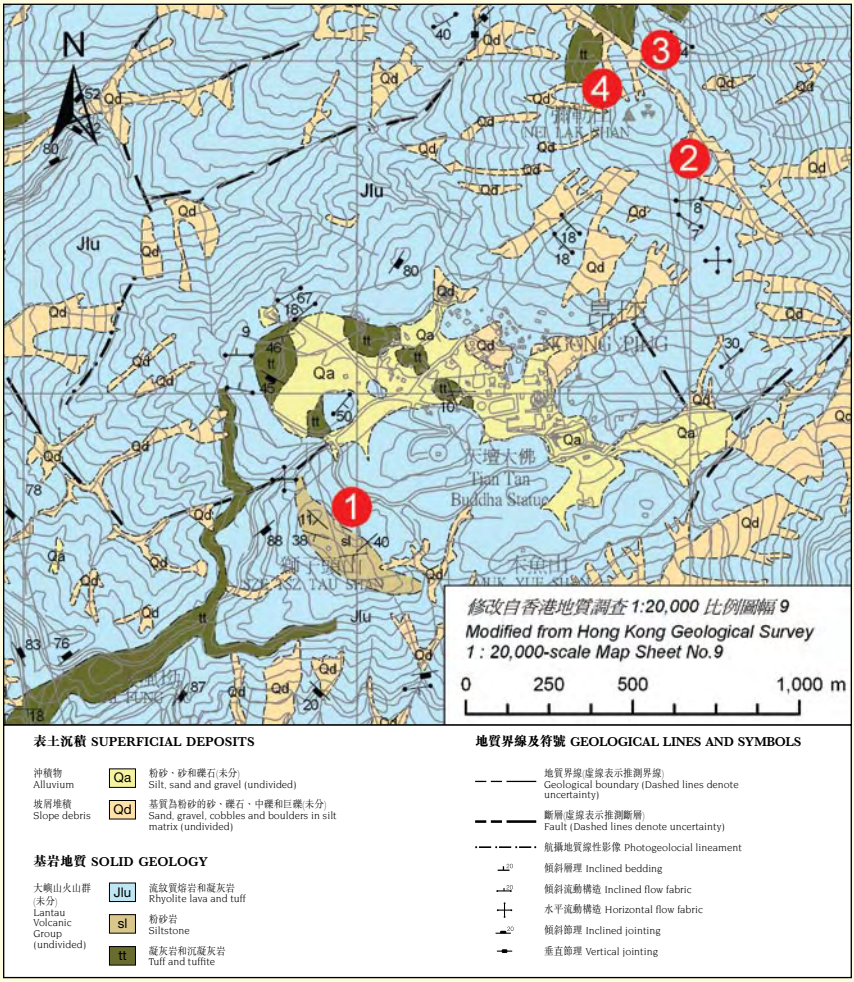
昂坪 NGONG PING

彌勒山的地質：昂坪寶蓮寺上彌勒山的地質主要是中生代火山岩，一般呈現稱為流狀條帶的薄層構造。這些流紋質的岩石同時含有結晶良好和破碎的晶體。它們可能源自極其炙熱的火山灰，從火山噴出然後形成有如熔岩般的火山灰流。在彌勒山山頂附近，角礫凝灰岩含有15%的岩石碎片，其大小約有30-60毫米，最大的則達300毫米。

Geology of Nei Lak Shan: The geology of Nei Lak Shan above Ngong Ping Monastery is dominated by Mesozoic volcanic rocks that exhibit thin planar layering known as flow banding. These rhyolitic rocks contain both well-formed and shattered crystals. They probably originated as extremely hot ash flows, which later reconstituted to form lava-like flows. Near the summit of Nei Lak Shan, tuff breccia is exposed comprising 15% angular fragments, with sizes mostly in the range of 30-60 mm, up to a maximum of about 300 mm.



CEDD 土木工程拓展署
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資料由土力工程處香港地質調查組編製。
Prepared by the Hong Kong Geological Survey, Geotechnical Engineering Office.

1 昂坪 Ngong Ping

昂坪以西突出的山脊，主要由凝灰質沉積岩組成。在天壇大佛西南方約400米，山脊由淺灰色粉砂岩和凝灰質粉砂岩組成。這層火山岩向西南方傾斜約11-40°，約小於50米厚。

The prominent ridges west of Ngong Ping are primarily composed of tuffaceous sedimentary rocks. About 400 m southwest of the Buddha, the ridge is composed of light grey siltstone and tuffaceous siltstone. The layer dips southwest at 11 to 40°, and is less than 50 m thick.

2 平面的流狀條帶構造 Planar Flow Banding

彌勒山的岩石中呈現平行流狀條帶，是由於火山灰或熔岩流動時仍然十分炙熱。這些平面流狀條帶也許代表了「熔結」的火山灰。流狀條帶構造有時可能會出現相交的圖案，又或是高度扭曲的複雜摺疊。這些不規則的構造可在彌勒山的山坡觀察得到。它們的形成可能是由於火山灰流的變化或不同程度的重結晶。

Thin, parallel bands within the rocks of Nei Lak Shan are thought to be caused by flow of the ash or lava while it was still very hot. Some of these planar flow bands may represent "welding" of the ash particles. Sometimes, flow-banding may show cross-cutting patterns, or be highly contorted to produce complex flow folding. These types of irregular flow banding may be seen on the lower slopes of Nei Lak Shan. They may form in response to variations in flow during emplacement and/or in the degree of recrystallisation.

3 破碎及呈良好晶狀的晶體 Broken and Well-shaped Crystals

仔細檢查岩石表面會發現，岩石含有非常豐富的晶體。它們包括結晶良好和破碎的晶體，這表明了不同的晶體結晶階段。第一階段可能發生在火山灰噴出、沉積之前，而第二階段則在火山灰沉積之後發生。

差異風化 - 物理和化學風化有時突顯了岩石些微的成分差異，使岩石表面呈現不規則的紋理。這是由於岩石本身抗風化的能力有輕微的不同。岩石中含石英質較多的部分，一般來說會較耐風化。

Close-up inspection of rock surfaces reveals that the rocks are remarkably crystal rich. They comprise a mixture of broken and well-shaped crystals, which suggest that two phases of crystal growth have occurred. The first phase may have occurred prior to deposition on the surface, whereas the second phase occurred after deposition.

Differential Weathering - Physical and chemical weathering of the rocks, by the action of wind and water, sometimes accentuates minor compositional differences in the rocks, leading to irregular surface textures. The irregular surface has developed due to minor differences in the resistance of the rocks to weathering. In general, the more quartz-rich a portion of the rock is, the more resistant it is to weathering.

資料匣 BOX

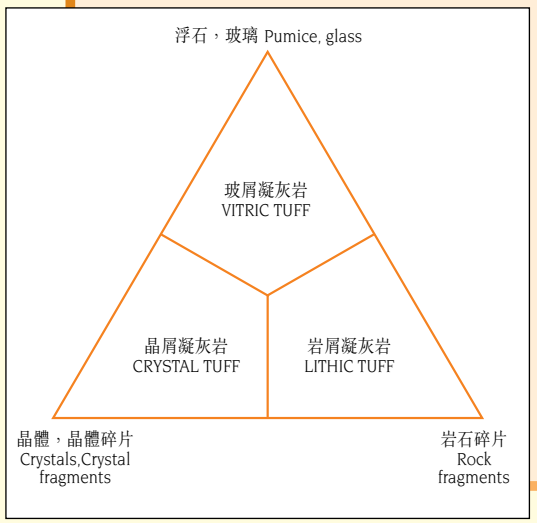
香港的凝灰岩皆根據其物理特性(包括主要成分和粒度)，按國際地質科學聯合會的建議而歸類。凝灰岩依據其主要成分:晶體/晶體碎片、岩石碎片或浮石(玻璃)，來分類為岩屑凝灰岩、屑凝灰岩或玻屑凝灰岩(Le Maitre,1989)(圖A1-1)。凝灰岩同時以其粒度大小來分類(Schmid, 1981; Fisher & Schminke,1984)(見下表)。

舉例來說，如果一凝灰岩的成分主要包含晶體碎屑，而碎屑的平均粒度介於0.06和2毫米，即可分類為粗火山灰晶屑凝灰岩。

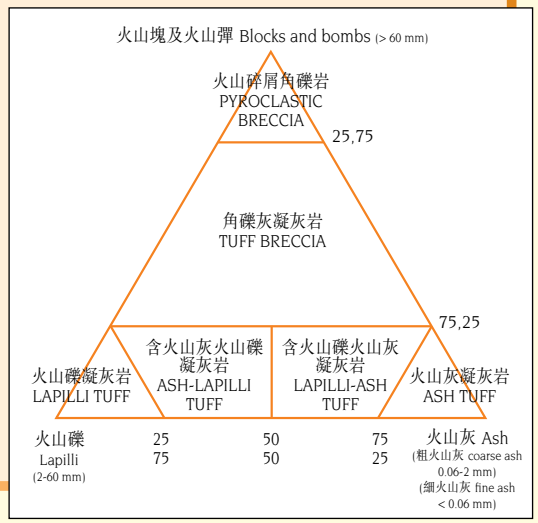
粒度 Clast Size	火山碎屑物 Pyroclasts	岩石名稱 Rock Name	
< 2 mm	粗火山灰 Coarse ash (0.06-2 mm) 細火山灰 Fine ash (<0.06 mm)	粗火山灰凝灰岩 Coarse ash tuff 細火山灰凝灰岩 Fine ash tuff	
2 - 60 mm	火山礫 Lapilli	火山礫凝灰岩 Lapilli tuff	含75%以上火山礫粒度的火山碎屑物 > 75% lapilli-sized pyroclasts
		含火山灰火山礫凝灰岩 Ash-lapilli tuff	含50-75%火山礫粒度的火山碎屑物 50% - 75% lapilli-sized pyroclasts
		含火山礫火山灰凝灰岩 Lapilli-ash tuff	含25-50%火山礫粒度的火山碎屑物 25% - 50% lapilli-sized pyroclasts
> 60 mm	火山塊及火山彈 Blocks and bombs	角礫凝灰岩 Tuff breccia	含25-75%火山塊及火山彈粒度的火山碎屑物 25-75% block and bomb-sized pyroclasts
		火山碎屑角礫岩 Pyroclastic breccia	含75%以上火山塊及火山彈粒度的火山碎屑物 >75% block and bomb-sized pyroclasts

The tuffs of Hong Kong are classified in terms of their physical characteristics (including dominant composition and clast size), according to the International Union of Geological Sciences recommendations. Based on composition (after Le Maitre, 1989), a tuff is classified as lithic tuff, crystal tuff or vitric tuff when its dominant composition is crystals / crystal fragments, rock fragments or pumice (glass) respectively (Figure A1-1). A tuff is also classified based on its clast size (after Schmid, 1981 and Fisher & Schminke, 1984) (See table below).

For example, if a tuff contains dominantly crystal fragments of an average clast size ranging between 0.06 and 2 mm, then the tuff is classified as coarse ash crystal tuff.



圖A1-1. 凝灰岩以成分來歸類。
Figure A1-1. Classification of tuffs based on composition.



圖A1-2. 凝灰岩以粒度來歸類。
Figure A1-2. Classification of tuffs based on clast size.

Fisher, R.V. & Schminke, H.U. 1984. Pyroclastic rocks. Springer Verlag, New York, 472 p.

Le Maitre, R.W. (ed.) 1989. A classification of the igneous rocks and glossary of terms. Recommendations of the International Union of Geological Sciences on the Systematics of Igneous Rocks. Blackwell Scientific Publications, Oxford, 193 p.

Schmid, R. 1981. Descriptive nomenclature and classification of pyroclastic deposits and fragments: recommendations of the IUGS Subcommission on the Systematics of Igneous Rocks. Geology, Vol. 9, pp 41–43.

4 角礫凝灰岩
Tuff Breccia

角礫凝灰岩是當大塊角礫狀的火山岩碎片，與較幼細的火山灰碎片膠結、凝固而成的岩石。角礫凝灰岩可能有多個來源，它們可能是近火山噴發口的產物，又或是由於舊有的火山岩屑遭侵蝕而形成。

Large angular fragments of volcanic rocks which have been cemented together by smaller ash fragments produces a rock type known as tuff breccia. Tuff breccia may have multiple origins, ranging from the products of near-vent volcanic eruptions, to erosion of older volcanic debris.

如何前往? How to Get There?

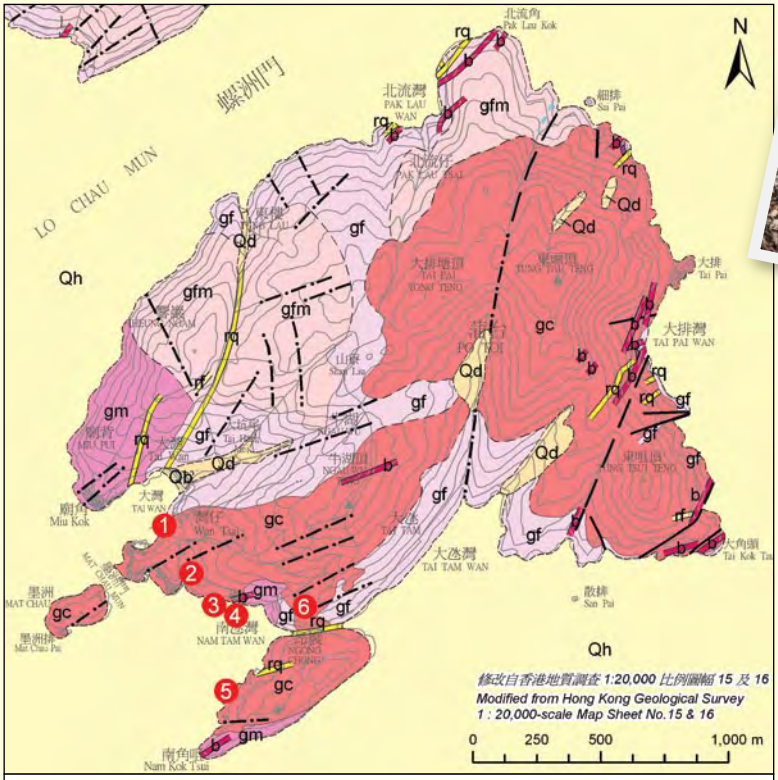
昂坪的寶蓮寺是受歡迎的旅遊景點，並有完善的公共交通。巴士服務包括來往梅窩至昂坪的2號路線、來往大澳至昂坪的21號路線，以及來往東涌至昂坪的23號路線。此外，亦可乘坐昂坪360纜車由東涌到昂坪。從昂坪往彌勒山山頂的兩條路線，皆須攀登約300米。稍微較短的路線是沿寶蓮寺後面的小徑登山，該小徑初段約70-80米雜草叢生，不太好走。另外沿彌勒山東南坡山脊的登山路徑雖然稍長，但由於坡度較緩而較多人使用。

Po Lin Monastery at Ngong Ping is a popular tourist destination and is well served by public transport. Bus services include Route no. 2 from Mui Wo to Ngong Ping, Route no. 21 from Tai O to Ngong Ping, and Route no. 23 from Tung Chung to Ngong Ping. In addition, there is the Ngong Ping 360 Cable Car from Tung Chung. There are two possible routes to the summit of Nei Lak Shan, both involving a climb of about 300 m. A slightly shorter route is along the footpath from behind Po Lin Monastery, although the initial 70-80 metres of the path is overgrown. A second slightly longer, but gentler and more popular, route follows the path along the southeast ridge of Nei Lak Shan.

蒲台群島 PO TOI ISLANDS

蒲台群島的地質：蒲台群島的地質以花崗岩為主，一般呈粗粒至等細粒。這些花崗岩的年齡尚未經放射同位測年確定。但是根據岩石的化學特徵，估計蒲台群島的花崗岩與赤柱半島的花崗岩屬同一年代即早白堊世。蒲台花崗岩被許多石英斑岩及基性岩牆侵入，同時展現出發育良好的節理。

Geology of Po Toi Islands: The geology of Po Toi Islands is dominated by granitic rocks that are generally coarse-grained to equigranular fine-grained. A radiometric age for the granite has not yet been determined, but on the basis of geochemistry, it is thought to be the same age as granite exposed on Stanley Peninsula *i.e.* Early Cretaceous. The Po Toi granite is intruded by numerous quartzphyric rhyolite and mafic dykes, and exhibits well-developed sheeting joints.



表土沉積 SUPERFICIAL DEPOSITS

- 海灘沉積 Beach deposits — Qb 砂 Sand
- 海洋沉積 Marine deposits — Qh 深灰色海泥和砂(未分) Undivided, dark grey marine mud and sand
- 坡積物 Slope deposits — Qd 基質為粉砂、礫石、中礫和巨礫 Sand, gravel, cobbles and boulders in silt matrix

基岩地質 SOLID GEOLOGY

蒲台花崗岩 Po Toi Granite

- gf 細粒花崗岩，0.06-2毫米 Fine-grained granite, 0.06-2 mm
- gfm 中細粒花崗岩 Fine- to medium-grained granite
- gm 中粒花崗岩，2-6毫米 Medium-grained granite, 2-6mm
- gc 粗粒花崗岩，>6 毫米 Coarse-grained granite, >6 mm
- b 基性岩牆(未分) Mafic dykes (undivided)
- rq 酸性岩牆(未分)，石英斑岩及長石斑岩岩牆 Felsic dykes (undivided), quartzphyric rhyolite and feldsparphyric rhyolite dykes

地質界線及符號 GEOLOGICAL LINES AND SYMBOLS

- 地質界線(虛線表示推測界線) Geological boundary (Dashed lines denote uncertainty)
- 斷層(虛線表示推測斷層) Fault (Dashed lines denote uncertainty)
- 航攝地質線性影像 Photogeological lineament
- q 石英 Quartz

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Civil Engineering and Development Department

資料由土力工程處香港地質調查組編製。
Prepared by the Hong Kong Geological Survey, Geotechnical Engineering Office.

1 大灣
Tai Wan

花崗岩體之間的侵入接觸關係，對於確定不同花崗岩體的相對年齡非常重要。利用地質特徵，例如接觸帶兩邊岩石粒度和節理模式的改變、斷層和岩脈的連續性，以及相互切割關係原則、包含碎塊原則等等，皆可用以評估不同岩體的相對年齡。在碼頭附近的岩石露頭，提供了極好的地點，以了解如何利用不同的地質特徵來確定幾種侵入岩的相對年齡。

Intrusive contacts between granite bodies are extremely important for determining the relative age of intrusion. Using features such changes in grain size and joint patterns across the contact, continuity of faults, dykes and mineral veins across the contact, and the principle of cross-cutting relationships and the principle of included fragments, it is possible to make accurate assessments of relative age. The rock exposure near the pier provides an excellent place to learn how to determine the relative age of various intrusive bodies.

2 蒲台郊遊徑
Po Toi Country Trail

風化使花崗岩形成獨特而渾圓(或呈橢圓形)的岩石核。當風化層被侵蝕後，這些岩石核被遺留在花崗岩的地形上，形成巨大的石塊。沿蒲台島郊遊徑可看有許多有趣的花崗岩巨礫，有些看似動物或人類，如烏龜石和僧人石等等。

Weathering of the granitic rocks produces distinctive, rounded (or ellipsoidal) corestones. Following their exhumation (having been eroded out) from the weathered profiles, these corestones are commonly seen as giant boulders littering on the granitic landscape. There are many unusually-shaped granite boulders, some resembling animals or humans (such as Tortoise Rock and Monk Rock), along Po Toi Country Trail.

3 石刻
Rock Carving

蒲台島的南部有一組古代石刻，在岸邊的花崗岩上雕刻而成。它們呈不同的圖案：其中一組類似動物和魚類，而另一組則呈連鎖螺旋圖形。對於這些古代石刻是在什麼時代、為什麼而作，是如何和誰人創造等問題，我們所知甚少，儘管估計它們與青銅器時代(約公元前一千五百至一千七百年)有關。

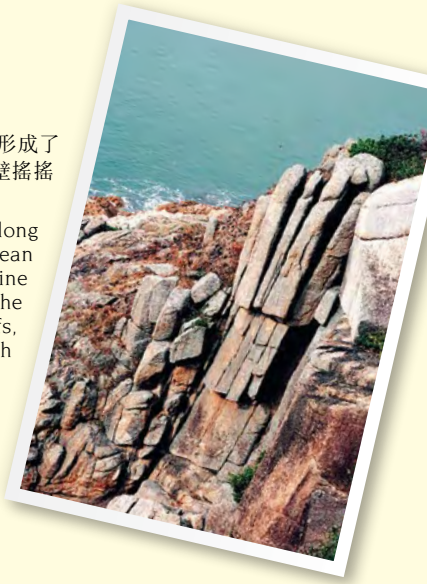
A group of ancient rock carvings (petroglyphs) is located at the southern part of Po Toi Island. The rock carvings have been carved into granite above the foreshore. They are of different patterns: one group resembles animal and fish patterns, while the other consists of interlocking spirals. Little is known about when, why, how and by whom the carvings were made, although they are thought to be related to the Bronze Age (about 1500 to 1700 BC).

4 南丫灣
Nam Tam Wan

基性岩牆在蒲台島非常普遍，它們大多1.5至2米寬，並呈東北走向。這些基性岩牆有時可能與石英斑岩侵入相關。在石刻旁邊可以發現其中一列基性岩牆。

Mafic dykes are a common feature on Po Toi Island. The dykes are mostly between 1.5 and 2 m wide, and are oriented to the northeast. The dykes may sometimes be associated with quartzphyric rhyolite intrusions. One of these mafic dykes is found next to the rock carving site.

5 佛手岩
Buddha's Palm Cliff



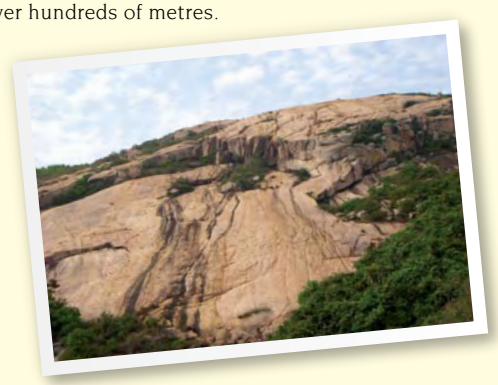
蒲台島沿岸的侵蝕地貌，主要受控於強大的破壞性海浪，因而形成了陡峭崎嶇的海岸線。花崗岩內張開的的垂直節理，促使岩石峭壁搖搖欲墜並且倒下，形成如佛手岩等獨特的地貌景觀。

Coastal erosion is the dominant geomorphological process along the south coast of Poi Toi due to the destructive power of ocean waves. This has led to the development of a rugged coastline featuring steep granite cliffs. Dilated vertical joints within the granite have promoted toppling failure of the rock cliffs, sometimes leading to the formation of scenic landforms, such as the Buddha's Palm Cliff at Nam Kok Tsui.

6 昂裝
Ngong Chong

蒲台島大多數山坡的表面是光滑的花崗岩，皆受到席裂節理所控制。這些節理跟地面大致平行，由於應力卸荷而形成。這些平緩的節理可延伸超過幾百米。

Most of the hillslopes of Po Toi are dominated by smooth granite rock surfaces, which are controlled by sheeting joints. These joints are subparallel to the land surface and have developed in response to stress relief. The low angle joints may be continuous over hundreds of metres.



表A2-1 。香港花崗岩的粒度分類。
Table A2-1. Grain size classification of granitic rocks in Hong Kong.

粒度 Grain Size	岩石名稱 Rock Name
> 20 mm	非常粗粒花崗岩(偉晶岩) Very coarse-grained granite (pegmatite)
6 - 20 mm	粗粒花崗岩 Coarse-grained granite
2 - 6 mm	中粒花崗岩 Medium-grained granite
0.06 - 2 mm	細粒花崗岩 Fine-grained granite
<0.06 mm	微花崗岩 Microgranite

資料匣 BOX

節理類型 Types of Joints

節理是岩石石中的裂縫，沿裂縫並沒有出現明顯錯動。一些地質特徵(如懸崖面、突岩和巨礫)的形狀和方向皆受岩體的節理模式控制。節理的排列模式常有一個幾何的特徵和有規律的間隔。它們有三種主要模式：

- **構造節理**與區域構造變形相關，通常與區域性斷層系統，或與侵入岩引致的變形有關。它們可能在剪切或拉張下形成。
- **應力卸荷節理**在岩石中接近地面的地方發育，是由於侵蝕作用移除了岩石之上的覆蓋層而使圍壓減少所致。如果它們是大規模而與地形相平行，則稱為席裂節理。而規模較小、彎曲或同心的節理，特別是與岩核發展有關的，則稱為剝落節理。
- **冷卻節理**是由於火成岩形成時冷卻和收縮而發展。它們通常垂直於冷卻表面，並會呈六角柱狀。

Joints are fractures or cracks in rocks along which there has been no detectable displacement. The shape and orientation of features such as cliff faces, tors, and boulders are controlled by the jointing pattern within the rock mass. Joint patterns generally have a characteristic geometry and a regular spacing. They develop in three main modes:

- **Tectonic joints** are associated with regional tectonic deformation, typically with the regional network of faults, or deformation associated with emplacement of plutons. They may be formed under shear or tension.
- **Stress relief joints** develop in rocks close to the ground surface as a result of relaxation of confining pressure (overburden) following erosion of the overlying layers. If they are large scale and subparallel to the topography they are called sheeting joints. However, smaller scale curved or concentric joints, particularly those associated with development of corestones are called exfoliation joints.
- **Cooling joints** develop as a result of cooling and contraction in granitic and volcanic rocks following their emplacement. They are typically perpendicular to the cooling surface and may form hexagonal columns.

如何前往? How to Get There?

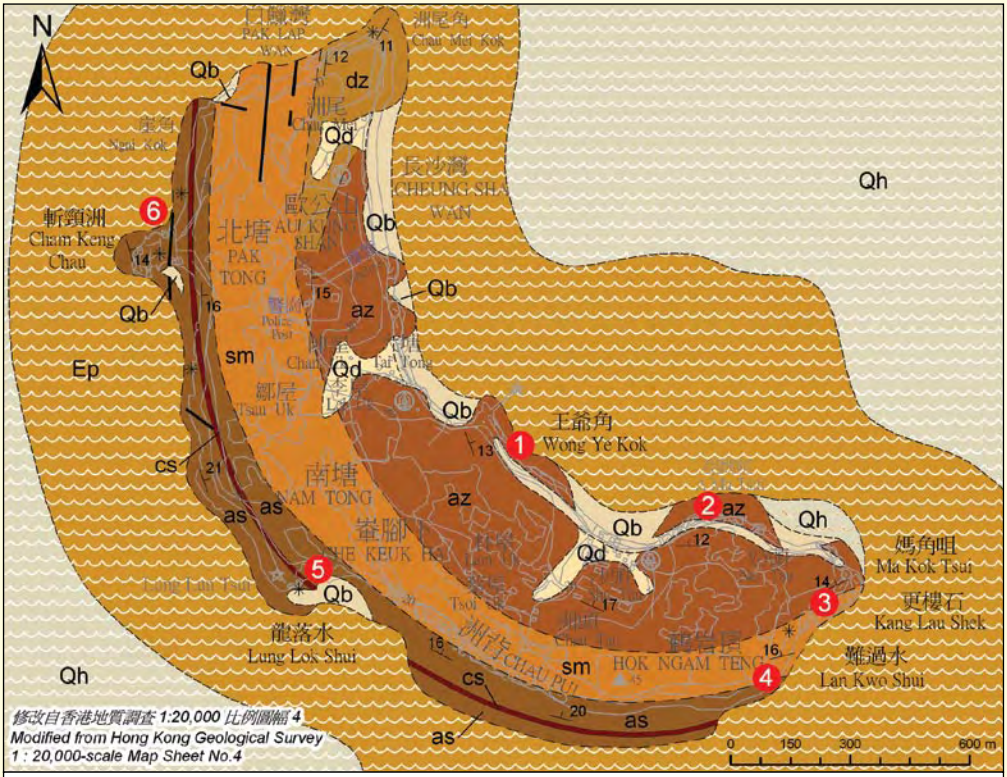
逢星期二和星期四設有限度的街渡服務來往香港仔至蒲台島，班次為上午10時從香港仔往蒲台島，而下午2時自蒲台島返回香港仔。逢星期六有兩班自香港仔開出的航班，分別為上午10時和下午2時，亦有一班從赤柱在下午1點20分開往蒲台島。回程航班在星期六下午12點40分往赤柱，以及下午二時及下午四時往香港仔。星期日及公眾假期從赤柱開出的班次會增加，但只有一班在上午8時15分從香港仔開出。

A limited Kaito service operates from Aberdeen to Po Toi on Tuesdays and Thursdays, departing Aberdeen at 10:00 am and returning from Po Toi at 2 pm. On Saturdays, there are two departures from Aberdeen at 10 am and 2 pm, as well as a departure from Stanley at 1:20 pm. Return sailings on Saturdays depart from Po Toi at 12:40 pm for Stanley, and 2 pm and 4 pm for Aberdeen. There are increased frequencies of sailings from Stanley on Sundays and public holidays, but only one departure at 8:15 am from Aberdeen.

平洲 PING CHAU

平洲的地質：平洲的粉砂岩是香港最年輕的岩石。它們在始新世(約五千五百萬年前)半乾旱的氣候條件下，在湖泊中沉積。湖泊週期地乾涸，使鹽結晶而成。昆蟲化石和瀝青化的植物碎片在平洲的岩石中被發現。今天，這些薄的岩層向北方和東北方緩緩傾斜。

Geology of Ping Chau: The siltstones on Ping Chau are the youngest rocks in Hong Kong. They were originally deposited in a lake under semi-arid conditions during the Eocene (about 55 million years ago). The lake periodically dried up, allowing salts to crystallise. Fossil insects and bituminised plant fragments have been discovered in the rocks on Ping Chau. Today, these thinly bedded layers are gently inclined towards the north and northeast.



表土沉積 SUPERFICIAL DEPOSITS

海灘沉積 Beach deposits	Qb	砂、中礫、巨礫和礫石 Sand, cobbles, boulders and gravel
海洋沉積 Marine deposits	Qh	深灰色海泥和砂(未分) Undivided, dark grey marine mud and sand
泥石流沉積 Debris flow deposits	Qd	未分選的砂、礫石至巨礫基質為黏土/粉砂 Unsorted sand, gravel, cobbles and boulders, clay/silt matrix

基岩地質 SOLID GEOLOGY

平洲組 Ping Chau Formation

Ep	深灰色薄層粉砂岩和雲質粉砂岩夾泥岩(未分) Undivided, dark grey thinly bedded siltstone and dolomitic siltstone with mudstone
az	含沸石粉砂岩夾含鈣石粉砂岩 Zeolite-bearing siltstone with aegirine-bearing siltstone
dz	雲質粉砂岩夾灰質粉砂岩 Dolomitic siltstone with calcareous siltstone
sm	粉砂岩和雲質粉砂岩夾泥岩 Siltstone and dolomitic siltstone with mudstone
cs	燧石岩 Chert
as	含雲石粉砂岩夾雲質粉砂岩 Aegirine-bearing siltstone with dolomitic siltstone

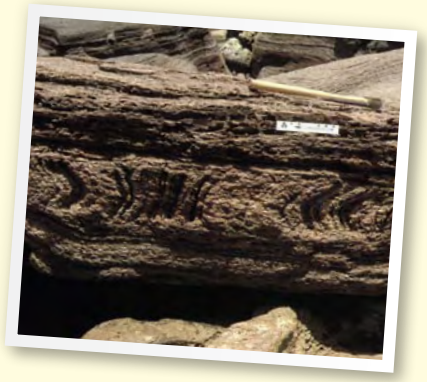
地質界線及符號 GEOLOGICAL LINES AND SYMBOLS

- 地質界線(虛線表示推測界線) Geological boundary (Dashed lines denote uncertainty)
- 斷層(虛線表示推測斷層) Fault (Dashed lines denote uncertainty)
- 傾斜層理 Inclined bedding
- 化石產地 Fossil locality

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

資料由土力工程處香港地質調查組編製。
Prepared by the Hong Kong Geological Survey, Geotechnical Engineering Office.

1 王爺角 Wong Ye Kok



平洲地質的特點是其薄層白雲質及鈣質粉砂岩。在許多岩層內有豐富的植物碎片。在一些層理上，霓石和玫瑰花形的沸石出現假石膏晶體。這些礦物可能與低溫變質作用有關。

The geology of Ping Chau is characterised by thinly-bedded dolomitic and calcareous siltstones. Plant fragments are abundant in many layers. On some horizons, aegirine and zeolite (rosette-shaped) crystals occur as pseudomorphs of gypsum. These minerals are probably related to low temperature alteration.

2 媽角咀 Ma Kwok Tsui

傾斜的沉積岩層常見稱為陡崖的獨特地貌，它的特色是地形一邊為緩傾的順向坡而另一邊為陡峭的崖坡。從遠處看，平洲是一個向東北傾斜的大陡崖。沿岸的岩石則組成一系列平行的細小陡崖。

Inclined, bedded sedimentary rocks commonly form distinctive landforms called escarpments, which are characterised by a gently inclined dip slope and a steep scarp slope. Viewed from a distance, it can be seen that the island of Ping Chau is a large escarpment, dipping to the northeast. The rocks exposed on the wave-cut platforms around the island form a parallel series of minor escarpments.

資料匣 BOX

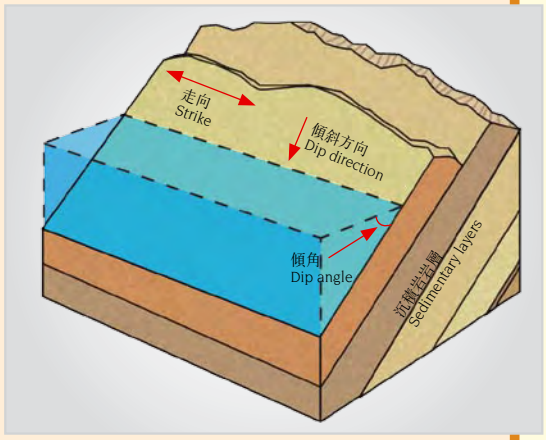
傾斜沉積岩層的走向及傾角
Strike and Dip of Inclined Sedimentary Layers

走向及傾角表達了岩層、節理、斷層或紋理等地質面的三維方向。

- **走向：**走向是指傾斜的地質面與虛擬的水平面相交而成的線所指的方向(圖A3-1)。好像將一塊玻璃放入一碗水內，由於水面處於水平，玻璃上的水位線是水平線，即走向線，而水位線所指的方向便是走向。
- **傾角：**傾角一般是指傾斜角度，即地質面與水平之間的角度，指地質面於傾斜方向的傾斜度。傾斜方向與走向成垂直方向。水平的平面的傾角為0°，垂直的平面的傾角則為90°。

Strike and dip represents the three-dimensional orientation of geological surfaces such as bedding, joints, faults or foliations.

- **Strike :** The strike of an inclined geological plane is the direction of an imaginary horizontal line projected across the surface (Figure A3-1). Strike may be visualised by immersing a sheet of glass into a bowl of water. Because the water surface is horizontal, the waterline on the glass is a horizontal line, or a strike line. The direction (azimuth) of the waterline is the strike.
- **Dip :** Dip generally refers to the dip angle, which is the angle between a geological plane and the horizontal, *i.e.* the angle at which the plane slopes downwards, as measured in the dip direction. The dip direction is always perpendicular to the strike, and is the direction of maximum slope of an inclined plane. Thus, an horizontal plane has dip of 0°, and a vertical plane has a dip of 90°.



圖A3-1. 傾斜沉積岩岩層的走向及傾角。
Figure A3-1. Strike and dip of inclined sedimentary layers.

3 更樓石 Kang Lau Shek

更樓石是在平洲東南角的兩個海蝕柱。它們由於海浪侵蝕而形成，一般是當海蝕拱崩塌後，殘留下的岩石柱。

Two sea stacks, "rock towers", sit at the southeastern corner of Ping Chau. They were formed by wave erosion and commonly represent the residual stump of rocks left behind when a former sea arch collapsed.

4 難過水 Lan Kwo Shui

沿平洲的西南海岸，垂直懸崖高聳於廣泛的浪蝕平台之上。當漲潮時，浪蝕平台被海水淹沒，因此，這位置被稱為「難過水」。海浪不斷地侵蝕浪蝕平台，大塊岩石從懸崖墜落，分佈在海邊。

An extensive wave-cut platform, overlooked by vertical sea cliffs, occurs along the southwestern coast of Ping Chau. During high tides, the wave-cut platform is flooded by seawater, thus the location is called "difficult to pass". The wave-cut platform has been eroded by continuous wave action. Locally, huge blocks of rock have fallen from the sea cliffs and are scattered along the coast.

5 龍落水 Lung Lok Shui

潛入海的「龍」實際上是堅硬的燧石質粉砂岩岩層。燧石質粉砂岩含有非常幼細的矽結晶，使其耐於風化和侵蝕，構成挺拔的山脊。燧石質岩層約有0.8至1.2米厚，主要由極微細的石英與長石及較少量的碳酸鹽組成。燧石層的成因還沒有得到證實，不過有幾個可能的解釋曾被提出，如火山碎屑來源或與溫泉有關的沉積物等等。

The "Dragon" that is diving into the sea is actually a strong layer of cherty siltstone. Cherty siltstone contains very fine-grained crystalline silica, which, because it is resistant to weathering and erosion, forms an upstanding ridge. The layer is about 0.8 to 1.2 m thick and is composed of mostly very fine-grained quartz and feldspar, with subordinate secondary carbonate. The origin of the chert layer has not been confirmed, although several possible origins, such as a volcaniclastic source or a hot spring-related deposit, have been interpreted.

6 斬頸洲 Cham Keng Chau

斬頸洲的狹窄通道表現了斷層地貌。岩石在斷層的位置往往變得較弱，使之更易受到風化和侵蝕。因此在斷層通過的地方，岩石被切削得更深入，形成山谷。

The narrow passage across the headland at Cham Keng Chau is the geomorphological expression of a fault. Rocks commonly become weaker in fault zones, and tend to weather and erode more deeply than the rocks on either side of the fault, giving rise to valleys and gaps.

資料匣 BOX

平洲上的破壞性營力的海岸地形
Coastal Landforms Resulting from Destructional Processes on Ping Chau

地形的種類 Type of Landform	闡釋 Description
海蝕柱 Sea Stack	經由海浪沖擊而形成的塔狀或石柱殘骸。通常是海蝕拱崩塌後的殘骸。海蝕柱可以在接近、或現今海平面之上出現。 A tower, or residual stump, of rock, which is formed by wave action, commonly by the collapse of a sea arch leaving the seaward end isolated. Stacks may be near, or above, the present sea level.
浪蝕平台 Wave-cut Platform	通常出現於懸崖底部的岩架，由海浪磨蝕而成。浪蝕平台可位於高潮水位之上或之下。 A rocky ledge, usually at the base of a sea cliff, that is formed by wave abrasion. Wave-cut platforms may be located above or below high tide level.
浪蝕龕 Wave-cut Notch	由海浪侵蝕懸崖底部而成的切口，通常出現於浪蝕平台的後面。 A slot cut at the bottom of a cliff, usually at the back of a wave-cut platform, formed by wave action eroding the base of the cliff.

如何前往? How to Get There?

除可租用機動船或遊艇外，亦可以乘渡輪從馬料水前往平洲。然而，渡輪服務僅適用於週六和週日。星期六有兩班從馬料水出發的航班，於上午9時和下午3時30分開出，回程航班在下午5時15離開平洲。星期日只有上午9時一班班次從馬料水出發，回程班次則在下午5時15分離開。航程一般需時約1小時40分鐘。遇大風的天氣，航程可能需要2至3小時。沿着岸邊的平洲郊遊徑步行，可到達各地質景點，而於退潮時亦可沿海邊的岩石平台觀察岩層。

Apart from hiring a motor boat or crusier, one can take a public ferry from Ma Liu Shui to Ping Chau. However, the public ferry service is only available on Saturdays and Sundays. On Saturdays, there are two departures from Ma Lui Shui at 9 am and 3:30 pm. Return sailings on Saturdays depart from Ping Chau at 5:15 pm. There is only one return sailing on Sundays, departing from Ma Liu Shui at 9 am, and from Ping Chau at 5:15 pm. The traveling time is about 1 hour 40 minutes. On a windy day, the traveling time may take 2 to 3 hours. Access to rock outcrops is easy along Ping Chau Country Trail, and it is possible to observe the rock strata along the coastal platform at low tide.

糧船灣 HIGH ISLAND

糧船灣的地質：約一億四千萬年前，一次極端猛烈的火山爆發在香港的東南部發生。這次火山爆發導致一層厚厚的火山灰在破火山口盆地內沉積。火山灰逐漸冷卻收縮，形成壯觀的石柱。這些石柱現在出露在糧船灣、果洲群島和許多糧船灣海周圍島嶼。

Geology of High Island: About 140 million years ago, an extremely violent volcanic eruption occurred in the southeastern part of Hong Kong. This resulted in the deposition of a thick layer of volcanic ash within a volcanic depression (caldera). The volcanic ash slowly cooled and contracted, forming the spectacular columns that are now exposed at High Island, the Ninepin Group and many islands around Rocky Harbour.

表土沉積 SUPERFICIAL DEPOSITS

海灘沉積 Beach deposits	Qb	砂、中礫、巨礫和礫石 Sand, cobbles, boulders and gravel
海洋沉積 Marine deposits	Qh	深灰色海泥和砂(未分) Undivided, dark grey marine mud and sand
沖積物及坡積物 Alluvial and colluvial deposits	Qad	黏土/粉砂、砂及礫石(未分) Undivided clay/silt, sand and gravel

基岩地質 SOLID GEOLOGY

糧船灣組 High Island Formation	Kkh	主要為熔結細火山灰玻屑凝灰岩 Mainly welded fine ash vitric tuff
清水灣組 Clear Water Bay Formation	Kkw	主要為粗面英安岩和流紋岩 Mainly trachydacite and rhyolite lava
	b	基性岩脈，主要為玄武安山岩 Mafic dykes, mainly basaltic andesite

地質界線及符號 GEOLOGICAL LINES AND SYMBOLS

- 地質界線(虛線表示推測界線) Geological boundary (Dashed lines denote uncertainty)
- 斷層(虛線表示推測斷層) Fault (Dashed lines denote uncertainty)
- 水平流動構造 Horizontal flow fabric
- 20 傾斜流動構造 Inclined flow fabric
- 20 傾斜節理 Inclined jointing
- 垂直節理 Vertical jointing

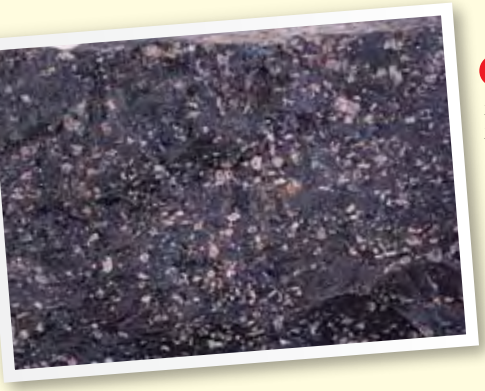
CEDD 土木工程拓展署
土力工程處
Geotechnical Engineering Office
Civil Engineering and Development Department

資料由土力工程處香港地質調查組編製。
Prepared by the Hong Kong Geological Survey, Geotechnical Engineering Office.

1 萬宜水庫東壩 East Dam of the High Island

萬宜水庫東壩的附近，六角柱狀火山岩出露。這些石柱的直徑約有一至兩米，而個別的石柱可高達三十米高。

Near the East Dam of the High Island Reservoir, hexagonal columns of volcanic rock are exposed. These columns are from 1 to 2 m in diameter and individual columns may be up to 30 m in height.



2 流紋岩質凝灰岩 Rhyolitic Fine Ash Tuff

在萬宜水庫東壩出露的火山岩呈均勻的厚層。他們是熔結的凝灰岩，含少量平板狀的鹼性長石晶體，和一些較大的石英和長石碎屑。這些岩石含有高矽質，即屬流紋岩質。

Volcanic rocks exposed near the East Dam of the High Island Reservoir are homogeneous and massive. They are called welded tuffs, containing small tabular-shaped alkali feldspar crystals, and some larger broken fragments of quartz and feldspar. These rocks have a high silica content, *i.e.* they are rhyolitic.

3 傾斜的六角石柱 Inclined Columns and Kink-Bands

大多數六角石柱皆略有傾斜。然而仔細觀察會發現，石柱在某些地點形成一種淺S形的曲線。這是由於在漫長的冷卻過程中，火山盆地局部塌陷，以至火山灰在沉積時緩慢地蠕動，導致石柱塑性的變形。

Most of the hexagonal columns are slightly inclined. However, close observation reveals that, at certain locations, the columns have developed a shallow S-curve. During the long cooling process, local subsidence of the caldera floor caused the ash layer to settle by slow creeping. This resulted in plastic deformation of the columns.

4 基性岩牆 Mafic Dyke

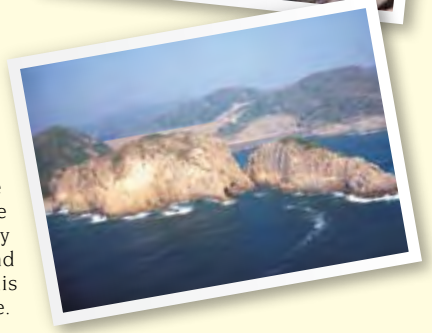
在這個位置，一帶狀深色的岩石穿過傾斜而彎曲的石柱。深色的是岩牆，它沿着凝灰岩中的裂縫入侵。這裂縫於石柱受拉張而彎曲和風化的地方形成。

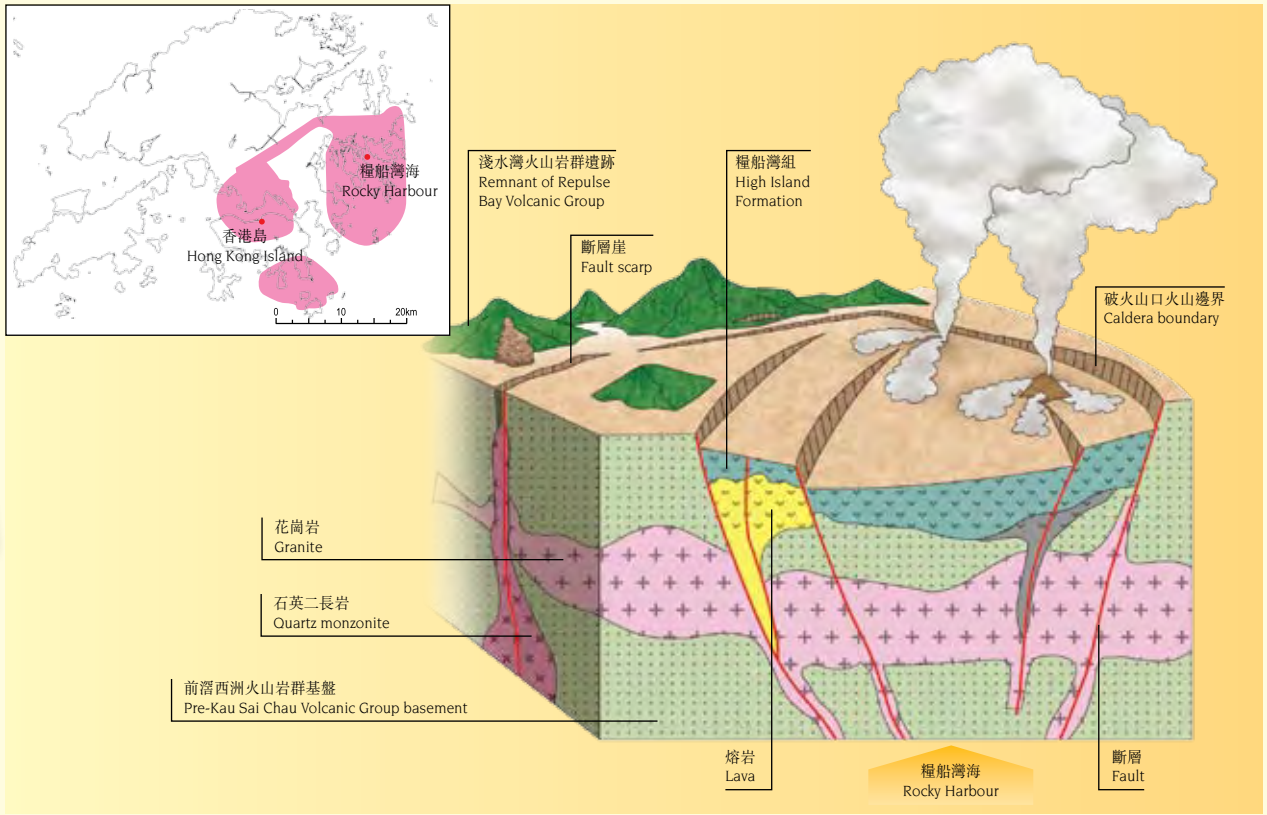
A thin band of dark rock cuts across the inclined and flexed columns obliquely at this location. The rock is a dyke that intruded along a fracture developed long after the hot ash had cooled and hardened to form hard tuff. The fracture is located in a zone where the columns are bent and weathered by tensional forces.

5 破邊洲 Po Pin Chau

柱狀節理發育的流紋質凝灰岩，於糧船灣海沿岸和周圍的島嶼出露。這些石柱形成非常陡峭或垂直峭壁，從大海崛起。由於個別或一列石柱崩塌導致懸崖後撤。這種機制使懸崖呈現獨特有條痕的外觀。

Columnar-jointed rhyolitic tuffs are exposed along the coastline of the many islands, *e.g.* Po Pin Chau. These columns form very steep or vertical cliffs that rise abruptly out of the sea. Cliff recession occurs by the undercutting and collapse of individual columns or sections of a column. This mechanism gives the cliffs a distinctive striated appearance.





圖A4-1. 一億四千萬年前的破火山口及相關的侵入岩之圖解(細圖為該火山活動時期形成的火成岩於本港之分佈)。

Figure A4-1. Schematic representation of caldera development and related subvolcanic intrusions 140 million years ago (Inset map indicates the distribution of igneous rocks in Hong Kong associated with this volcanic episode).

資料匣 BOX

萬宜水庫 High Island Reservoir

萬宜水庫位於西貢半島的南部與糧船灣洲的狹窄海道之間，其面積約為8平方公里，儲水量達2億8千立方公里。興建水庫的工程是在官門海峽東西兩邊加建兩道堤壩，將糧船灣洲和西貢半島連接起來。在興建主堤壩之前，先建造兩道圍堰，以隔開並抽乾圍堰內的海水，然後挖除海床的黏土和沙，使主壩能建造在堅硬的基岩之上。最後，淡水注入人工湖而成水庫。

興建萬宜水庫的計劃於1969年展開，在1971年正式動工，並在1978年11月竣工，工程歷時7年。東壩長485米，高106米；西壩長752米，高101米。堤壩建成後，圍堰仍然保留作主壩的護堤。東壩前的圍堰放了七千多塊各重約25噸的防波石，以阻擋海浪的衝擊。

圖A4-2. 萬宜水庫水壩建造並抽乾海水後，海床的沉積物暴露出來。
Figure A4-2. Sediments exposed on the floor of the High Island Reservoir following construction of the dams and draining of the area.

The High Island Reservoir covers an area of about 8 km^2 and is located between the southern part of the Sai Kung Peninsula and High Island in Rocky Harbour. Its storage capacity is about 280 million cubic metres. The reservoir was formed by building two main dams across the eastern and western entrances of Kon Mun Strait, thereby linking the once High Island to the Sai Kung Peninsula. Before the main dams could be built, two cofferdams were constructed in order to seal off the man-made lake. Seawater was then pumped out. Sediment and soil, which were originally lying on the seabed, were removed. The main dams were then founded on solid bedrock. Finally, fresh water was allowed to fill the reservoir.

The High Island Reservoir project began in 1969 with the construction works starting in 1971. The reservoir took 7 years to complete, and finally opened in November 1978. The East Dam is 485 m long and 106 m high, whereas the West Dam is 752 m long and 101 m high. The cofferdams are retained to serve as protective structures for the main dams. More than 7,000 pieces of dolosses, which are concrete structures weighting 25 tonnes each, were placed at the cofferdam for the East Dam to stop the pounding waves from the open sea.

如何前往? How to Get There?

萬宜水庫提供了觀察壯觀的柱狀凝灰岩的地點。萬宜水庫位於西貢東郊野公園。從北潭涌郊野公園遊客中心，可步行前往萬宜水庫。從西貢往黃石碼頭的94號巴士及從鑽石山港鐵站往黃石碼頭的96R巴士(只在週末及公眾假期服務)，則途經郊野公園遊客中心前面的停車場。由此下車，沿大網仔路向東南步行約1.5公里，即達萬宜水庫的涼亭。在這兒往西貢萬宜路向東南方走行約9公里，繞經西壩，直行至萬宜水庫的東壩。柱狀凝灰岩的地質觀察點在東壩的東北端。

High Island Reservoir provides a relatively convenient location for examining the spectacular outcrops of columnar-jointed tuff. High Island Reservoir is located in the Sai Kung East Country Park. Access is on foot from the Country Park Visitor's Centre at Pak Tam Chung, which is on the route of public bus no. 94 from Sai Kung to Wong Shek Pier, and no. 96R from Diamond Hill MTR Station to Wong Shek Pier (services only on weekends and public holidays). Alight by the car park in front of Country Park Visitor's Centre, then walk southeast along Tai Mong Tsai Road for about 1.5 km to the shelter at the High Island Reservoir. At this point, take the right branch to Sai Kung Man Wee Road, and walk southeast for about 9 km, crossing the West Dam, until the East Dam of High Island Reservoir is reached. The columnar-jointed tuff is visible at the far side of the dam.