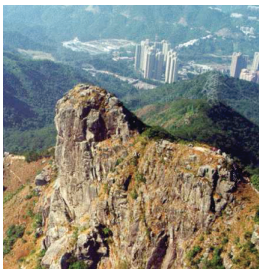
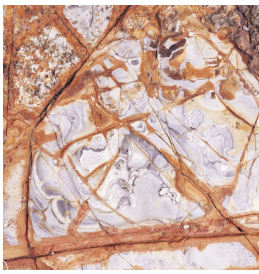
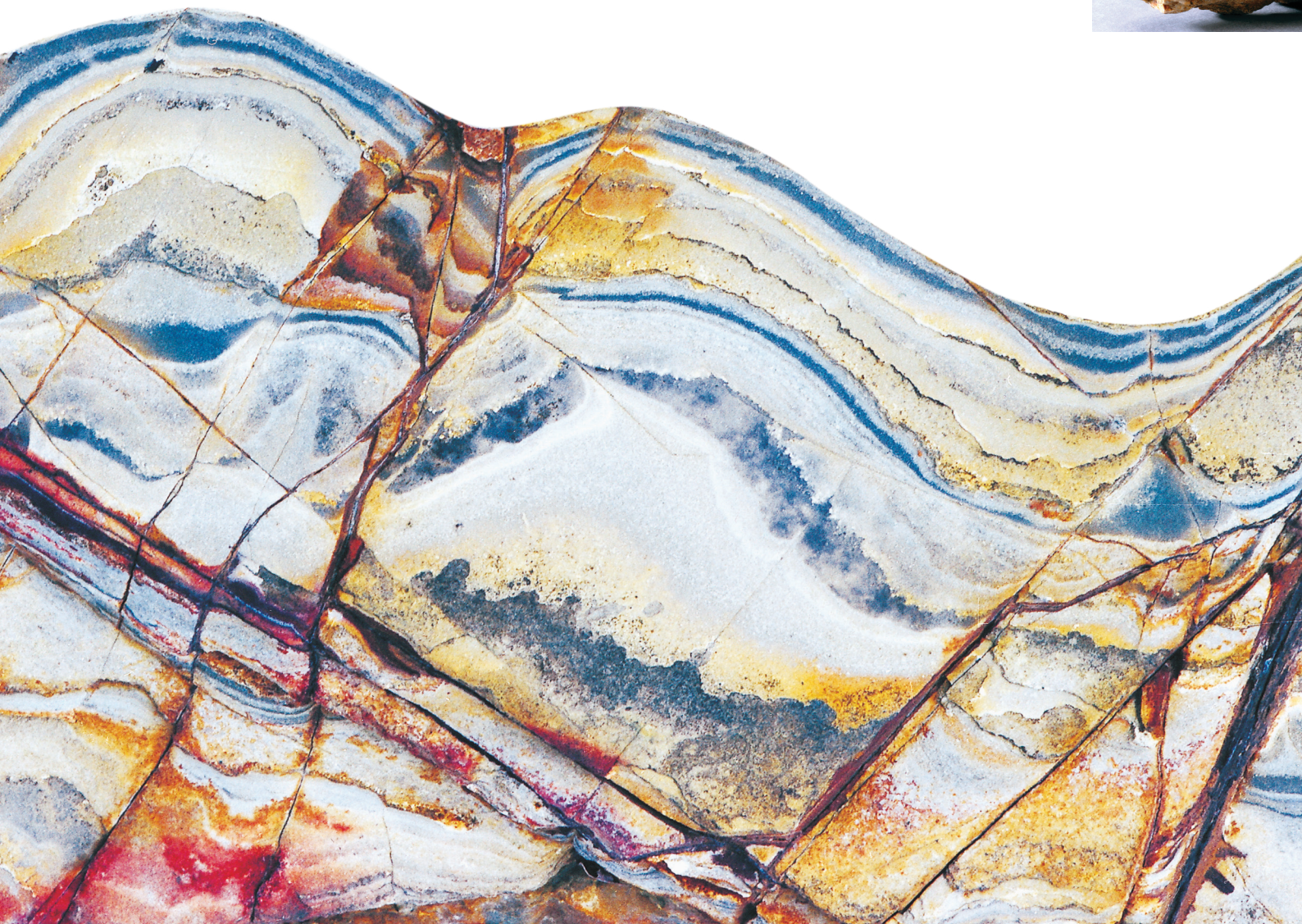
土木工程拓展署
土力工程處
Geotechnical Engineering Office
Civil Engineering and
Development Department

香港的岩石與礦物
HONG KONG ROCKS AND MINERALS

岩石與礦物 3
ROCKS AND MINERALS 3







前言

教育局於2005年公布，三年新高中學制將於2009年9月在中四級實施。地理科是其中一個重點的選修科目。

新高中地理科課程是根據2005年教育局出版的一份文件和課程發展議會《高中課程指引》(2007)的建議而制訂。在此課程中，地理被視為一門學科讓學生可以從空間的角度了解自身所處的地球。

土木工程拓展署轄下的土力工程處應教育局的請求，在天然災害及地球科學兩個新高中地理科課程內容上製備了一份「教學支援教材套」。其中有關香港岩石及礦物的資料亦適用於部份化學科的課程。

「教學支援教材套」包括了14本小書冊、4張海報、3片光碟及其他一些補充資料。此教材套在香港的斜坡安全、山泥傾瀉、地質及地貌等課題上提供了合適及最新的資料並同時符合新高中地理科課程的水平。

土力工程處的「香港地質調查組」負責編寫有關香港地質及地貌方面的內容，而「斜坡安全部」則負責香港斜坡安全及山泥傾瀉的部份，「斜坡安全部」的同事亦負責整個項目的策劃與安排。我謹向各位參與這項工作的同事致謝。

我相信這教材套對各位負責新高中地理科目的老師在擬備教材時能提供合適的參考。此教材套亦給予有興趣於這些課題的廣大讀者一些有用的資料。

陳健碩

陳健碩
土木工程拓展署
土力工程處處長
2008年12月

Foreword

In 2005, the Education Bureau (EDB) announced that a three-year New Senior Secondary (NSS) curriculum would be implemented at Secondary 4 in September 2009. Geography is one of the elective subjects under the NSS curriculum.

The NSS curriculum has been developed on the basis of the recommendations made by an EDB document in 2005 and a Senior Secondary Curriculum Guide of 2007. Within the curriculum, geography is seen as a key educational discipline that provides students with a spatial understanding of the Earth on which we live and work.

At the request of the EDB, the Geotechnical Engineering Office (GEO) of the Civil Engineering and Development Department have prepared support teaching materials for the NSS Geography curriculum under the topics of Natural Hazards and Earth Science. The materials written on rocks, minerals and ores in Hong Kong are also suitable for part of the Chemistry curriculum.

The "Teaching Support Materials Kit" consists of 14 booklets, 4 posters, 3 CDs and other supplementary information sheets. This teaching kit contains pertinent and up-to-date information on slope safety, landslides, geology and geomorphology in Hong Kong, written at a level that is suitable for the NSS Geography curriculum.

Hong Kong Geological Survey of GEO have compiled the teaching materials that describe the geology and geomorphology of Hong Kong. The Slope Safety Division of GEO have prepared the teaching materials on Hong Kong slope safety and landslides. Colleagues in the Slope Safety Division are also responsible for the overall planning and coordination of this project. Their contributions are gratefully acknowledged.

I am confident that, for years to come, secondary school geography teachers will find the kit invaluable for preparing their classroom teaching materials. The contents will also be of interest to the more general readers who may wish to learn more about these topics.

Raymond K S Chan
Head, Geotechnical Engineering Office
Civil Engineering and Development Department
December 2008

引言
Introduction

我們的地球是一個由大氣圈、水文圈、生物圈及岩石圈四個主要部份組成的動力體系。這四個部份在漫長的地球歷史中，持續互相影響。地質學為一門研究岩石圈的科學，並且包含岩石圈與其他三個部份相互作用的研究。

礦物和岩石是岩石圈的重要成分。雖然礦物種類超過三千種，但只有少數為常見組成岩石的礦物，例如石英、長石、雲母、角閃石、輝石、橄欖石及方解石**(岩石與礦物之一)**。岩石可視乎其形成的模式，劃分為火成、沉積及變質岩三大類**(岩石與礦物之一)**。過去地質年代期間，岩石逐漸從一種類變成另一類，這過程稱為岩石循環**(岩石與礦物之二)**。從仔細查驗岩石的岩理、成分及內部結構等特徵，可判斷該岩石的來源，這就是識別岩石的基礎**(岩石與礦物之二)**。在香港出現的岩石種類繁多，顯示區內複雜的地質情況**(岩石與礦物之三)**。

Our Earth is a dynamic system that comprises four main components: the atmosphere, the hydrosphere, the biosphere and the geosphere. These four components have been continuously interacting throughout the Earth's long history. Geology is the science that studies the geosphere, and encompasses the interactions between the geosphere and the other three components.

Minerals and rocks are essential components of the geosphere. Although there are over 3,000 species of minerals, only a few of them, such as quartz, feldspar, mica, amphibole, pyroxene, olivine and calcite, occur commonly as rock-forming minerals **(Rocks and Minerals 1)**. Rocks are classified into three main types, igneous, sedimentary and metamorphic, depending upon their mode of formation **(Rocks and Minerals 1)**. Over geological time, rocks are gradually transformed from one type to another in what is termed the Rock Cycle **(Rocks and Minerals 2)**. The origin of any particular rock can be determined by careful examination of its texture, composition, and internal structure, features that form the basis of rock identification and classification **(Rocks and Minerals 2)**. The large variety of rock types present in Hong Kong reflects the complexity of the geology of the region **(Rocks and Minerals 3)**.

內容
Contents

香港已知的地質史遠溯至四億多年前的泥盆紀時期，香港的岩石種類繁多，充分反映區內複雜的地質情況。對岩石作詳細研究，有助辨識地質歷史和構造環境的演變。

香港最古老的岩石為晚古生代陸上及淺海的沉積岩，這些泥盆紀、石炭紀及二疊紀的岩石主要出現於香港的東北及西北部地區。

中生代火山活動以前形成的沉積岩，包括有侏羅紀早期及中期沉積於沖積環境及淺海環境的砂岩、粉砂岩及泥岩。

中生代的火山岩及深成岩為香港主要的岩石種類，包含花崗岩岩體、流紋質岩牆及厚層的流紋質凝灰岩及熔岩。而大部份的火成岩出現於侏羅紀晚期及白堊紀早期時代。

中生代火山活動之後形成的沉積岩，和第三紀沉積岩主要出現於香港的東北部地區，其中包括沉積於陸上斷層盆地的紅層(帶紅色的沉積岩岩層) 以及蒸發性沉積物。

風化及侵蝕作用等地質過程，形成了現今香港的地貌，並引致較厚的第四紀表土沉積物囤積在個別地區。

香港最常見及最具代表性的岩石選列如下。而有關表土沉積的例子及香港常見的礦物亦一併於此章描述。

香港的岩石

古生代沉積岩

泥盆紀黃竹角咀組 — 礫岩及砂岩

(約四億一千萬至三億六千萬年前)

泥盆紀的岩石主要出現於香港赤門海峽北岸及馬鞍山兩地，這些岩石包括礫岩及砂岩岩層。於1982年，白沙頭洲沉積岩層中曾發現數塊魚化石(盾皮魚)的碎片，因而確定屬泥盆紀時代。泥盆紀礫岩呈白色，含有圓卵形石英岩和夾雜其中的石英岩粗沙粒填充物(圖1)。沉積物積聚在河流和三角洲的環境。

有關地質時代表，見地質圖之一。

石炭紀元朗組 — 大理岩

(約三億六千萬年前)

新界西北部蘊藏有大理岩，該處的大理岩並沒有露出地面，而是被厚厚的沉積物埋於元朗平原之下。大理岩乃變質石灰岩，原本積聚在溫暖及淺水的海洋環境。純大理岩含有95%以上的方解石晶體礦物，可被含微酸性的地下水溶解(圖2)。這些大理岩的溶洞發展為喀斯特地形(現已被埋藏)。

圖1. 泥盆紀黃竹角咀組的礫岩。
Figure 1. Conglomerate of the Devonian Bluff Head Formation.

The known geological history of Hong Kong spans over 400 million years since the Devonian period. The large variety of rock types present in Hong Kong reflects the complexity of the geology of the region. Detailed studies of the rocks enable the geological history and evolution of tectonic setting to be deciphered.

The oldest rocks in Hong Kong are of late Palaeozoic age and comprise non-marine and shallow marine sedimentary rocks. These Devonian, Carboniferous and Permian rocks crop out mainly in the northeast and northwest of Hong Kong.

The Mesozoic pre-volcanic sedimentary rocks comprise Early and Middle Jurassic sandstones, siltstones, and mudstones that were deposited in an alluvial, and shallow marine, sub-tidal environments.

Mesozoic volcanic and plutonic rocks are the dominant rock types in Hong Kong. They comprise granite plutons, rhyolitic dykes and thick rhyolitic tuffs and lavas. Most of the igneous rocks are of Late Jurassic to Early Cretaceous age.

Mesozoic sedimentary rocks, which are younger than the main volcanic episode, and Tertiary sedimentary rocks, are exposed mainly in northeastern Hong Kong. They comprise non-marine red bed and evaporitic sediments that were deposited in fault-controlled basins.

Weathering and erosion have shaped the present landscape of Hong Kong and led to the accumulation of locally thick Quaternary superficial deposits.

The most common and representative rocks of Hong Kong are selected and presented below. Examples of superficial deposits and common mineral occurrences in Hong Kong are also included in this chapter.

Hong Kong Rocks

Palaeozoic Sedimentary Rocks

Devonian Bluff Head Formation – conglomerate and sandstone

(around 410 to 360 million years ago)

Devonian rocks occur at two main locations in Hong Kong: on the northern shore of Tolo Channel and at Ma On Shan. They include layers of conglomerate and sandstone. Fragments of fossil fish (placoderm) were discovered in 1982 in the sedimentary rock layers at Harbour Island and thus confirmed the Devonian age of the rocks. The Devonian conglomerates are white in colour and contain rounded pebbles of quartzite set in a matrix of coarse quartz-rich sand (Figure 1). The sediments were deposited in fluvial and deltaic environments.

See Geological Maps 1 for details of the Geological Time Scale.

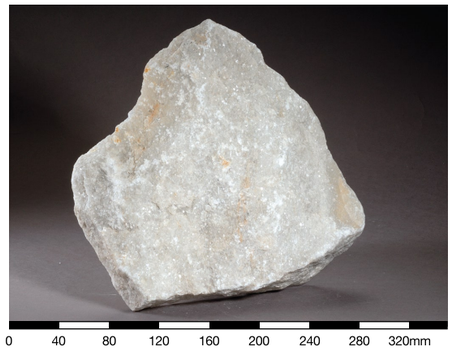


圖2. 石炭紀元朗組的大理岩。
Figure 2. Marble of the Carboniferous Yuen Long Formation.

石炭紀落馬洲組 — 石英岩及石墨片岩

(約三億四千萬年前)

落馬洲組岩石分佈於新界北部，主要由變質沉積岩組成，包括變質礫岩、變質砂岩、變質粉砂岩、石英岩及石墨片岩。石英岩主要由再結晶的石英，以及少量雲母、絹雲母組成。石墨片岩色澤深黑，並有明顯的的變質葉理(圖3)。這些沉積物多於潮汐灘地或三角洲扇一帶的環境沉積。

圖3. 石炭紀落馬洲組的石墨片岩。
Figure 3. Graphite schist of the Carboniferous Lok Ma Chau Formation.

二疊紀大埔海組 — 粉砂岩及泥岩

(約三億至二億五千萬年前)

二疊紀時代的岩石見於吐露港一帶，主要出現在馬屎洲，有含黃鐵礦(硫化鐵)的灰色粉砂岩及泥岩(圖4)，在馬屎洲出現的沉積岩岩層一般受滑動褶皺以致變形。此外，粉砂岩及泥岩中發現一些海洋生物化石，證實為二疊紀時代的岩石，而原來的沉積物在近岸潮汐灘地環境沉積。

圖4. 二疊紀大埔海組的粉砂岩。
Figure 4. Siltstone of the Permian Tolo Harbour Formation.

中生代火山活動前之沉積岩

早侏羅紀赤門組— 含化石粉砂岩及泥岩

(約二億至一億九千萬年前)

深涌、鳳凰笏及大棠(元朗)發現少量的侏羅紀初期岩石，包括灰至灰白色薄層粉砂岩、泥岩(圖5)及砂岩透鏡體。在1924年，香港發現的首枚化石是【香港菊石】，在赤門海峽北岸的泥岩中找到，證實屬早侏羅紀時期。其沉積物大多沉積於淺海洋的潮下帶。

Carboniferous Yuen Long Formation – marble *(around 360 million years ago)*

Marble occurs in the northwest New Territories. It is not exposed at the surface, but is buried beneath thick sediments on the Yuen Long Plain. The marble is metamorphosed limestone, which was originally deposited in a warm and shallow sea environment. Pure marble contains more than 95% crystalline calcite minerals that are readily dissolved by weakly acidic groundwater (Figure 2). Solution cavities occur in the marble, which have resulted in the development of a karst topography (now buried).

Carboniferous Lok Ma Chau Formation – quartzite and graphite schist

(around 340 million years ago)

The Lok Ma Chau Formation is distributed in the northern New Territories. It comprises mainly metamorphosed sedimentary rocks, including meta-conglomerate, meta-sandstone, meta-siltstone, quartzite and graphite schist. Quartzite is composed mainly of recrystallised quartz with some tiny flakes of sericite, mica. Graphite schist is dark black in colour and shows well developed metamorphic foliation (Figure 3). The sediments were deposited on a tidal flat or as a deltaic fan.

Permian Tolo Harbour Formation – siltstone and mudstone *(around 300 to 250 million years ago)*

Rocks of Permian age are found in Tolo Harbour, mainly on Ma Shi Chau. They are greyish siltstones and mudstones (Figure 4) that contain pyrite minerals (iron sulphide). The sedimentary layers on Ma Shi Chau are commonly deformed by slump folding. Several marine fossils have been identified in the siltstones and mudstones, which have confirmed a Permian age for the rocks and indicate that the rocks were originally deposited in a near-shore tidal flat environment.

Mesozoic Pre-volcanic Sedimentary Rocks

Early Jurassic Tolo Channel Formation – fossil-bearing siltstone and mudstone

(around 200 to 190 million years ago)

Early Jurassic rocks occur as small exposures at Sham Chung, Fung Wong Wat and Tai Tong. They consist of grey to greyish white thinly bedded siltstone and mudstone (Figure 5) with lenses of sandstone. In 1924, the first fossil in Hong Kong, an ammonite (*Hongkongites hongkongensis),* was discovered embedded in the mudstone on the northern shore of Tolo Channel. This confirmed the age as Early Jurassic. The sediments were probably deposited in a shallow marine, sub-tidal environment.

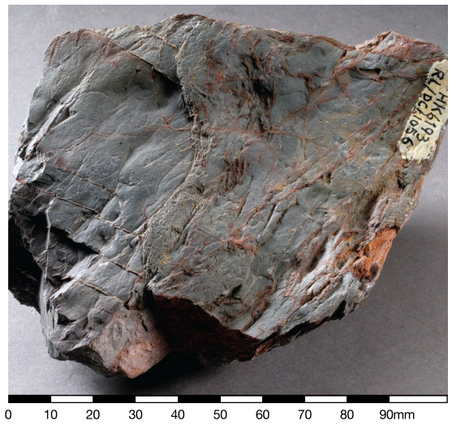


圖5. 早侏羅紀赤門組的泥岩。
Figure 5. Mudstone of the Early Jurassic Tolo Channel Formation.

中侏羅紀大澳組 — 砂岩及粉砂岩

(約一億九千萬至一億八千萬年前)

大澳組的岩石展現於大嶼山西部，大澳至深屈灣沿岸。該區的沉積岩由一層一層的砂岩(圖6)和粉砂岩組成，顯示出不同的沉積結構，如交錯層理和收縮裂縫。大澳組同時亦發現植物化石，確認為中侏羅紀時期形成。沉積物大多堆積於沖積層平原環境。

圖6. 中侏羅紀大澳組的砂岩。
Figure 6. Sandstone of the Middle Jurassic Tai O Formation.

中生代火山岩

中侏羅紀屯門組— 安山岩熔岩

(約一億八千萬年前)

由安山質火山岩及火山碎屑沉積岩組成的屯門組分佈於屯門谷一帶。而安山岩熔岩(圖7)常見於構成這岩石的上部，呈深灰色，粒體極微小，大多顯現變質葉理；間中帶有綠簾石礦化作用，令岩石色澤略帶綠色。

圖7. 中侏羅紀屯門組的變質安山岩熔岩。
Figure 7. Meta-andesite lava of the Middle Jurassic Tuen Mun Formation.

中侏羅紀荃灣火山岩群 — 粗火山灰晶屑凝灰岩 *(約一億六千四百萬至一億六千萬年前)*

荃灣火山岩群主要出現在新界東北及西北部，粗火山灰晶屑凝灰岩(圖8)為主要的岩石，火山岩由石英、長石、角閃石、黑雲母及岩石的碎屑組成。這些火山灰噴發自鄰近的火山中心。

圖8. 中侏羅紀荃灣火山岩群的粗火山灰晶屑凝灰岩。
Figure 8. Coarse ash crystal tuff of the Middle Jurassic Tsuen Wan Volcanic Group.

中侏羅紀荃灣火山岩群 — 凝灰角礫岩

(約一億六千四百萬至一億六千萬年前)

石龍拱的凝灰角礫岩(圖9)由直徑長達6米、呈棱角狀的岩石碎片構成。這些岩石碎片主要包括火山岩以及少量石英岩和燧石。根據岩石碎片的角狀及大小，可推斷其沉積地點在火山噴道附近。

Middle Jurassic Tai O Formation – sandstone and siltstone

(around 190 to 180 million years ago)

The Tai O Formation is exposed along the coast from Tai O to Sham Wat Wan in the western part of Lantau Island. These sedimentary rocks include alternating layers of sandstone and siltstone (Figure 6) and show a variety of sedimentary structures such as cross bedding and shrinkage cracks. Plant fossils have also been found in the Tai O Formation, confirming the age as Middle Jurassic. The sediments were probably deposited on an alluvial plain.

Mesozoic Volcanic Rocks

Middle Jurassic Tuen Mun Formation – andesite lava *(around 180 million years ago)*

The Tuen Mun Formation comprises andesitic volcanic rocks and volcaniclastic sedimentary rocks that are distributed along the Tuen Mun Valley. Andesite lava (Figure 7) is common in the upper part of the formation. The andesite is dark grey, very fine-grained and commonly shows metamorphic foliation. Sporadic epidote mineralization gives the rock a greenish colour.

Middle Jurassic Tsuen Wan Volcanic Group – coarse ash crystal tuff

(164 to 160 million years ago)

The Tsuen Wan Volcanic Group is mainly exposed in the northeastern and northwestern New Territories. The dominant rock type is coarse ash crystal tuff (Figure 8), which is composed of crystal fragments of quartz, feldspar, hornblende and biotite, locally containing rock fragments. The volcanic ash was erupted from a nearby volcanic centre.

Middle Jurassic Tsuen Wan Volcanic Group – tuff breccia *(164 to 160 million years ago)*

Tuff breccia (Figure 9) at Shek Lung Kung comprises angular rock fragments that are up to 6m in diameter. The rock fragments consist mainly of volcanic rocks with some quartzite and chert. The size and angularity of the fragments suggest that they were deposited close to a volcanic vent.

圖9. 中侏羅紀荃灣火山岩群的凝灰角礫岩。
Figure 9. Tuff breccia of the Middle Jurassic Tsuen Wan Volcanic Group.

晚侏羅紀大嶼山火山岩群 — 流紋岩熔岩及凝灰岩 *(約一億四千八百萬至一億四千六百萬年前)*

大嶼山火山岩群主要展現在大嶼山及荔枝莊。於大嶼山的火山岩(圖10)大多含石英及長石的晶體，並有獨特的流狀結構。這些流狀結構是由黏性的熔岩流，或由既厚又濃密熔結的火山灰流形成。這些火山灰流可能與破火山口崩塌有關。

圖10. 晚侏羅紀大嶼山火山岩群的凝灰岩。
Figure 10. Tuff of the Late Jurassic Lantau Volcanic Group.

晚侏羅紀大嶼山火山岩群 — 火山碎屑岩 *(約一億四千八百萬至一億四千六百萬年前)*

在荔枝莊亦發現了火山碎屑岩(圖11)的岩層，由層理清楚的凝灰質泥岩、燧石粉砂岩、砂岩、礫岩及凝灰岩組成，常見軟沉積物變形和火焰狀構造。這些火山沉積物大概以泥石流的過程，迅速地在火山拗陷的湖中，在未經固結的沉積物上堆積。

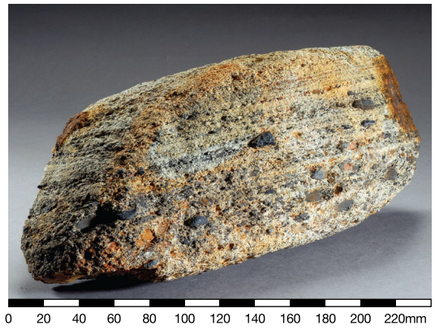


圖11. 晚侏羅紀大嶼山火山岩群的火山碎屑沉積岩。
Figure 11. Volcanic sandstone of the Late Jurassic Lantau Volcanic Group.

早白堊紀淺水灣火山岩群 — 條紋斑狀細火山灰玻屑凝灰岩 *(約一億四千三百萬至一億四千二百萬年前)*

淺水灣火山岩群主要在港島南區、東九龍及西貢一帶出現。細火山灰凝灰岩是這火山岩群的主要種類，內含極微細火山灰粒及一般呈現條紋斑狀(圖12)。條紋斑狀葉理屬熔結結構，即指在火山岩內，熾熱的浮石(即流紋質火山玻璃)被鎔合、壓緊及最後排列一致的構造。熔結構造正好反映火山灰沉積時的溫度非常高。

早白堊紀淺水灣火山岩群 — 粗火山灰晶屑凝灰岩 *(約一億四千三百萬至一億四千二百萬年前)*

粗火山灰晶屑凝灰岩是淺水灣火山岩群另一種主要岩石。在大灘海發現的凝灰岩(圖13)含石英、粉紅色的長石、黑雲母等礦物的晶屑及其他岩石碎片。火山岩發現熔結構造，相信火山岩群可能在一億四千三百萬年前破火山口的周期性爆發而形成。

Late Jurassic Lantau Volcanic Group – rhyolite lava and tuff *(148 to 146 million years ago)*

The Lantau Volcanic Group is exposed on Lantau Island and at Lai Chi Chong. The volcanic rocks on Lantau Island (Figure 10) generally contain crystals of quartz and feldspar and display distinct flow structures. They were either erupted as viscous lava flows, or as thick and densely welded volcanic ash flows. The volcanic ash flows were probably derived from explosive volcanic eruptions associated with the collapse of a caldera.

Late Jurassic Lantau Volcanic Group – volcaniclastic rocks *(148 to 146 million years ago)*

Volcaniclastic rocks (Figure 11) comprising well-bedded layers of tuffaceous mudstone, cherty siltstone, sandstone, conglomerate and tuff occur at Lai Chi Chong. Soft sediment deformation structures and flame structures are common. These volcanic sediments were probably deposited rapidly from debris flows onto unconsolidated sediments within a lake that occupied a volcanic depression.

Early Cretaceous Repulse Bay Volcanic Group – eutaxitic fine ash vitric tuff *(143 to 142 million years ago)*

The Repulse Bay Volcanic Group is exposed in southern Hong Kong Island, eastern Kowloon and Sai Kung. One of the major rock types of the volcanic group is fine ash vitric tuff which commonly displays a eutaxitic foliation (Figure 12). Eutaxitic foliation is a welding structure that forms when hot pumice (volcanic glass of rhyolitic composition) is fused, compressed and consequently oriented in the volcanic rock. The welding structure suggests that the volcanic ash was extremely hot during deposition.

圖12. 早白堊紀淺水灣火山岩群的條紋斑狀細火山灰玻屑凝灰岩。
Figure 12. Eutaxitic fine ash vitric tuff of the Early Cretaceous Repulse Bay Volcanic Group.

Early Cretaceous Repulse Bay Volcanic Group – coarse ash crystal tuff *(143 to 142 million years ago)*

Coarse ash crystal tuff is the other major rock type of the Repulse Bay Volcanic Group. In Long Harbour (Tai Tan Hoi), the tuff (Figure 13) contains crystal fragments of quartz, pink feldspar and biotite minerals, and some rock fragments. Welding structures can be seen in the volcanic rocks. The volcanic group was probably formed by periodic eruptions from a caldera-type volcano at around 143 million years ago.

圖13. 早白堊紀淺水灣火山岩群的粗火山灰晶屑凝灰岩。
Figure 13. Coarse ash crystal tuff of the Early Cretaceous Repulse Bay Volcanic Group.

早白堊紀滘西洲火山岩群 — 流紋岩熔岩及凝灰岩 *(約一億四千一百萬至一億四千萬年前)*

滘西洲火山岩群之流紋岩熔岩(圖14)及凝灰岩於西貢東郊野公園及清水灣半島出現。這些火山岩呈深灰色，含極細粒平板狀長石晶體並普遍呈流層狀。流層是由於黏性岩漿的流動和有緻密熔結構造的火山灰，於地表拖行而形成。這些熔岩及火山灰大概從沿着斷層的火山裂縫噴出。

圖14. 早白堊紀滘西洲火山岩群的流紋岩熔岩。
Figure 14. Rhyolite lava of the Early Cretaceous Kau Sai Chau Volcanic Group.

早白堊紀滘西洲火山岩群 — 細火山灰玻屑凝灰岩 *(約一億四千一百萬至一億四千萬年前)*

於糧船灣及果洲群島發現的六角柱狀火山細灰凝灰岩(圖15)，屬滘西洲火山岩群。這些凝灰岩顏色略帶紅，極微細的火山灰內含有粉紅長石晶體碎屑，而柱狀成因是當熾熱的火山灰墜落、冷卻和收縮而成。這些火山岩大概於一億四千萬年前，由一次非常強烈的破火山口形火山爆發中形成。

中生代侵入性火成岩

中侏羅紀大嶼山花崗岩 — 巨大斑晶中粒花崗岩

大嶼山花崗岩(圖16)主要分佈於大嶼山島上，但亦同時於其他地點以獨立岩體出現，如屯門、索罟群島及南丫島。大嶼山花崗岩呈灰色，內含石英、斜長石和鉀長石，以及角閃石和黑雲母。岩石中礦物一般是中粒，但仍有極大的鉀長石晶體(巨大斑晶) (5-15毫米)，讓此岩石冠上巨大斑晶岩理的稱號。

中侏羅紀大埔花崗閃長岩 — 斑狀細粒花崗閃長岩

大埔花崗閃長岩(圖17)主要在新界中部和青衣發現，亦於香港中區及南區以間斷露頭出現。此岩石內含石英和長石，附有黑雲母和角閃石等礦物。部分晶體較基質大，使岩石呈不等粒狀(斑狀)岩理。若與花崗岩相比，花崗閃長岩的石英含量較少，而斜長石比鉀長石佔更大的成份，是岩石中的主要長石。

圖15. 早白堊紀滘西洲火山岩群的細火山灰玻屑凝灰岩。
Figure 15. Fine ash vitric tuff of the Early Cretaceous Kau Sai Chau Volcanic Group.

Early Cretaceous Kau Sai Chau Volcanic Group – rhyolite lava and tuff

(141 to 140 million years ago)

Rhyolite lava (Figure 14) and tuff of the Kau Sai Chau Volcanic Group is present in Sai Kung East Country Park and on the Clear Water Bay Peninsula. The volcanic rock is dark grey, very fine-grained with tabular shaped feldspar crystals and commonly shows flow banding. Flow banding was created by the laminar flow of a viscous magma and/or densely welded volcanic ash across the ground surface. The lava and volcanic ash were probably erupted from a fissure-like volcano located along a fault.

Early Cretaceous Kau Sai Chau Volcanic Group – fine ash vitric tuff

(141 to 140 million years ago)

At High Island and on the Ninepin Islands, fine ash vitric tuff of the Kau Sai Chau Volcanic Group (Figure 15) is present in the form of hexagonal columns. The tuff is slightly reddish in colour, very fine-grained and contains crystal fragments of pink feldspar. These columns were developed when the hot volcanic ash was ponded, cooled and contracted. The volcanic rocks were probably formed from a very explosive eruption of a large caldera-type volcano about 140 million years ago.

Mesozoic Intrusive Igneous Rocks

Middle Jurassic Lantau Granite – megacrystic medium-grained granite

The Lantau Granite (Figure 16) occurs mainly on Lantau Island, but can also be found as isolated outcrops in other places, such as Tuen Mun, the Soko Islands, and Lamma Island. The Lantau Granite is grey in colour and contains quartz, plagioclase feldspar and alkali feldspar in roughly equal proportions, as well as hornblende and biotite. The minerals are generally medium-grained, although very large crystals (megacrysts) (5 – 15mm) of alkali feldspar are present, giving the rock what is termed a megacrystic texture.

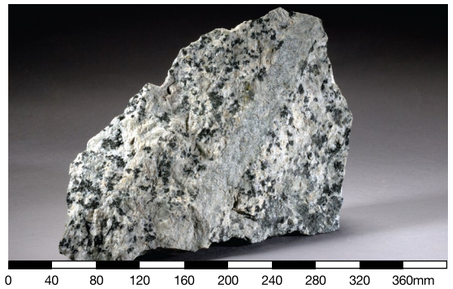


圖16. 巨大斑晶中粒花崗岩(中侏羅紀大嶼山花崗岩) 及細晶岩岩脈。
Figure 16. Megacrystic medium-grained granite (Middle Jurassic Lantau Granite) with a fine-grained aplite vein.

Middle Jurassic Tai Po Granodiorite – porphyritic fine-grained granodiorite

The Tai Po Granodiorite (Figure 17) occurs mainly in the central New Territories and on Tsing Yi, and also as discontinuous outcrops in the central and southern parts of Hong Kong. The rock contains quartz, feldspar with subordinate biotite and hornblende minerals. The grain sizes of some of the crystals are relatively larger than that in the groundmass, giving the rocks an inequigranular (porphyritic) texture. Compared with granite, granodiorite contains slightly less quartz, and plagioclase is more dominant than alkali feldspar.

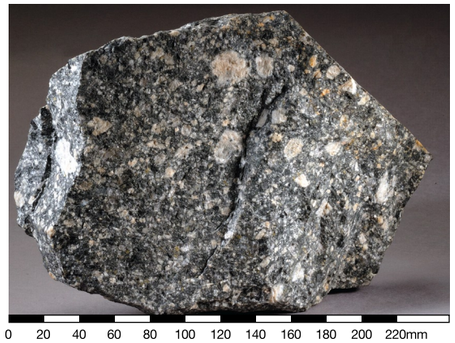


圖17. 斑狀細粒花崗閃長岩(中侏羅紀大埔花崗閃長岩)。
Figure 17. Porphyritic fine-grained granodiorite (Middle Jurassic Tai Po Granodiorite).

晚侏羅紀針山花崗岩 — 斑狀細粒花崗岩

針山花崗岩(圖18)於城門河谷的西北方形成一個東北向呈橢圓形的侵入體。這花崗岩呈淡粉紅灰色及斑狀岩理。岩石內含有相對較大的石英晶體，而斜長石則可於粒狀的基質中發現。

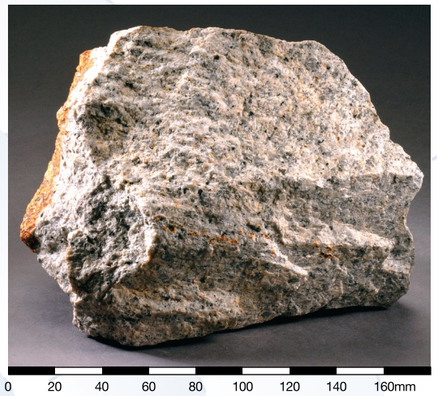


圖18. 斑狀細粒花崗岩(晚侏羅紀針山花崗岩)。
Figure 18. Porphyritic fine-grained granite (Late Jurassic Needle Hill Granite).

晚侏羅紀大嶼山岩牆群 — 長石斑岩

在大嶼山北部及青衣一帶發現的長石斑岩岩牆，大致上互相平衡，稱為岩牆群。長石斑岩岩牆(圖19)的明顯特徵是在極微細的深色基質中，找到巨型平板狀的長石晶體(斑狀岩理)。這些巨型晶體，大小可達10至30毫米，又稱斑晶。長石斑岩岩牆的化學成分與花崗岩相若。

圖19. 長石斑岩(晚侏羅紀大嶼山岩牆群)。
Figure 19. Feldsparphyric rhyolite (Late Jurassic Lantau Dyke Swarm).

早白堊紀塘福石英二長岩 — 斑狀石英二長岩

大嶼山的石英二長岩(圖20)呈淡粉紅灰色，並含有較大粒的長石晶體。石英二長岩屬侵入性火成岩，內含份量相近的斜長石及鉀長石，以及少量石英。深色的礦物如黑雲母和角閃石亦可於此岩石中發現。這些石英二長岩的岩漿大概源自地球深處，沿着已有的通道(例如斷層)侵入。

早白堊紀九龍花崗岩 — 等粒中粒花崗岩

九龍花崗岩(圖21)以維多利亞港為中心，形成呈圓形的侵入岩體。其岩石一般為中粒等粒(即指晶體大小相近，約1-3毫米不等)，色澤呈淡粉紅帶灰，內含石英、斜長石、鉀長石及黑雲母。

Late Jurassic Needle Hill Granite – porphyritic fine-grained granite

The Needle Hill Granite (Figure 18) forms a northeast-trending elliptical intrusive body on the northwestern side of the Shing Mun Valley. The granite is light pinkish grey in colour and has a porphyritic texture. It contains relatively large crystals of quartz and plagioclase feldspar set in granular fine-grained groundmass.

Late Jurassic Lantau Dyke Swarm – feldsparphyric rhyolite

On northern Lantau Island and Tsing Yi, feldsparphyric rhyolite dykes occur in a swarm comprising numerous sub-parallel intrusions. The most distinctive feature of the dykes is the presence of large tabular-shaped feldspar crystals that are set in very fine-grained dark groundmass (porphyritic texture) (Figure 19). The large crystals, known as phenocrysts, range from 10 to 30mm in length. The chemical composition of these dykes is similar to granite.

Early Cretaceous Tong Fuk Quartz Monzonite – porphyritic quartz monzonite

Quartz monzonite (Figure 20) on Lantau Island is pinkish grey, and porphyritic fine-grained, containing large crystals of feldspar. Quartz monzonite is an intrusive igneous rock containing approximately equal amounts of plagioclase feldspar and alkali feldspar, and a small amount of quartz. Dark coloured minerals, such as biotite and hornblende are also found in the rocks. The quartz monzonite magma probably originated from a deep part of the Earth's crust and intruded along well-defined conduits (such as faults).

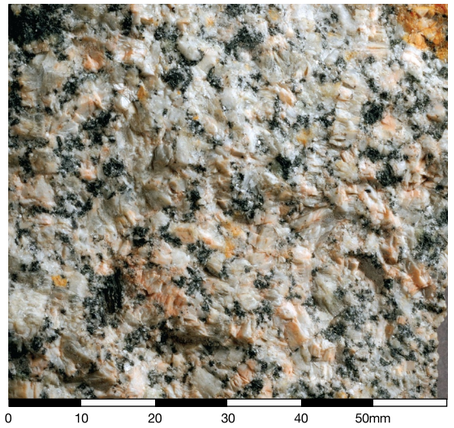


圖20. 石英二長岩(早白堊紀塘福石英二長岩)。
Figure 20. Porphyritic quartz monzonite (Early Cretaceous Tong Fuk Quartz Monzonite).

Early Cretaceous Kowloon Granite – equigranular medium-grained granite

The Kowloon Granite (Figure 21) forms a roughly circular intrusive body centred on Victoria Harbour. The granite is generally medium-grained equigranular (*i.e.* crystals are of roughly equal grain size ranging between 1 to 3mm) and has a pinkish grey colour. It contains quartz, plagioclase feldspar, alkali feldspar and biotite.

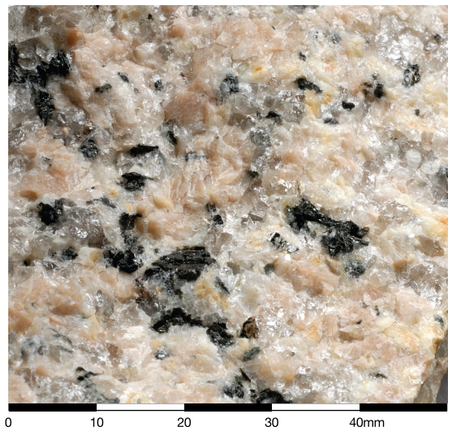


圖21. 等粒中粒花崗岩(早白堊紀九龍花崗岩)。
Figure 21. Equigranular medium-grained granite (Early Cretaceous Kowloon Granite).

偉晶花崗岩

偉晶花崗岩(圖22)通常在岩牆、透鏡體或在接近花崗岩侵入邊緣的地方形成。偉晶花崗岩中個別的晶體大小可達20毫米。其礦物成分主要包括：長石、石英和黑雲母，以及黃鐵礦及綠泥石。

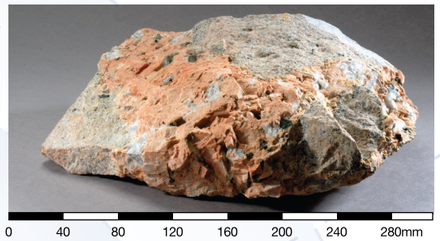


圖22. 偉晶花崗岩
Figure 22. Pegmatite

細晶岩

細晶岩是一種極細粒狀之花崗岩，一般於花崗岩的脈脈及岩牆出現(圖16)。個別晶體大小通常小於1毫米，且呈砂糖狀岩理。

基性及中性岩牆

基性及中性岩牆(圖23)遍佈香港。外表呈深灰色，一般闊度不足1米的狹窄岩牆。以化學角度而言，此類岩牆明顯地較花崗閃長岩含更少的二氧化矽。

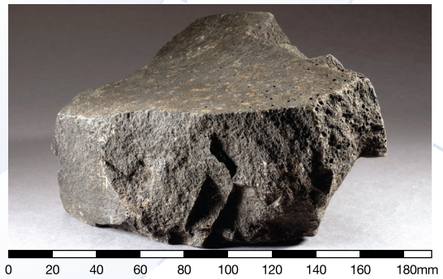


圖23. 基性 / 中基性岩牆
Figure 23. Mafic / intermediate dyke

中生代火山活動後之沉積岩

早白堊紀八仙嶺組— 礫岩、砂岩及粉砂岩 *(約一億四千萬至一億年前)*

八仙嶺組見於新界東北部，沿八仙嶺形成一列顯著向北傾斜的陡崖。八仙嶺組的礫石呈灰白色，由火山岩、泥岩及赤紅砂岩等岩石的渾圓細礫組成。八仙嶺組的粉砂岩(圖24)呈紫紅色，並且展示薄層。於白堊紀初期，當香港的火山活動剛停止時，這些沉積物在河道中堆積而成。

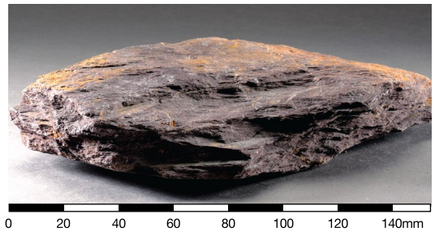


圖24. 早白堊紀八仙嶺組的粉砂岩。
Figure 24. Siltstone of the Early Cretaceous Pat Sin Leng Formation.

晚白堊紀赤洲組 — 礫岩及砂岩

(約一億年前)

赤洲組是在赤洲上出現的褐紅色的礫岩和砂岩岩層。在砂岩中發現由水流形成的交錯層理，這些沉積物堆積成沖積扇。

Pegmatite

Pegmatite (Figure 22) occurs in dykes, lenses or veins near the margins of granitic intrusions. It comprises a very coarse-grained igneous rock with individual crystals up to 20mm in size. The constituent minerals are mainly feldspar, quartz and muscovite, but may also include pyrite and chlorite.

Aplite

Aplite is a very fine-grained granitic rock that generally occurs as veins and dykes in granitic rocks (Figure 16). The grain size of individual minerals is generally less than 1mm, and the rock shows a sugary texture.

Mafic and intermediate dykes

Mafic and intermediate dykes (Figure 23) are widespread throughout Hong Kong. They are dark grey in colour and generally form narrow dykes of basaltic andesite less than 1m wide. Geochemically, they contain significantly less silica (SiO_2) than the granitic rocks.

Mesozoic Post-volcanic Sedimentary Rocks

Early Cretaceous Pat Sin Leng Formation – conglomerate, sandstone and siltstone

(around 140 to 100 million years ago)

The Pat Sin Leng Formation conglomerate occurs in the northeastern New Territories where it forms a prominent south facing escarpment, the Pat Sin Leng. The conglomerate is greyish white in colour, and comprises subrounded pebbles of volcanic rocks, mudstone and reddish sandstone.

The siltstone (Figure 24) is reddish purple in colour, and is thinly bedded. These pebbles were originally deposited in river channels soon after the cessation of volcanic activity in Hong Kong during the Early Cretaceous.

Late Cretaceous Port Island Formation – conglomerate and sandstone

(around 100 million years ago)

On Port Island, reddish brown layers of conglomerate and sandstone occur. Cross-bedding, created by water currents, is developed in the sandstone. The sediments were probably deposited in river channels.

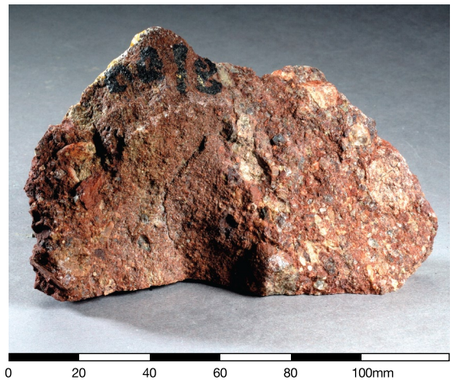


圖25. 晚白堊紀赤洲組的砂岩。
Figure 25. Sandstone of the Late Cretaceous Port Island Formation.

晚白堊紀吉澳組 — 角礫岩 *(約一億年前)*

吉澳組散佈於新界東北部多個離島，包括吉澳及鴨洲。吉澳組是由一系列角礫岩(圖26)、礫岩、砂岩及粉砂岩組成，並由方解石礦物膠結而成。這些沉積物顏色由褐紅至灰白不等，多從斷層崖崩出來，並形成扇形沖積物。

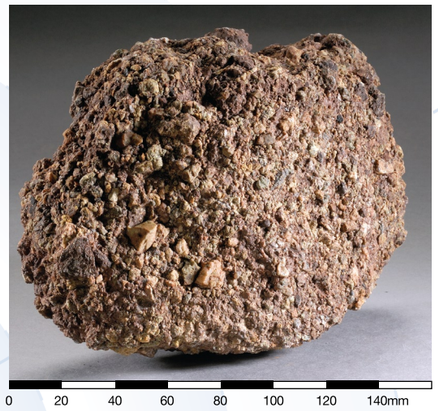


圖26. 晚白堊紀吉澳組的角礫岩。
Figure 26. Breccia of the Late Cretaceous Kat O Formation.

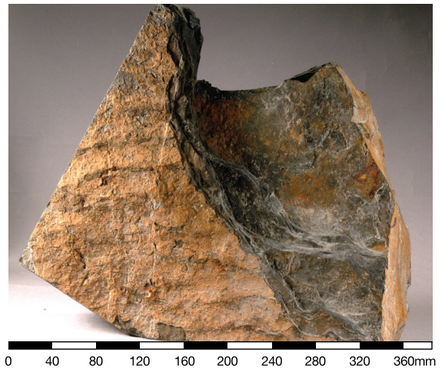


圖27. 早第三紀平洲組的粉砂岩。
Figure 27. Siltstone of the Early Tertiary Ping Chau Formation.

早第三紀平洲組 — 燧石質粉砂岩

(約五千萬年前)

在平洲西岸的龍落水，露出一層燧石質粉砂岩(厚度高至1.2米)。燧石質粉砂岩(圖28)含極微細的二氧化矽晶體，燧石質粉砂岩非常堅硬，可以抵禦風化和侵蝕。

新生代沉積岩

早第三紀平洲組 — 粉砂岩*(約五千萬年前)*

平洲組是香港最年輕的岩層，岩石由薄層粉砂岩(圖27)組成，並略斜向東北方。在此組沉積岩內，曾發現昆蟲化石及瀝青化植物碎片。這些沉積物於湖底沉積，當湖水周期性的乾涸，鹽(石膏)便沉澱形成。其後，石膏被溶解，在粉砂岩上留下石膏晶體的空模子，而這些模子最終被次生礦物包括霓輝石、方解石、沸石及錐輝石等礦物填補。

變質岩

糜棱岩 — 與斷層有關的變質岩 (動力變質作用)

糜棱岩(圖29)常見於新界西北部，是一種有葉理的變質岩，與韌性斷層有關。一般呈強烈的平面葉理，並含較粗粒的「眼睛形」晶體，稱為斑狀岩石碎屑。

Late Cretaceous Kat O Formation – breccia

(around 100 million years ago)

The Kat O Formation is exposed on several scattered outlying islands in the northeastern New Territories, including Crooked Island and Ap Chau. It comprises a sequence of breccia (Figure 26), conglomerate, sandstone and siltstone, cemented by calcite minerals. The colour of the sedimentary rocks varies from reddish brown to greyish white. The sediments were probably eroded from a fault scarp and deposited as an alluvial fan.

Cenozoic Sedimentary Rocks

Early Tertiary Ping Chau Formation – siltstone *(around 50 million years ago)*

The Ping Chau Formation, which is the youngest rock formation in Hong Kong, comprises thin layers of siltstone (Figure 27), which are gently inclined towards the northeast. Fossil insects as well as bituminized plant fragments have been discovered in the sedimentary rocks. The sediments were originally deposited within a lake that periodically dried up allowing salt crystals (gypsum) to form. However, the salt crystals (gypsum) were later dissolved, leaving behind only the moulds of the original crystals of gypsum in the siltstone. These moulds were subsequently filled by secondary minerals, including aegirine, calcite, zeolite and acmite minerals.

Early Tertiary Ping Chau Formation – cherty siltstone *(around 50 million years ago)*

A layer of cherty siltstone (up to 1.2m thick) is well exposed at Lung Lok Shui on the western coast of Ping Chau. Cherty siltstone (Figure 28) contains very fine-grained crystalline silica. It is a very strong rock resistant to weathering and erosion.

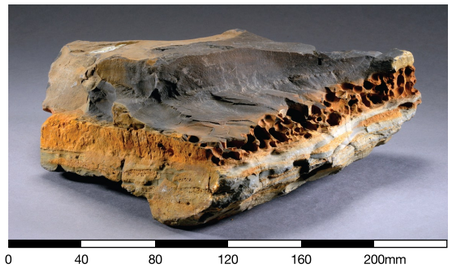


圖28. 早第三紀平洲組的燧石質粉砂岩。
Figure 28. Cherty siltstone of the Early Tertiary Ping Chau Formation.

Metamorphic Rocks

Mylonite - Metamorphic rocks related to faulting (dynamic metamorphism)

Mylonite (Figure 29) commonly occurs in the northwestern New Territories. Mylonite is a foliated metamorphic rock that is associated with ductile faults. It generally displays strong planar foliation and contains coarser grained "eye-shaped" crystals, called porphyroclasts.

圖29. 糜棱岩
Figure 29. Mylonite

角頁岩 — 接觸變質岩

角頁岩(圖30)是一種沒有葉理的變質岩。在香港，火山岩常受到附近花崗岩的侵入而變質形成角頁岩。在太平山周圍以及港島西面可以見到。在變質過程中，新的礦物如雲母及紅柱石，亦因此產生。在香港大學附近原有凝灰質砂岩的角頁岩外表呈斑點狀岩理，這些斑點大概是紅柱石礦物的富集。

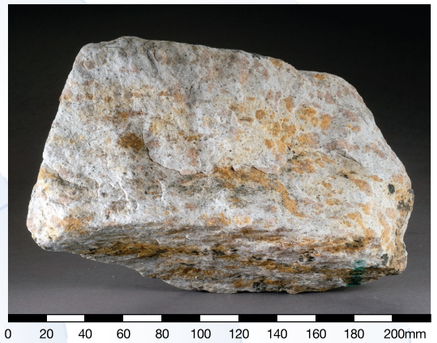


圖30. 角頁岩
Figure 30. Hornfels

大理岩及矽卡岩 — 接觸變質岩

矽卡岩(圖31)屬接觸變質岩，因含碳酸鹽的沉積岩(如大理岩)受周邊花崗岩侵入變質而成。矽卡岩含鈣、鎂及鐵矽酸鹽礦物。馬鞍山鐵礦主要為矽卡岩，含有鐵及鎂的礦物，如磁鐵礦和赤鐵礦等。

圖31. 矽卡岩
Figure 31. Skarn

雲英岩化的花崗岩

雲英岩化的花崗岩(圖32)擁有糖狀岩理，粒子大小平均1毫米。岩石主要含有石英及白雲母，令外表顯得閃爍而有光澤。位於東九龍魔鬼山附近的幼粒花崗岩，因受帶有礦物質的熱溶液而變質，形成雲英岩化的花崗岩。

表土沉積

香港的表土沉積主要包括山坡沉積(坡積物)、河流沉積(沖積物)及離岸沉積(泥與沙)。香港的土地約兩成是由第四紀時期的表層沉積物覆蓋，另外約有6%由填海得來。

岸上表土沉積

坡積物

香港大部分的山坡都覆蓋著一層坡積物，儘管這些坡積物大多非常薄(不足1米厚)。坡積物包含的顆粒大小不一，由被水沖下斜坡的幼細粉砂及沙粒，以至由泥石流堆積下來的巨礫不等(圖33)。然而，香港地質調查組地圖上，只記錄超過2米厚的坡積物，而這些較厚的坡積物多數出現於麓坡。

在飽受風化影響的花崗岩上的坡積物相對較厚，而火山岩受風化影響較微，坡積物相對較薄。坡積層在多個大山群留下廣泛沉積物，如獅子山山脊、半山區、飛鵝山山坡、青山山下、大帽山和大嶼山島上。

Hornfels – Contact metamorphic rocks

Hornfels (Figure 30) is a non-foliated metamorphic rock. In Hong Kong, volcanic rock that has been metamorphosed to hornfels, commonly surrounds granite intrusions. An example is found around Victoria Peak in western Hong Kong Island. During contact metamorphism, new minerals, such as mica and andalusite, may form in the country rock. Near the University of Hong Kong, contact metamorphic tuffaceous sandstone displays a spotted texture. The spots are probably concentrations of andalusite crystals.

Marble & Skarn – Contact metamorphic rocks

Skarn (Figure 31) is a contact metamorphic rock formed by the alteration of carbonate-bearing sedimentary rocks (such as marble) adjacent to an igenous intrusion. It comprises calcium, magnesium and iron silicate minerals. The Ma On Shan iron ore is hosted in skarn rocks and contains iron- and magnesium-bearing minerals, such as magnetite and haematite.

Greisenized granite

Greisenized granite (Figure 32) has an average grain size of 1mm and exhibits a sugary texture. It comprises mainly quartz and muscovite, which gives it a shiny appearance. Near Devil's Peak in eastern Kowloon, fine-grained granite has been altered to greisenized granite by hot and mineral-rich fluid (metasomatism).

圖32. 雲英岩化花崗岩
Figure 32. Greisenized granite

Superficial Deposits

Superficial deposits in Hong Kong primarily consist of hillslope deposits (colluvium), river deposits (alluvium), and offshore deposits (mud and sand). Quaternary superficial deposits cover about 20% of the land surface of Hong Kong. Reclamations constitute about 6% of the present land area of Hong Kong (1,105km^2).

Onshore Superficial Deposits

Colluvium

A layer of colluvium blankets most of the hillslopes, although in many areas it is very thin (less than 1m thick). Colluvium comprises a range of grain sizes from fine-grained silt and sand washed down slopes by water, to coarse accumulations of large boulders deposited by landslides (Figure 33). Only deposits of colluvium greater than 2m thick have been mapped on the Hong Kong Geological Survey maps. These thicker deposits mostly occur on the footslopes.

沖積層

沖積物填蓋了香港大部分的小溪和河谷，不論是狹窄的山溪或是較深和較闊的低地河谷(圖34)。

在河道及河流邊灘的沖積物一般是較粗粒的沙和礫石，而較幼細的沉積則在河漫灘上。在香港地質圖上，可以看到沖積層的獨特樹狀分佈。

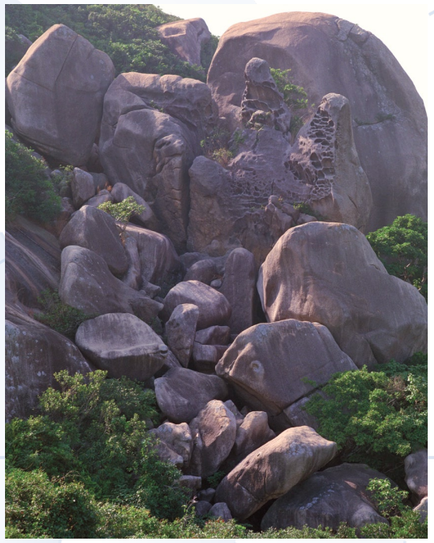


圖33. 在港島香坎角堆積在河流中，含有巨礫的坡積物。
Figure 33. Bouldery colluvium occupying a drainage line in Chung Hom Kok, Hong Kong Island.

圖34. 新界林村河谷上的沖積物。
Figure 34. Alluvium occupying the floor of the Lam Tsuen Valley, New Territories.

離岸表土沉積

香港的海床都是朝向南及東南方緩緩地傾斜，並被一層海泥掩蓋。這層海泥約於一萬一千年前開始堆積，期時是冰河時期過後，海平面迅速上升。海泥全面掩蓋了在海平面較低時沉積的沖積物。

海沙在水流較強的地區出現，這是由於較幼的沉積物不能堆積。這些地方包括如潮汐水道及島嶼間的峽隙。海沙層亦會出現於沿岸受海浪作用而形成的沙灘和沙洲。

多個寬闊的進潮口，例如后海灣和沙頭角在潮間帶囤積了淤泥，均被紅樹林覆蓋。

香港的礦物

含金屬礦物

錫-鎢-鉬 (Sn-W-Mo) 礦化作用

錫-鎢-鉬(Sn-W-Mo)的礦化作用在香港多處偶然出現，但主要在花崗岩的接觸帶及沿主要斷層一帶出現。

這些礦物包括鎢錳鐵礦、輝鉬礦及錫石。錫-鎢-鉬的礦化作用大多於細粒花崗岩內發生。

鎢錳鐵礦[(Fe,Mn)WO_4](圖35)曾於針山、蓮花山和沙螺灣開採，青山及魔鬼山也曾設有小型礦場。

Colluvium is relatively thick over the granitic rocks, where it is derived from the deep weathered profiles. Colluvium is relatively thin over the volcanic rocks, which have shallow weathered profiles. Colluvium forms extensive deposits at the base of several large hill masses, such as the Lion Rock ridge, the Mid-levels area, the slopes of Fei Ngo Shan, below Castle Peak, Tai Mo Shan, and on Lantau Island

Alluvium

Alluvium fills most of the stream and river valleys in Hong Kong. Relatively thin, narrow deposits occupy the hillside tributaries, and thicker, more extensive deposits floor the lowland valleys (Figure 34).

Alluvium generally comprises coarse-grained sands and gravels in the river channels and point bars, and fine-grained sediments on the floodplains. Alluvium forms distinctive dendritic patterns on the geological maps of Hong Kong.

Offshore Superficial Deposits

The seabed in Hong Kong slopes gently to the south and southeast, and is generally covered with a layer of marine mud. The blanket of marine mud has accumulated since the rapid post-glacial rise in sea level that commenced approximately 11,000 years ago. The marine mud overlies older, mostly alluvial, sediments that were deposited by rivers when the sea level was lower.

Sand occurs on the seabed in areas where tidal currents prevent the finer sediments settling. These areas include tidal channels and the gaps between islands. Sand also occurs in the coastal zone where wave action has created beaches and sandbars.

Several wide tidal inlets, such as in Deep Bay and at Starling Inlet, have accumulations of intertidal mud that is covered with mangroves.

Hong Kong Minerals

Metalliferous Minerals

Tin-Tungsten-Molybdenum(Sn–W–Mo) mineralization

Sporadic **Tin-Tungsten-Molybdenum** (Sn–W–Mo) mineralization is present in many parts of Hong Kong but is mainly found in the contact zones of granites.

The minerals include wolframite, molybdenite and cassiterite. Many of the fine-grained granites provide hosts for Sn–W–Mo mineralization.

- Wolframite [(Fe,Mn)WO_4] (Figure 35) was mined at Needle Hill, Lin Fa Shan and Sha Lo Wan, with minor workings at Castle Peak and Devil's Peak.

圖35. 鎢錳鐵礦
Figure 35. Wolframite

- 雖然多個地區曾發現錫石 [SnO_2] (圖36)，如上塘、針山及魔鬼山，但該礦物從未被商業開採。

圖36. 錫石
Figure 36. Cassiterite

- 輝鉬礦 [MoS_2] (圖37) 通常與鎢錳鐵礦一併被發現，但該礦物從未被商業開採。

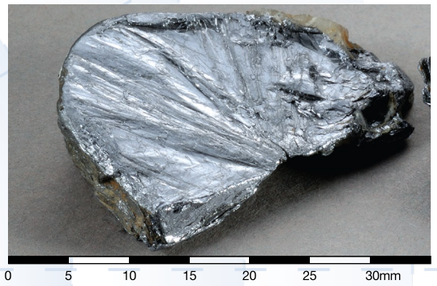


圖37. 輝鉬礦
Figure 37. Molybdenite

鉛 - 鋅 - 銅 (Pb-Zn-Cu) 礦化作用

鉛-鋅-銅(Pb-Zn-Cu)的礦化作用主要於新界與火山岩相關的岩脈，或於大嶼山的花崗岩中出現。鉛-鋅的礦石曾於蓮麻坑開採，亦有少量在大帽山、銀礦灣及大嶼山東南部採挖出來。

- 蓮麻坑礦場曾開採出方鉛礦 [PbS] (圖38)、黃銅礦 [$CuFeS_2$] (圖39)、閃鋅礦 [ZnS] (圖40) 及小量的金 (圖41)。
- 大嶼山銀礦灣開採的方鉛礦中曾發現銀 (圖42)。

圖38. 方鉛礦
Figure 38. Galena

圖39. 黃銅礦
Figure 39. Chalcopyrite

圖40. 閃鋅礦
Figure 40. Sphalerite

圖41. 金
Figure 41. Gold

鐵 (Fe) 礦化作用

鐵 (Fe) 礦化作用在香港多個區域均有存在，有多種礦物。

- 馬鞍山是本港最大的鐵礦礦床，磁鐵礦 [$(Fe,Mg)Fe_2O_4$] (圖43) 曾經從這裡與花崗岩有關的矽卡岩礦床中採出。而磁黃鐵礦 [FeS] (圖44) 和赤鐵礦 [Fe_2O_3] (圖45) 亦曾於馬鞍山礦場發現。
- 有報告指出在蓮麻坑、梅窩及大帽山，以及於馬尿洲、鴉洲和平洲的沉積岩中發現黃鐵礦 [FeS_2] (圖46)。

- Cassiterite [SnO_2] (Figure 36) has been noted in several areas, such as Sheung Tong, Needle Hill, and Devil's Peak, but has never been exploited commercially.
- Molybdenite [MoS_2] (Figure 37) commonly occurs in association with wolframite, but has never been exploited commercially.

Lead-Zinc-Copper (Pb–Zn–Cu) mineralization

Lead-Zinc-Copper (Pb–Zn–Cu) mineralization is mainly present in association with veins in volcanic rocks in the New Territories and in granites on Lantau Island. Pb–Zn ore was once mined at Lin Ma Hang, and on a small scale at Tai Mo Shan, Silver Mine Bay, and southeastern Lantau Island.

- Galena [PbS] (Figure 38), chalcopyrite [$CuFeS_2$] (Figure 39), and sphalerite [ZnS] (Figure 40), with traces of gold (Au) (Figure 41), were mined at the Lin Ma Hang mine.
- Silver (Ag) (Figure 42) also occurs within galena at Silver Mine Bay on Lantau Island.

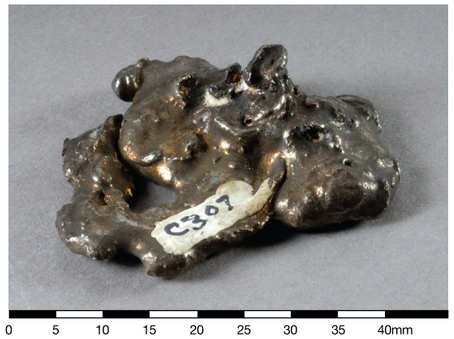


圖42. 銀
Figure 42. Silver

Iron (Fe) mineralization

Iron (Fe) mineralization occurs in many areas of Hong Kong and in a variety of mineral occurrences.

- The largest iron deposit is found at Ma On Shan where magnetite [$(Fe,Mg)Fe_2O_4$] (Figure 43) has been mined from a granite-related calc-silicate skarn deposit. Pyrrhotite [FeS] (Figure 44) and haematite [Fe_2O_3] (Figure 45) have also been reported from the Ma On Shan Mine.

圖43. 磁鐵礦
Figure 43. Magnetite

圖44. 磁黃鐵礦
Figure 44. Pyrrhotite

圖45. 赤鐵礦
Figure 45. Haematite

- Pyrite [FeS_2] (Figure 46) has been reported at Lin Ma Hang, Mui Wo, and Tai Mo Shan, and as concretions in sedimentary rocks on Ma Shi Chau, A Chau, and Ping Chau.

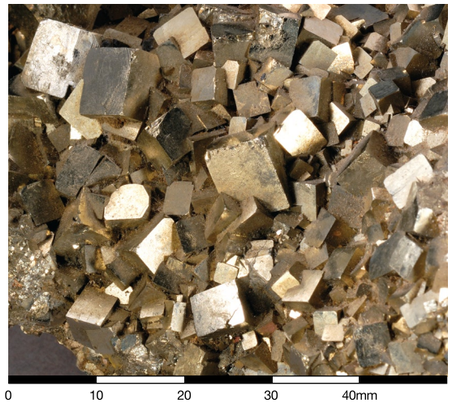


圖46. 黃鐵礦
Figure 46. Pyrite

非金屬礦物

長石

燒製陶瓷、瓷磚及玻璃用的高質鹼性長石[$K(AlSi_3O_8)$](圖47)曾於沙田銅鑼灣的偉晶花崗岩中開採出來。鹼性長石及斜長石[$Ca(Si_3O_8)$](圖48)亦曾於茶果嶺的花崗岩中，受風化的岩牆內、以及大小磨刀洲和赤鱲角上開採得出。

圖47. 鹼性長石
Figure 47. Alkali feldspar

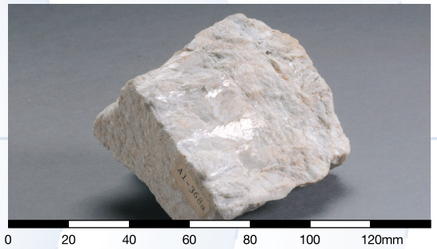


圖48. 斜長石
Figure 48. Plagioclase feldspar

石英

香港多個花崗岩風化殘積土壤和厚石英礦脈區均曾開採出石英[SiO_2](圖49)，另外，石英沙亦是在赤鱲角開採高嶺土時的副產品。位於白角、望后石、樟樹頭、大嶼山望東坑、小欖、米埔、沙田銅鑼灣、針山、上葵涌和荔枝角的小規模礦場，均曾開採石英礦脈。石英海沙亦是多項重要填海工程的填料來源，如赤鱲角、西九龍及葵涌貨櫃碼頭。

圖49. 石英
Figure 49. Quartz

綠柱石

於魔鬼山一帶含鎢錳鐵礦的石英脈存在於熱蝕變質的細粒花崗岩中，曾有報導指其中可開採出高質的綠柱石[$Be_3Al_2(SiO_{18})$](圖50)，但這些礦物卻從未被商業開採。另外，於鶴咀山一帶亦發現小量綠柱石。

石墨

石墨[C](圖51)存在於大磨刀上的石英岩、變質砂岩及變質粉砂岩的不同層理間，曾經在島上開採。該石墨在厚達4.5米的斜傾的礦層中採得。

Non-metalliferous Minerals

Feldspar

High quality alkali feldspar [$K(AlSi_3O_8)$] (Figure 47) used for ceramics, tile and glass manufacture was once mined from a large pegmatite at Tung Lo Wan, Sha Tin. Alkali feldspar and plagioclase feldspar [$Ca(Si_3O_8)$] (Figure 48) were also mined at Cha Kwo Ling from a weathered dyke within granite and on The Brothers and Chek Lap Kok.

Quartz

Quartz [SiO_2] (Figure 49) was mined from weathered granitic soils and thick quartz veins at several localities across Hong Kong. On Chek Lap Kok, silica sand was produced as a by-product of kaolin mining. Smaller operations working quartz veins have existed at Pak Kok and Mong Hau Shek, Cheung Shue Tau, Mong Tung Hang on Lantau Island, Siu Lam, Mai Po, Tung Lo Wan, Needle Hill, Sheung Kwai Chung and Lai Chi Kok. Offshore sand, predominantly from the Pleistocene alluvial deposits, was an important source of fill materials for major reclamation projects, such as the Chek Lap Kok, West Kowloon and Kwai Chung Container Terminals.

Beryl

In the Devil's Peak area, high-grade beryl [$Be_3Al_2(SiO_{18})$] (Figure 50) has been reported from wolframite-bearing quartz veins within hydrothermally altered fine-grained granite. However, the deposit has not been exploited commercially. Minor quantities of beryl have also been reported from the D'Aguilar Peak area.

圖50. 綠柱石
Figure 50. Beryl

Graphite

Graphite [C] (Figure 51), interbedded with quartzite, meta-sandstone and meta-siltstone was once mined on West Brother Island. The graphite occurs in steeply dipping seams, up to 4.5m thick.

圖51. 石墨
Figure 51. Graphite

香港九龍公主道一零一號
土木工程拓展署大樓
土木工程拓展署 土力工程處

網址：http://www.cedd.gov.hk
香港斜坡安全網頁: http://hkss.cedd.gov.hk

Geotechnical Engineering Office, Civil Engineering and Development Department,
Civil Engineering and Development Building, 101 Princess Margaret Road,
Homantin, Kowloon, Hong Kong

Internet homepage : http://www.cedd.gov.hk
Hong Kong Slope Safety Website : http://hkss.cedd.gov.hk