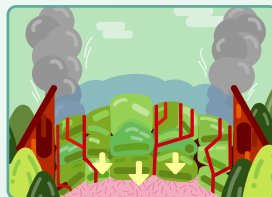
西貢萬宜水庫一帶的六角岩柱。

The hexagonal rock columns around High Island Reservoir of Sai Kung.

資料匣 Box

六角岩柱的形成

Formation of Hexagonal Rock Columns



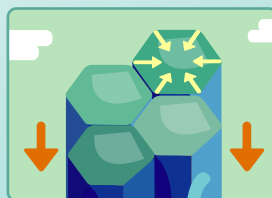
當超級火山噴發時，破火山口形成並由熾熱的火山灰填滿。

During the supervolcanic eruption, the caldera was formed and eventually filled up with hot volcanic ash.



隨火山灰在破火山口盆地冷卻收縮，形成從上到下由冷卻表面擴展的冷卻節理。

As the ash cooled in the caldera depression, thermal contraction caused cooling joints to develop which then propagated down perpendicular to the cooling surface.



冷卻節理以六邊形的形態形成，是因為要最有效地釋放拉伸應力。

These cooling joints were formed in a hexagonal pattern as this is the most efficient arrangement for releasing tensile stress.

六角岩柱
Hexagonal Rock
Columns



超級火山的崩塌標誌著香港火山活動的終結，再噴發的機會不大。如果有時間，不妨到西貢參觀，好好欣賞大自然為我們帶來的地貌吧！

The collapse of the supervolcano hinted the end of volcanic activities in Hong Kong and the supervolcano is unlikely to erupt again. If you have time, let's visit Sai Kung and appreciate the landscape brought by our mother nature together!

超級火山會有一天突然再噴發嗎？

Will the supervolcano erupt again someday?



香港岩石

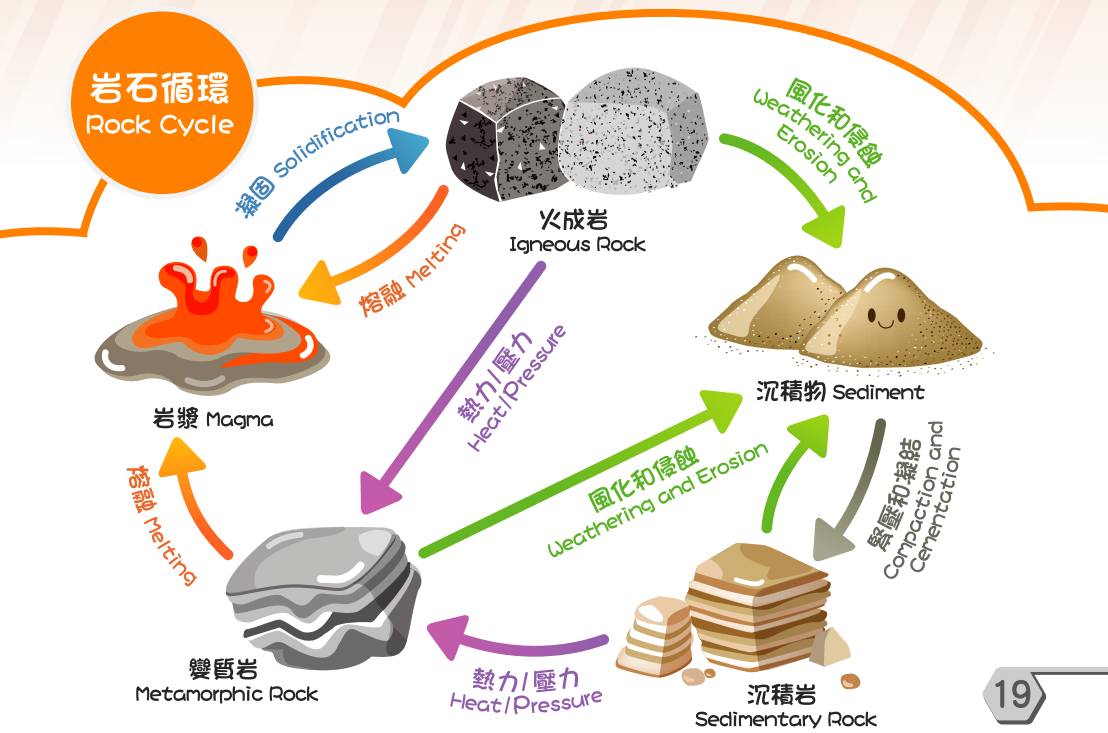
Rocks in Hong Kong

剛才我們提到香港大約百分之八十五土地面積都是由火成岩組成，剩下的百分之十五土地面積由沉積岩和變質岩組成。然而，這兩種岩石的分佈範圍非常狹窄，大多位於香港東北部和西部。

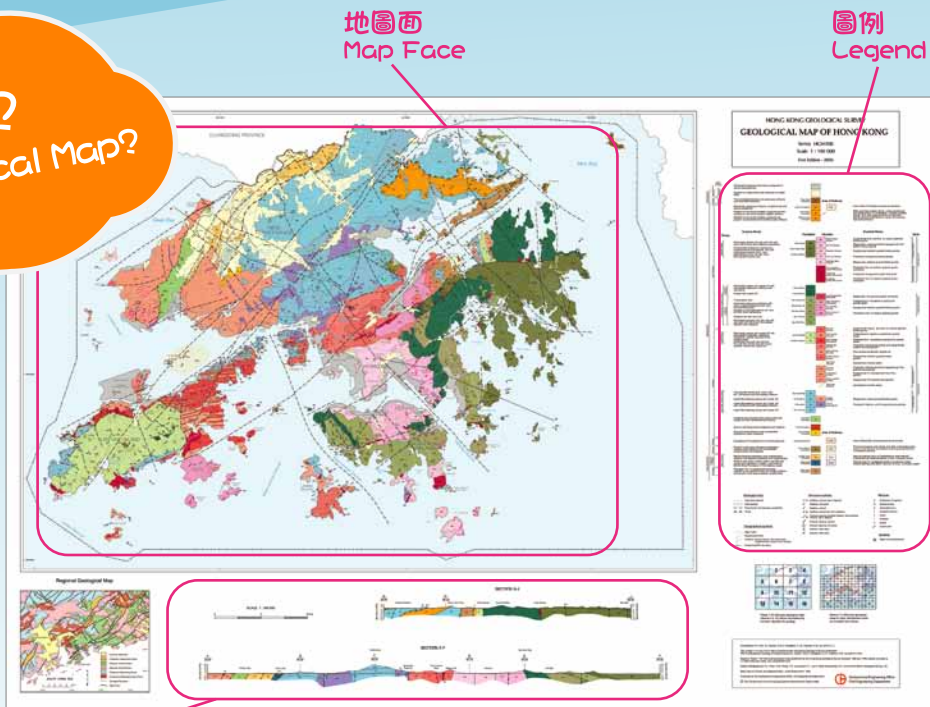
香港的沉積岩主要由已存在的岩石被侵蝕後剝落的碎屑而形成。變質岩是由已存在的岩石受到高溫及/或高壓而形成。

Just now, we mentioned that igneous rocks account for about 85% of Hong Kong's land area. The remaining 15% of land area is occupied by sedimentary and metamorphic rocks. However, these two types of rocks are very restricted in distribution and mainly found in the northeastern and western parts of Hong Kong.

Sedimentary rocks in Hong Kong are mainly formed from the eroded clasts of pre-existing rocks. Metamorphic rocks are formed when a pre-existing rock is subject to high temperature and/or high pressure.



甚麼是地質圖？ What is a Geological Map?



剖面圖
Cross-sections

香港地質調查1:100,000比例香港地質圖
Hong Kong Geological Survey 1:100,000-scale Hong Kong Geological Map

Geological maps contain information about different rock types. Geologists compile a geological map mainly by fieldwork and data interpretation. They mark the positions of a variety of rock types and present them on the map by using different colours.

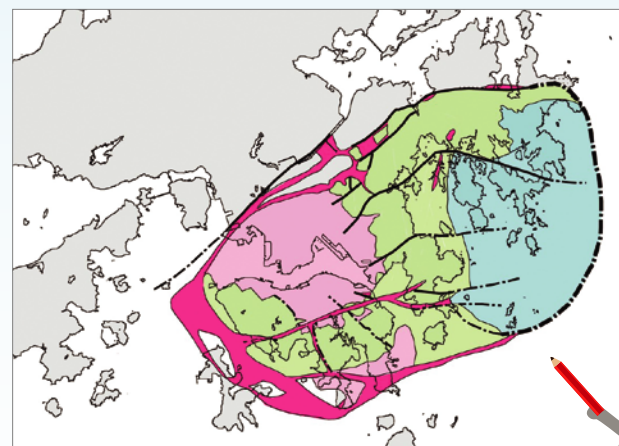
Other important geological data, such as the distribution of superficial deposits and location of geological structures, will also be placed on the map in terms of polygons, lines and symbols. A legend will be included in the geological map to explain the meaning of the above information. Geological maps usually include one or more representative cross-sections, which allow the readers to better understand the subsurface geology.

It is worth noting that a geological map is an interpretation by geologists, based on the available information at the time when the map was prepared. Geological maps can be revised and improved as more data become available.

地質圖包含不同岩石類型的資料。地質學家主要透過野外考察以及詮釋數據，從而繪製地質圖。他們會使用不同顏色，把各種岩石的位置標記在地圖上。

重要的地質數據，例如表土沉積物的分佈、地質結構的位置等，亦會以圖形、線條和符號的形式在地圖上展示。地質圖圖例可以解釋以上資料。另外，地質圖一般都包括一個或以上具代表性的剖面圖，讓讀者更能理解地面下的地質。

值得留意，地質圖僅表達了地質學家於製圖時，對所得的資料詮釋。隨著數據增加，地質圖可進一步得以修訂和改進。

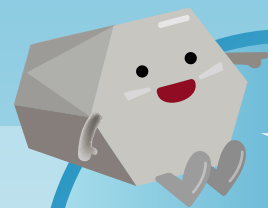


- 圖例 Legend
- 火山岩 (六角岩柱)
Volcanic Rocks
(Hexagonal Rock Columns)
 - 火山岩 Volcanic Rocks
 - 花崗岩類 Granitic Rocks
 - 岩牆 Dyke
 - 較古老的岩石 Older Rocks

香港破火山口地質圖(簡化版)
Geological Map of Hong Kong's Caldera (Simplified Version)

詞彙表 Glossary

詞彙 Term	解釋 Explanation	頁 Page
破火山口 Caldera	因火山噴發而崩塌形成的大型凹陷 A large depression formed from eruption and collapse of a volcano	P.12-15,17, 21
岩牆 Dyke	在已存在的岩石中形成的牆狀(片狀)岩石侵入結構 A tabular (sheet-like) rock body that cuts through pre-existing rocks	P.13, 21
侵蝕 Erosion	風化後的岩石物質被風、水或冰帶走 Transport of weathered rock materials by wind, water or ice	P.14, 19
花崗岩類 Granitic Rocks	含有石英和長石礦物的火成岩，並顯現出互鎖的岩理 Igneous rocks that comprise mainly quartz and feldspar minerals, and show an interlocking texture	P.8-9, 13, 21
節理 Joints	岩石中的裂縫，沿裂縫並沒有出現明顯錯動 Fractures in rocks along which no detectable displacement has occurred	P. 17
岩漿 Magma	位於地地下熔化的岩石 Melted rock under the ground	P.8-9, 11, 19
顯微鏡 Microscope	放大微小物品以作仔細觀察的工具 An instrument that can produce enlarged images of small objects	P.7
礦物 Minerals	天然形成的無機晶體，亦是岩石的基本成分 Naturally occurring inorganic crystals, and the fundamental components of rocks	P.6, 9
放射性年齡測定法 Radiometric Dating	根據放射性同位素的衰變率和半衰期從而測定岩石年齡的方法 A method to determine the age of the rocks based on the rate of decay and half-life of radioactive elements	P.7
岩理 Rock Texture	岩石中晶體的大小、形狀和排列 Size, shape and arrangement of crystals in rocks	P.6
表土沉積物 Superficial Deposits	未被整固的沉積物 Unconsolidated accumulation of sediments	P.20-21
地殼運動 Tectonic Activities	板塊的移動 Movement of tectonic plates	P.14
火山灰 Volcanic Ash	火山噴發的產物 Product of volcanic eruption	P.12, 17
風化 Weathering	岩石在地球表面的分解作用 Breakdown of rocks on the Earth's surface	P.14, 19



掃描以了解更多
超級火山及香港地質的歷史
Scan to learn more on the
supervolcano and Hong Kong's
geological history

動畫 Animation



中文版
Chinese
Version



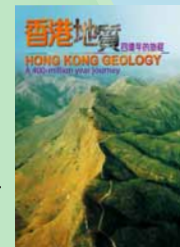
英文版
English
Version



香港地質大爆炸 -
糧船灣超級火山的故事
Hong Kong's Big Bang -
The Discovery of High Island
Supervolcano



香港地質 -
四億年的旅程
Hong Kong
Geology -
A 400-million Year
Journey



香港超級火山 Hong Kong's Supervolcano

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當山泥傾瀉警告生效時，
應遠離斜坡！記得打開以下錦囊！
When the Landslip Warning is in
force, we should stay away from
slopes! Remember to read the
tips below!

收到!
Got it!



山泥傾瀉自救錦囊
Landslide Self-help Tips

香港斜坡安全網頁
Hong Kong Slope Safety Website



中文版
Chinese Version



英文版
English Version



f Q Geo Channel 土力場



甚麼是超級火山?
What is a supervolcano?

超級火山在甚麼時候噴發?
When did the supervolcano erupt?

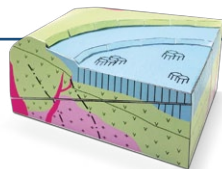
超級火山在哪裡?
Where is the supervolcano?

超級火山會再噴發嗎?
Will the supervolcano erupt again?



香港超級火山立體概念模型 3D Conceptual Model of Hong Kong's Supervolcano

組裝說明 Assembly Instructions



所需文具 Stationery required: 剪刀 Scissors, 膠水 Glue/雙面膠紙 Double-sided tape, 膠紙 Plastic tape, 筆 Pen

A

摺疊 Fold

黏貼在一起
Stick together

此部分暫時不要黏貼
Do not stick this part for now

B

6

C

沿著黑色邊界線
裁剪直到此處
Cut along the edge of black line and stop cutting here

沿著白色線裁剪
並向下摺疊
Cut along the white lines and fold downward

圍著筆把紙張捲曲
Wrap around a pen to make it curl up

黏貼此部分到後方
Stick this part to the back

使用膠紙黏貼在一起
Stick together with tape

3

4

5

3

4

5

向上摺疊並黏貼在一起
Fold upward and stick together

D

A

B

C

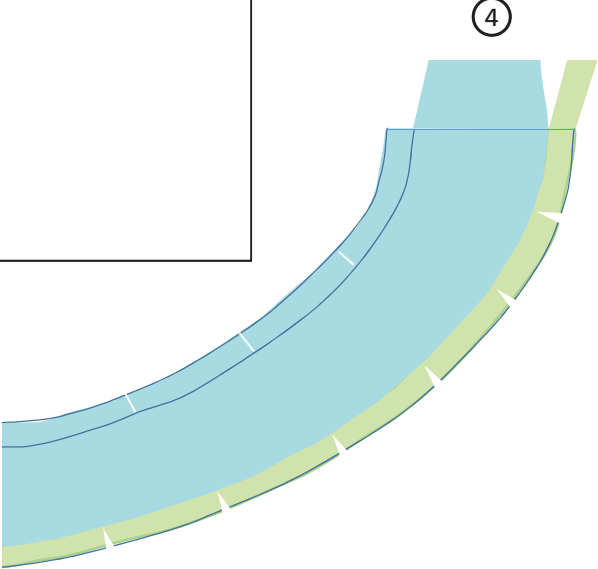
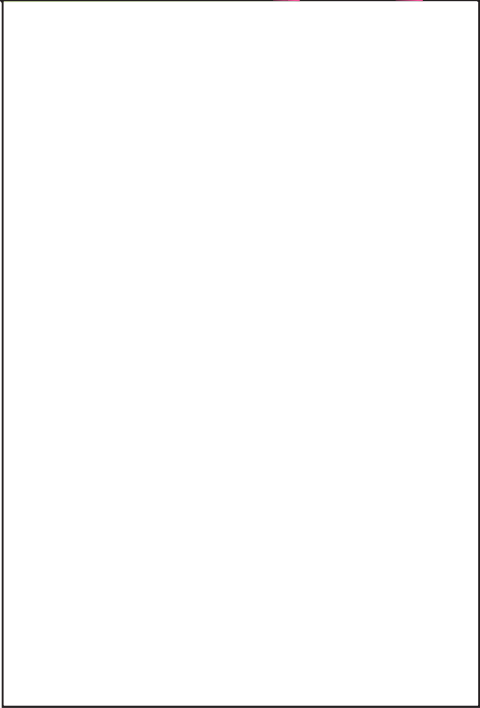
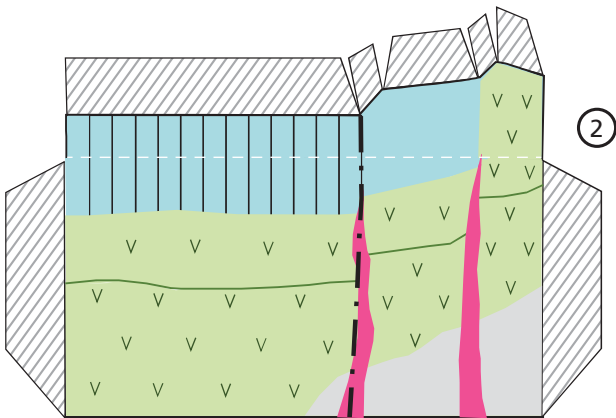
D

1

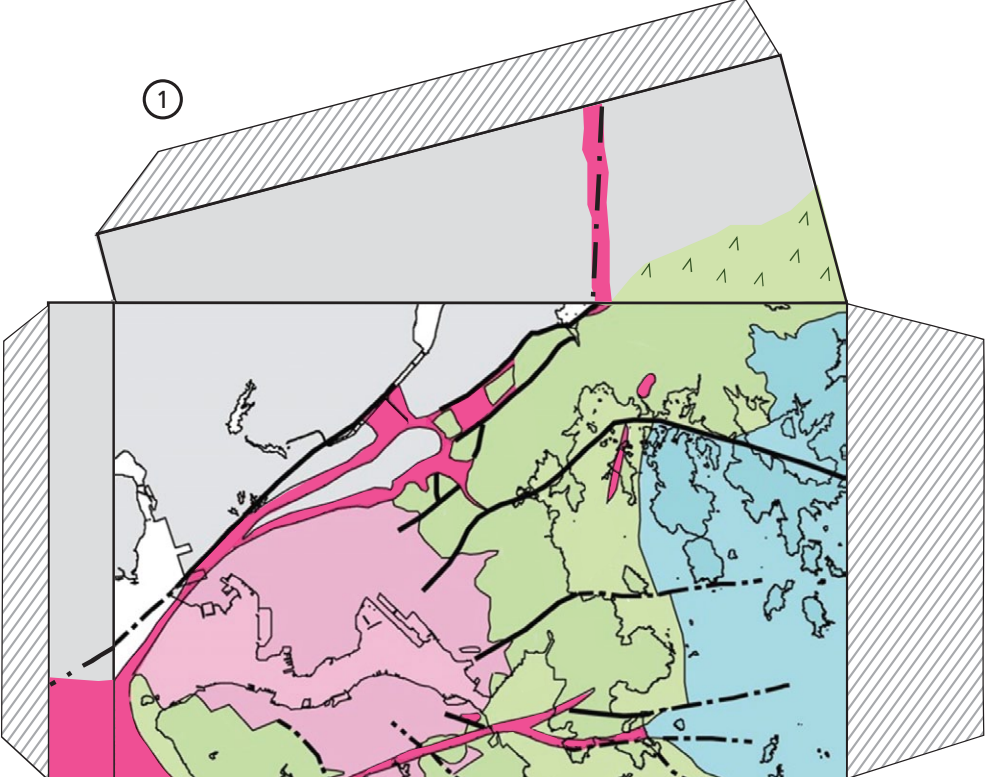
2

3

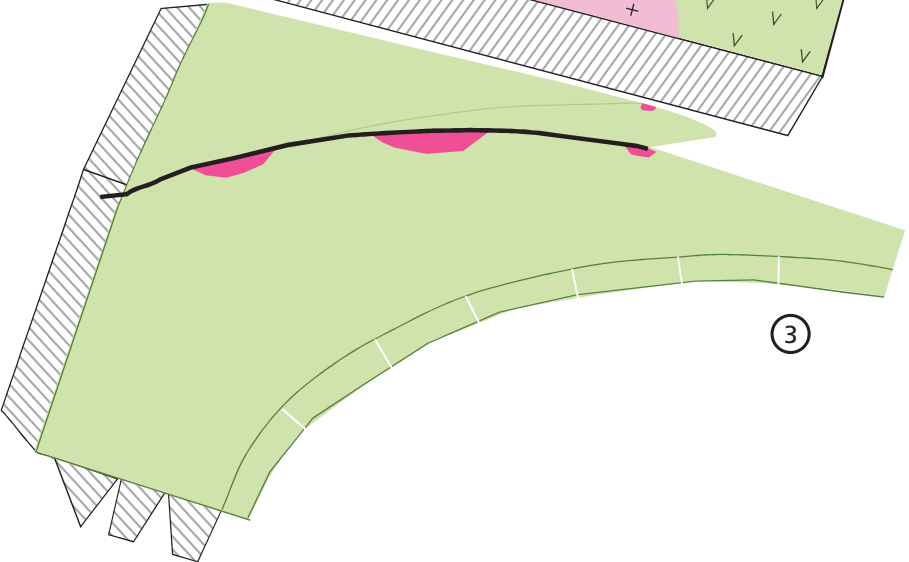
A



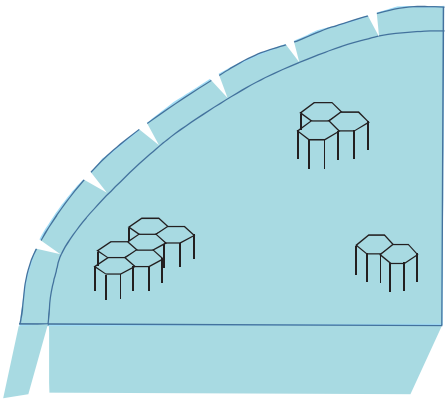
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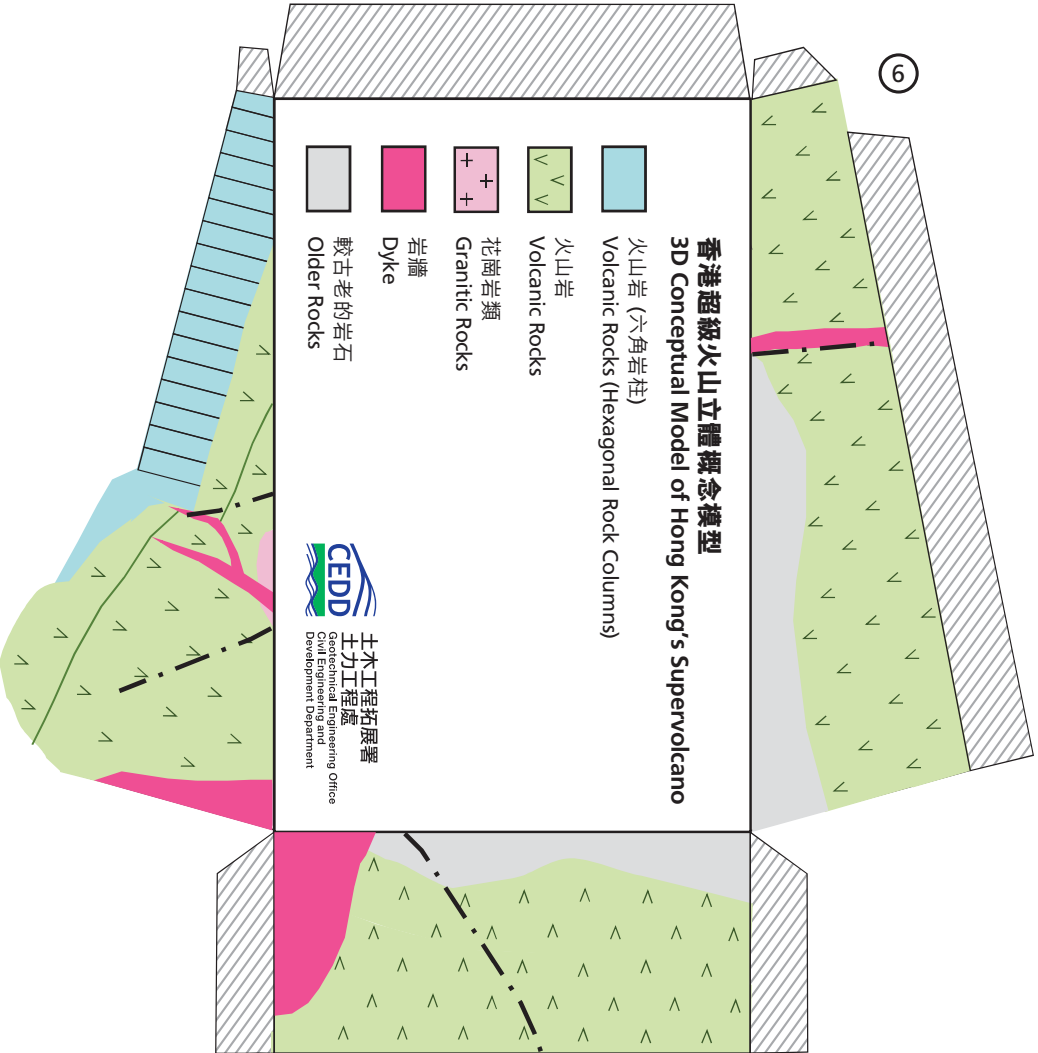
3



5



6



香港超級火山立體概念模型 3D Conceptual Model of Hong Kong's Supervolcano

火山岩 (六角岩柱)
Volcanic Rocks (Hexagonal Rock Columns)

火山岩
Volcanic Rocks

花崗岩類
Granitic Rocks

岩牆
Dyke

較古老的岩石
Older Rocks



土木工程拓展署
Geotechnical Engineering Office
Civil Engineering and
Development Department