



# Preface 序

The natural forces created the exquisite carvings and world-class geological phenomena on Taiwan's Northeast Coast. Subject to the alternation of ocean erosion and weathering over millions of years, this scenic area is known for its abundant and bizarre rock formations. Its distinctive landscape---dotted with the famous mushroom rocks, beehive rocks, tofu rocks (or chessboard rock), weathering rings, ocean-erosion ditches and marine pot holes---is an extremely magnificent and invaluable treasure given by Mother Nature to the human beings.

Through the establishment of "Bitou-Longdong Geological Park", we hope to offer tourists at home and abroad a scenic spot suitable for geological and ecological trips, as well as the best field-trip site for school programs in geology---and consequently meet our goal of providing ecological entertainment-education. With an aim to achieve a balance between environmental protection and regional socio-economic development, the Bitou-Longdong Geological Park promotes environment-friendly eco-tourism that protects the ecology, offers education and promotes tourism all at the same time. I sincerely invite you to explore the Nature's wonderful works of art at the Northeast Coast--on an in-depth geological and ecological trip!

Northeast and Yilan Coast National Scenic Area Administration

Director

Meik Ang- Chen



大自然精心雕鑿，賦與東北角海岸世界級的地質景觀。在海水千百萬年來的侵蝕、風化交互作用下，豐富多樣的奇岩怪石蔚然成形，著名的蕈狀石、蜂窩岩、豆腐岩、風化紋、海蝕溝與海蝕壺穴等特殊地形景觀，是大自然贈與人類，至為璀璨耀眼的無價瑰寶。

我們期望藉由「鼻頭—龍洞地質公園」的成立，提供一處適合國內、外遊客地質生態旅遊，以及學校地質戶外教學活動的最佳場所，進而達成寓教於樂的生態教育目標。促使環境保護與區域社經發展達成平衡，推行對環境友好，實現保護、教育和觀光發展的生態旅遊概念。僅以最誠摯的心，邀請您前來東北角探索大自然的鬼斧神工，來趟深度的地質生態體驗之旅！

東北角暨宜蘭海岸國家風景區管理處

處長

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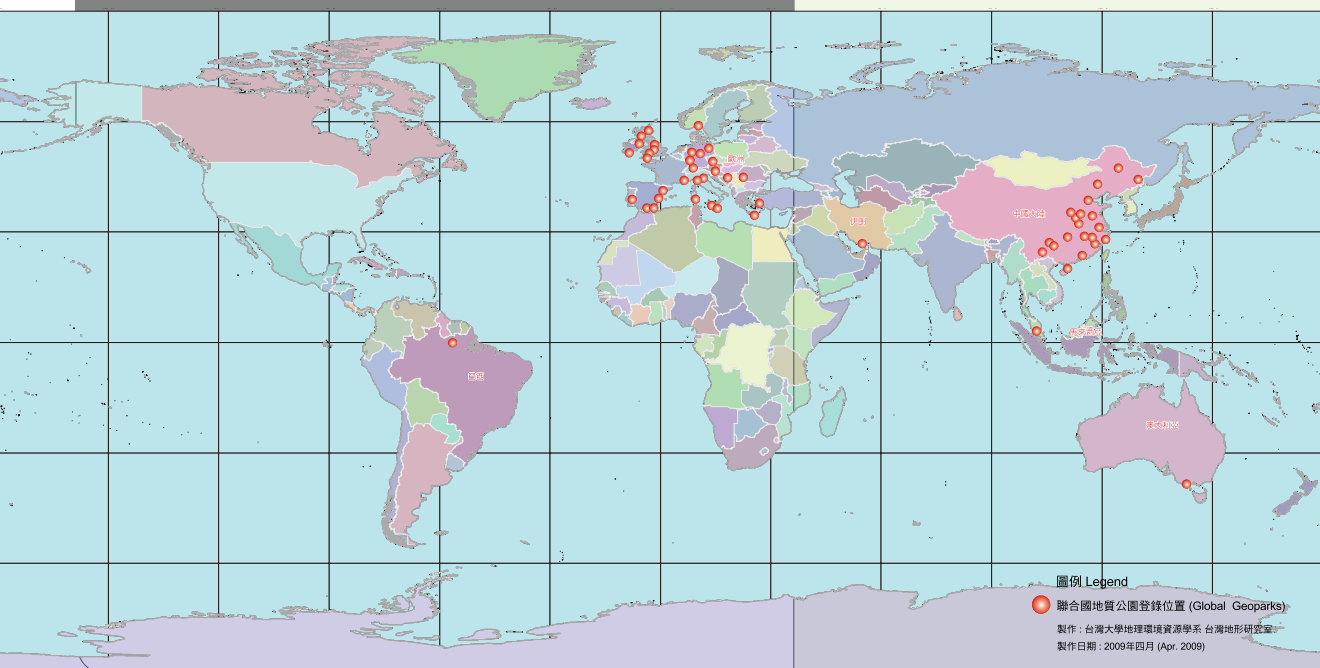




# 世界地質公園的背景

## Background of Global Geoparks Network

聯合國全球地質公園分布圖  
Global Geoparks Network

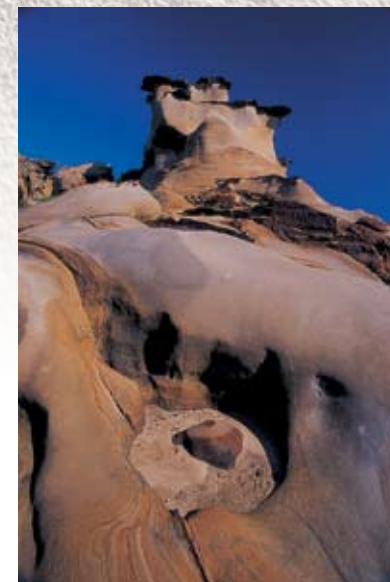


「世界地質公園」是由聯合國教科文組織所推動的一個工作。成立地質公園的主要目的，是為了達到環境保護與增進區域社經發展，促進資源的永續發展。藉由提升大眾對地球遺產價值的認知，並增進對地球與環境承載力的認識，促使我們能更明智地使用地球資源，進而達到人與地之間的平衡關係。



The concept of the Geopark was originally initiated by UNESCO in 1999 and has been subscribed to by many countries. Under the theme of landscape conservation, outstanding geological and geomorphological sites were identified as suitable for sustainable development. In 2009 there are 57 global Geoparks located in 20 countries that are on the list of UNESCO making the global geopark network a reality.

Since 1999 many special sites of scientific interest of geological and geomorphological importance were used to promote local industries, education, conservation and tourism. These sites raised awareness amongst the public and increased attention of management and long term planning issues.





## 臺灣地質公園的背景

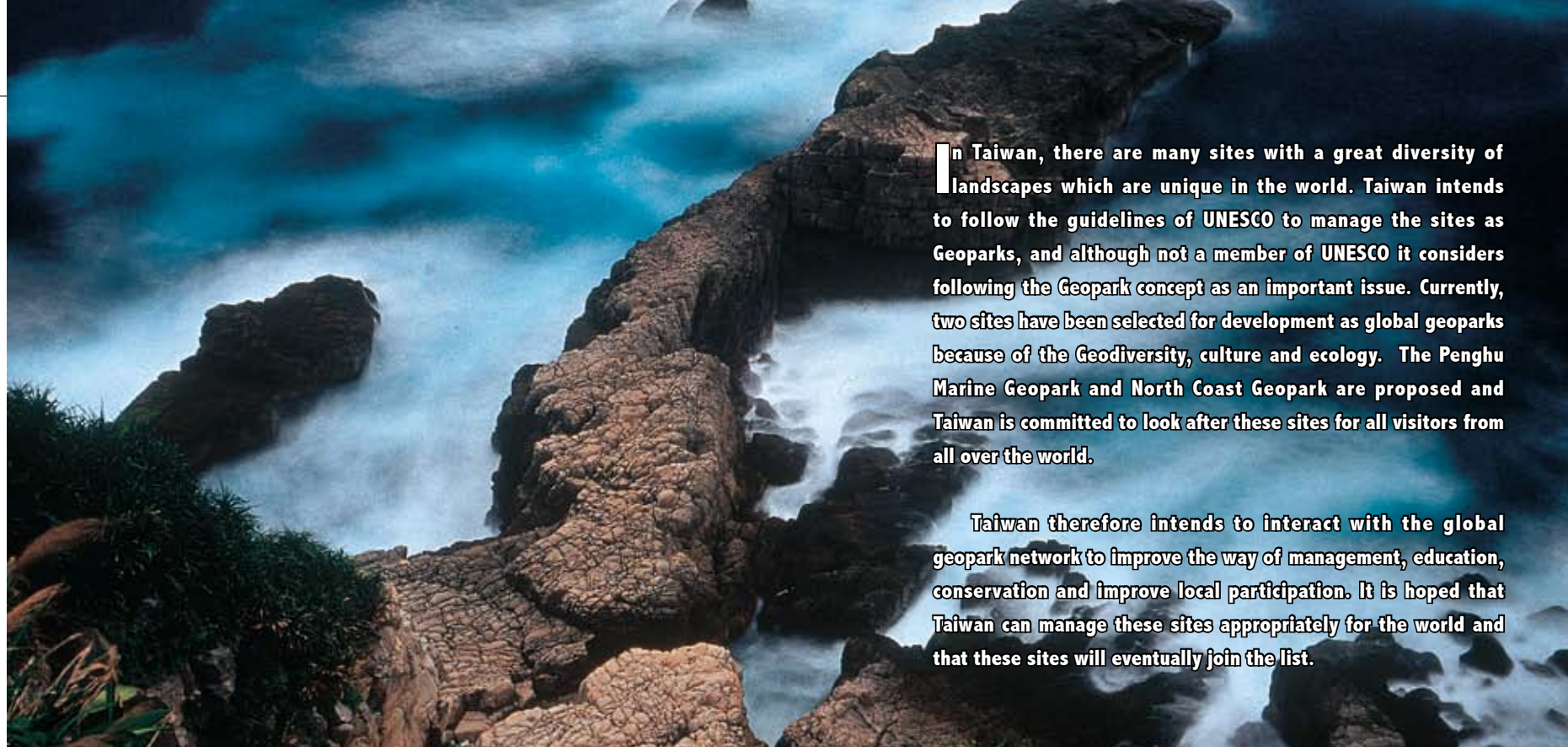
## Background of Taiwan Geopark

地質公園在公園綠地系統中，兼具了自然公園與特殊公園的特質，在目前雖沒有明確的法規確立其地位，但隨著時代的演進，臺灣和世界各國交流日益密切，吸收海峽對岸、亞洲鄰國及世界先進國家對保育及經營管理地質公園的知識，而將其應用在美麗寶島，已是刻不容緩的事。我們應加速地質公園的推動，進一步促成相關法規之制訂、相關組織之成立、相關知識之宣導，建立地質公園的制度，進而爭取世界遺產、地質公園架構的認證，使世界每一個人都嚮往美麗寶島的風光。

設立地質公園的目的，除了希望達到保育特殊地質、地形景觀外，同時也希望藉由地景保育，創造地方特色，促進區域社會經濟的發展。基於這樣的觀念，臺灣每一個區域、縣市或鄉鎮市，都可以試著找出具有獨特性、代表性、特殊性的地質、地形景點，配合國土綜合發展計畫、各縣市綜合發展計畫的規劃，發展經營具有地方特色的地質公園。

In Taiwan, there are many sites with a great diversity of landscapes which are unique in the world. Taiwan intends to follow the guidelines of UNESCO to manage the sites as Geoparks, and although not a member of UNESCO it considers following the Geopark concept as an important issue. Currently, two sites have been selected for development as global geoparks because of the Geodiversity, culture and ecology. The Penghu Marine Geopark and North Coast Geopark are proposed and Taiwan is committed to look after these sites for all visitors from all over the world.

Taiwan therefore intends to interact with the global geopark network to improve the way of management, education, conservation and improve local participation. It is hoped that Taiwan can manage these sites appropriately for the world and that these sites will eventually join the list.



▲龍洞岩場  
Longdong Rock Fields



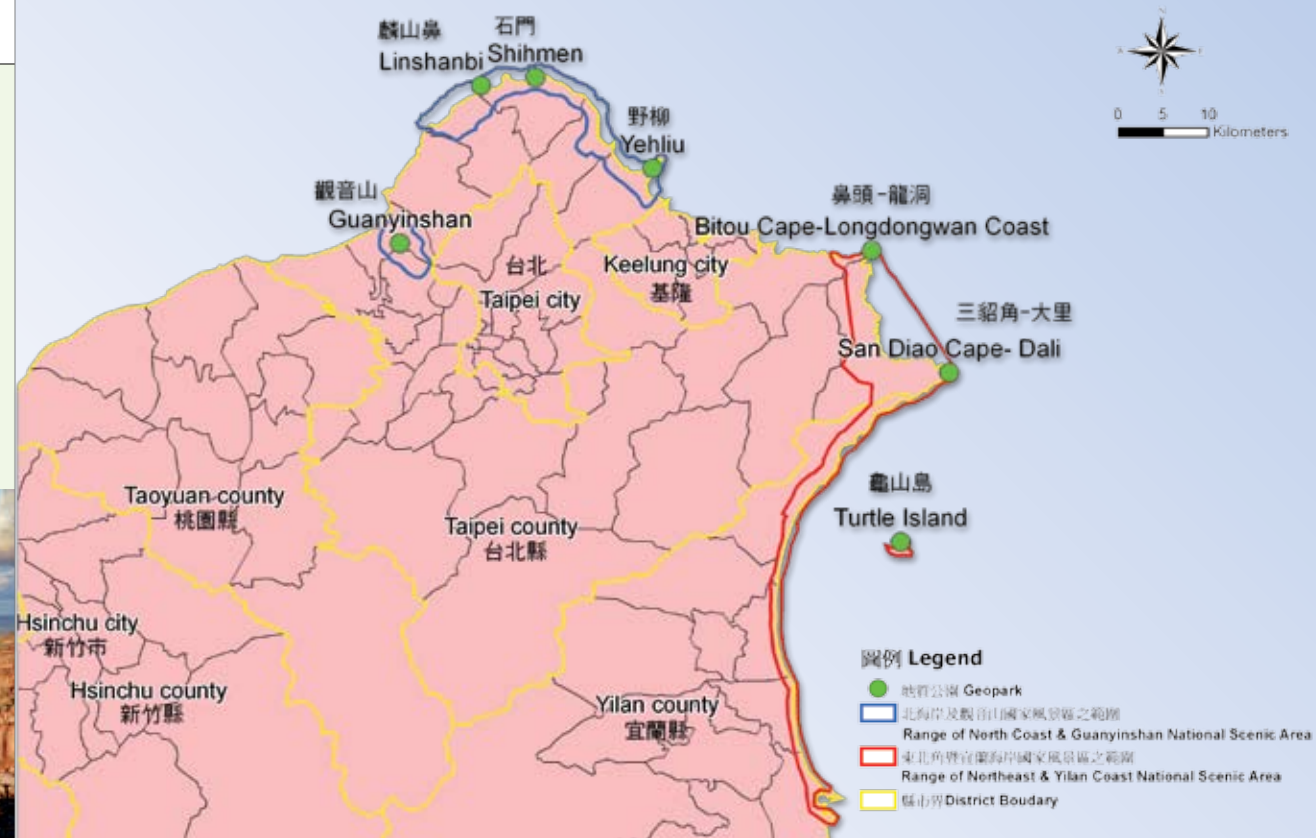


# 北部海岸地質公園 全區簡介

## The location of the North Coast Geopark

►南雅 / 杜雪梅 攝  
Nanya / Photography by Du Shui-Mei

**北**部海岸地質公園位於臺灣的北方，許多景點呈環狀分布，如同珠寶般點綴在海岸線上，因此又稱皇冠海岸。造訪皇冠海岸，可以看到北海岸多樣的自然與人文景觀，諸如白沙灣的沙灘、石門的海拱、金山的燭臺石、朱銘美術館等。



北部海岸地質公園分布圖 North Coast Geopark

北部海岸主要由北海岸及觀音山國家風景區管理處與東北角暨宜蘭海岸國家風景區管理處所管轄，地質景點包括觀音山、麟山鼻、石門、野柳、鼻頭-龍洞、三貂角-大里與龜山島等7個主要景點。

本書以東北角暨宜蘭海岸國家風景區管理處所管轄之地質公園：鼻頭-龍洞地質公園、三貂角-大里地質公園、龜山島地質公園做介紹。

The Northern Coastal Geopark, located in the North of Taiwan, is also called "the Crown Coast." It includes various natural and human cultural sights of the northern coast, such as the beach of Baisanwan, the sea arch of Shihmen, the candlestick stone in Chinshan, and the Juming Sculpture museum, etc. The northern coast is governed by the North Coast & Guanyinshan National Scenic Area Administration, and the Northeast and Yilan Coast National Scenic Area Administration. There are mainly seven scenic spots, including the Guanyinshan, Linshan Cape, Shihmen, Yehliu, Bitou-Longdong, the San Diego Cape-Dali, and the Turtle Island.



▲龜山島  
Turtle Island

▲小野柳  
Little Yie-liu



# 東北角海岸的大地構造

## Geological Characters of the Northeast Coast of Taiwan

回顧地球億萬年來的地質演變，北部海岸可以說是臺灣的縮影。它從華南邊上的一片陸地下沉成海，再從海底被擠上高山。此區主要的地形分成陸地地形與海岸地形。陸地地形屬丘陵地形，以澳底為界。海岸地形以三貂角為界，以北是標準的岬灣海岸地形，以南因其地質構造與海岸線平行，故少岬灣，海岸線較平直。岩石經過幾百萬年不斷的侵蝕、磨蝕、風化、搬運等作用，形成各式各樣的特殊地景。

就區域地質與構造而言，東北角地區包含雪山山脈地層、西部麓山帶新第三紀之地層，因板塊運動產生擠壓、褶皺等構造，形成東北角地區的地形沿東北—西南向的線形排列。

**R**epresenting the geological development of the earth over the past hundreds of millions of years, the northern coast can be regarded as the epitome of Taiwan.

The north coast is formed because of the constant erosion and weathering by the northeastern monsoon and great typhoon waves for long duration of time ever since the emergence of the island of Taiwan. There are various kinds of natural strange and spectacular rocks, such as weathering rings, mushroom shaped rock, honeycomb rocks, trace fossils, bean curd-shaped rock, cuesta and marine-cut platform. The main scenic spots are Nanya spectacular rock, Bitou Cape, Longdong Coast Park, Longdong South Ocean Park, Ma-gan, Lailai Marine-cut platform, Beiguan Sea Tide Park, and Turtle Island.

The Northeast area can be classified into three blocks according to the stratum periods and the degree of deterioration of the rock strata. Slightly weathered (Sheishan mountain stratum), intermediate weathered zone (Aoti Massif), and the late Tertiary periods strongest weathered rocks of the western mountain foothills.

The northeastern coast area includes the Sheishan mountain metamorphic strata of the late Tertiary period. The topography of the area is aligned along the northeast to the southeast geological structures. Igneous rock, such as quartz-andesite, occur at Keelung Hil. Mineralization at Chinkuashih and Giufen areas contain abundant minerals such as gold and coppers.

The Longdong and Chiuchi faults are the boundary between the sedimentary, transition and metamorphic rocks which outcrop from west to east along the coast. North of Longdong fault are the foot hill of the Sheishan Mountain. South of the Chiuchi fault are the Sheishan Mountain strata. Between the two faults lies the massif of Aoti, which is the intermediate zones of two geological districts mentioned above.



本區的鼻頭角及三貂角為突出於海面之岬角，以地層年代及岩層變質度來區分東北角地區，可將其分成古第三紀地層輕度變質地層（雪山山脈地層）、變質過渡帶（澳底地塊）及新第三紀末變質地層（西部麓山帶地層）三大區塊。分別以龍洞斷層及屈尺斷層為界，龍洞斷層以北屬麓山帶地層，屈尺斷層以南為雪山山脈地層，而介於屈尺斷層與龍洞斷層間的澳底地塊，為上述兩個地質區的變質過渡帶。

以下為本區主要地層的介紹：

### □ 雪山山脈地層

由四稜砂岩、乾溝層、大桶山層及澳底層所構成。四稜砂岩主要由厚層的白色粗粒石英砂岩及石英質礫石組成；乾溝層與大桶山層則由暗灰色硬頁岩夾薄層的泥質砂岩所組成，代表大陸棚或大陸斜坡等較深海之沉積；澳底層是由厚層砂岩、頁岩、砂頁岩薄互層組成，其上部並夾數層薄煤層，代表淺海至濱海相的沉積，由於受到變質作用，所以岩層皆比一般同類的沉積岩來得堅硬。

### □ 麓山帶地層

由中新世之木山層、大寮層、石底層、南港層、南莊層及桂竹林層所構成。其中木山層、石底層及南莊層主要由厚層砂岩、砂頁互層、白砂岩及夾煤層所組成，為濱海相沉積物；而大寮層、南港層、桂竹林層則由厚層泥質砂岩、厚層頁岩組成，並含多量海相化石，代表大陸棚淺海相沉積，這些中新世濱海相及淺海相的地層間隔且循環出現，表示本區於此時期之地層，經歷多次海進海退之沉積循環。

### □ 澳底地塊地層

位於屈尺斷層與龍洞斷層之間的地區稱之為澳底地塊，地層上屬於麓山帶地質區與雪山山脈地質區，前人研究將此區分成另一套地層，並做成此三區之地層對比。就岩性及變質度而言，澳底地塊因受不同程度之造山運動擠壓應力，成為連續漸變帶。



**The following is an introduction of the main stratum in this district:**

### □ The Sheishan Mountains formation

The Sheishan mountains formation is a four- layered sandstones with thick white large grains of quartz sandstone and quartz gravel. There are also argillaceous sandstones with thin layers of dark grey hard shale, representing the relatively deep sea deposits on the continental shelf or the continent slope. The rocks rest on the Aoti formation a thick floor of sandstone, shale, and a thin layer of sand shale also with several layers of thin coal seams. These represent the deposits from the shallow sea to the seashore.

### □ Sedimentary Formations

The sedimentary sandstone contains many rock formations, including the Mushan, Daliao, Shihdi, Nangang, Nanjhuang, and the Gueijhulin formations. The Mushan, Shihdi and Nangang formations are mainly thick sandstones, sandy-shales white sandstones and coal seam. It is formed from marine sediment closed to the seashore. The Daliao, Nangang and Gueijhulin formations include thick layers of argillaceous sandstone, shales, including marine fossil layers. Representing the shallow marine deposit of the continental shelf. These Miocene Epoch seashore and shallow marine strata appear to repeat at intervals, showing that the strata of this period went through cyclical deposition during numerous transgressions and regressions.

### □ Aoti Massif Formation

The area between the Longdong fault and the Chiuchi fault is called the Aoti massif.

The formation belongs to the foothill mountain belt geological district and Sheishan Mountain geological district. The Aoti massif formation presents a continuous metamorphic



gradation zone, because of varying intensity of or tectonic stress.

In Yehliu, and Longdongwang in Northeast coast, we can trace of many fossils in different sizes and shapes, such as round, ellipse, rectangular, tubular branching and even irregular lines. Some urchin fossils, which are commonly called “the sand money”. The fossils are piled up in a layer of sandstone, but not each layer has fossils, only a few part of the urchins are preserved intact. Most are incomplete.

The Daliao sandstone is formed in the shallow sea environment, which is about 10 to 20 meters of depth, 10-20 million years ago. A lot of creatures lived on the sea bed at that time, leaving abundant trace fossil in the sandstone. The environment at that time is the



same as present. When the typhoons come in summer, the sea bed at the shallow sea will be distributed by the powerful waves, causing the death of animal on the sea floor. These remains are carried by the current, and deposited elsewhere, forming layers of sandstone. Geologists utilize there trace fossils to judge how animals lined in the floor, and obtain a greater understanding of the natural environment and habitat.



東北角海岸鳥瞰與地質圖 Bird View of North East Coast and Geological Information



▲ 南雅奇石 / 孔世龍 攝  
Nanya Peculiar Rocks/Kong Shih-Long

## 地質年代表 Correlation of Strata

時代 EPOCH	地層 STRATUM	性質 PROPERTY	距今年代 AGE
全新世 HOLOCENE	砂丘 SAND DUNE	砂、粉砂 Sand, silt	
	沖積層 ALLUVIUM	礫石、砂及黏土 Gravel, sand, and clay	
	階地堆積層 TERRACE DEPOSITS	礫石、砂及黏土 Gravel, sand, and clay	1萬年內
中新世 MIOCENE	桂竹林層 KUEICHULIN FORMATION	泥質砂岩、頁岩 Muddy sandstone, shale, whitestone	900-375萬年前
	南莊層 NANCHUANG FORMATION	砂岩及頁岩互層、含煤層 Alternations of sandstone and shale, intercalated coal seams	1200-900萬年前
	南港層 NANKANG FORMATION	砂岩、粉砂岩及頁岩 Sandstone, siltstone and shale	1900-1200萬年前
	石底層 SHIHTI FORMATION	砂岩及頁岩互層、含煤層 Alternations of sandstone and shale, intercalated coal seams	2000-1900萬年前
	大寮層 TALIAO FORMATION	頁岩及砂岩 Sandstone and shale	2200-2000萬年前
	木山層 MUSHAN FORMATION	砂岩及頁岩互層、含煤層 Alternations of sandstone and shale, intercalated coal seams	2390-2200萬年前
	澳底層 AOTI FORMATION	砂岩及頁岩、白砂岩含煤層 Sandstone and shale, white sandstone, intercalated coal seams	2390-2200萬年前
漸新世 OLIGOCENE	大桶山層 TATUNGSHAN FORMATION	硬頁岩夾泥質砂岩 Argillite intercalated with muddy sandstone	2750-2390萬年前
	蚊子坑層 WENTZUKENG FORMATION	硬頁岩夾泥質砂岩 Argillite intercalated with muddy sandstone	3200-2750萬年前
	龍洞砂岩 LUNGtung FORMATION	石英岩、礫岩 Quartzite, conglomerate	>3200萬年前

(資料來源：經濟部中央地質調查所)  
(Source: The Central Geological Survey, MoEA)



## 東北角地質公園之地形

## Landform of the Northeast Geopark

東北角豐富的地景資源處處充滿驚奇，回顧地球億萬年來的地質演變，東北角海岸可以說是臺灣的縮影，它從華南邊上的一片陸地下沉成海，再從海底被擠上高山，這一段滄海桑田的演變歷史，刻劃在龍洞岬古老堅硬的四稜砂岩中，也記錄在鼻頭角沉積的地層上。

海岸地形以三貂角為界，以北是標準的岬灣海岸地形，岩石經過千萬年海濤和強勁的東北季風不斷的侵蝕、磨蝕、風化、搬運等作用，形成如蘑菇般的蕈狀岩、豆腐似的豆腐岩、蜂巢式的蜂窩岩…等各種渾然天成的奇形怪石。東北角地質景觀包括南雅地區的風化紋地形；鼻頭角引人注目的蕈狀岩、海蝕崖、海蝕凹壁、海蝕平臺等海蝕地形；鹽寮至福隆間3公里長的沙灘；龍洞岬陡峭的四稜砂岩岩壁；萊萊、鶯歌石一帶的海蝕平臺，以及北關令人稱奇的單面山與單斜脊地形、豆腐岩地形等，還有，南方澳原為離岸島，因沿岸沙洲堆積與陸地形成陸連島，而構成沙頸岬，海岸地形景觀主要為海岬、海岸岩礁、海蝕崖、海蝕洞等。

本風景區多變之海岸地形，在在顯露豐富的獨特地質景觀，處處是欣賞地質之美的最佳去處。

There are many scenic spots around northeastern Taiwan. The northern coast is famous for its landscapes and provides an excellent outdoor classroom for school teaching.

The abundant geographical resources of the northeast coast offer surprises at each and every corner. In a way, the northeast coast is in fact a miniature projection of Taiwan, as it developed from an area of sunken land on the coast of South China that was then pushed up from the seas into a mountainous island. This was a period of great changes, a time of fierce evolution that has carved itself into Longdong Cape's ancient and adamant sandstone walls, and recorded itself into Bitou Cape's sediment beds.

The Cape of San Diego forms one border of the coastline landform. To the north of San Diego is a typical ria landform, where rock formations have been sculpted through erosion, abrasion, weathering, displacement, and other natural forces, forming mushroom-shaped mushroom rock, tofu-like chessboard rock, hive-like honeycomb rock... and other naturally formed rock formations such as Nanya area's erosion-formed striated rock formations; Bitou Cape's intriguing mushroom rocks, sea cliffs, platforms, undercut bluffs and other erosion landforms; a three mile stretch of golden beach between Yanliao and Fulong; Longdong Cape's steep sandstone cliffs; Lailai and Ying-ge's prominent wave-eroded platforms; and finally, Beiguan's extraordinary cuestas and tofu rock landforms.

As for Nanfanggao, it was originally an island, but gradual sand deposition led to its connection with the mainland, forming an isthmus. The coastline geological views seen here are capes, reefs, cliffs, and erosion caves. The diverse coastal landforms seen along the Northeast coast continues to reveal the unique nature of this area's geological background and development. It is indeed the perfect place for appreciation of the beauty of the land.

▲南雅奇石 Nanya Peculiar Rocks



## 鼻頭-龍洞地質公園

### Bitou-Longdong Geopark



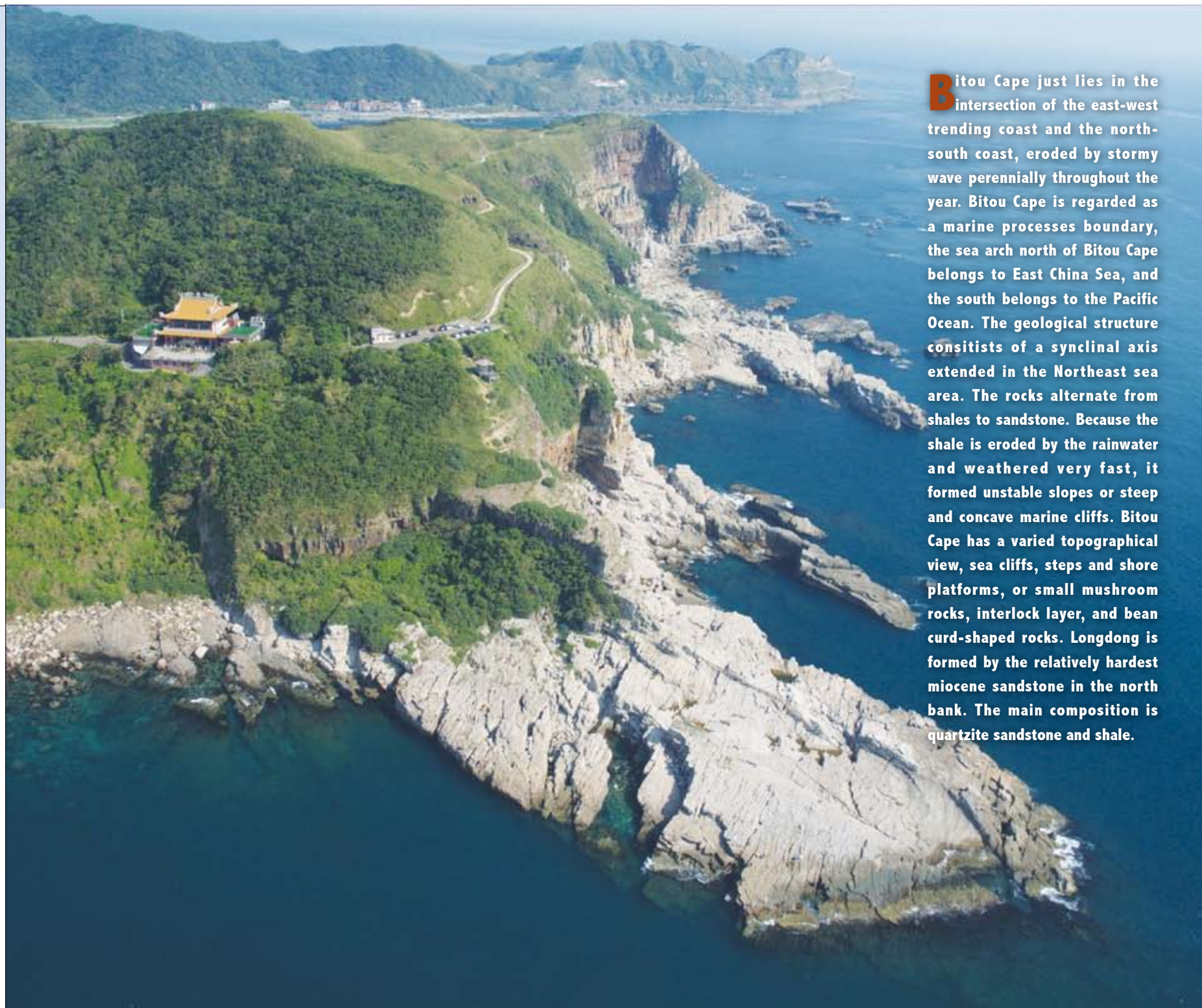
▲鼻頭角步道 / 黃志航 攝  
Bitou Cape Walkway / Photography by  
Huang Jhi-Hang



▲龍洞  
Longdong

**鼻**頭角位於東西向海岸及南北向海岸的交會點，終年受到風浪的侵蝕，以鼻頭角為分界點，鼻頭角以北的海域屬於東海，以南的海域屬於太平洋。在地質構造上此地是一向東北海域延伸的向斜軸。

鼻頭角的砂岩裡夾有頁岩層，由於頁岩受雨水侵蝕及風化的速度較快，因而形成不穩定的邊坡或是深凹的海蝕凹壁。本區具有相當多樣的地形景觀，囊括範圍較大的海崖、海階與海蝕平臺，與範圍較小的蕈狀岩、交錯層、豆腐岩等。龍洞出露的地層是由較北部海岸堅硬的岩石「四稜砂岩」（或稱四稜砂岩）所構成，其主要的成分是始新至漸新世的石英質砂岩。



**B**itou Cape just lies in the intersection of the east-west trending coast and the north-south coast, eroded by stormy wave perennially throughout the year. Bitou Cape is regarded as a marine processes boundary, the sea arch north of Bitou Cape belongs to East China Sea, and the south belongs to the Pacific Ocean. The geological structure consists of a synclinal axis extended in the Northeast sea area. The rocks alternate from shales to sandstone. Because the shale is eroded by the rainwater and weathered very fast, it formed unstable slopes or steep and concave marine cliffs. Bitou Cape has a varied topographical view, sea cliffs, steps and shore platforms, or small mushroom rocks, interlock layer, and bean curd-shaped rocks. Longdong is formed by the relatively hardest miocene sandstone in the north bank. The main composition is quartzite sandstone and shale.

▲鼻頭角-龍洞  
Bitou-Longdong





### □ Bitou-Longdong

1. The Bitou Cape contains shale layers, which are easily weathered and eroded by rain water.
2. There are various fossils in the sand stone-shale layer, such as sea shells and foraminifer, and they are usually well preserved and form fossil beds. The layer is possibly from deposition on the continental shelf.
3. The sand stone in Bitou Cape exhibits cross bedding, which is supportive evidence of ancient water flow directions.
4. The shell fossil sand trace fossils, all provide evidence and elaboration of ancient biology evolution.
5. Bitou area has diverse terrains and landscapes. Large abrasion cliffs, abrasion stairs and abrasion platforms, together with small mushroom-shaped stones, crisscross layer and bean curd-shaped stone.
6. Although abrasion stairs, cliffs and shore platforms are common in the northeast and Yilan coast scenic area, Bitou area has these 3 kinds of the terrains and landscapes at the same time. The area has a fossil

### □ 鼻頭-龍洞地質公園的特色

1. 鼻頭角的砂岩裡夾有頁岩層，由於頁岩受雨水侵蝕及風化的速度較砂岩快，而形成海蝕凹壁。
2. 砂岩及頁岩中均富含各類化石，包括貝殼及有孔蟲，經常集中而成化石帶，且保存良好。此層可能是在大陸棚淺海環境下沉積形成。
3. 鼻頭角的砂岩層中，常見堆積過程中形成交錯層（又稱偽層），它們隱藏著古代流水方向的證據。
4. 貝殼化石或生痕化石為古代生物演進過程提供說明。
5. 鼻頭角地區具有相當多樣的地形景觀，不論是範圍較大的海崖、海階與海蝕平臺，或是範圍較小的蕈狀岩、交錯層、豆腐岩等，其特色無法以人工景觀來取代。
6. 雖然海階、海崖與海蝕平臺在東北角暨宜蘭海岸

國家風景區內為常見的地形景觀，但是鼻頭角卻是同時擁有此三種地形景觀之地，加以區內小地形發達，並富含化石，也是此區最具特色的地方。

7. 龍洞整個是由北濱相對最堅硬的岩石「四稜砂岩」（又稱龍洞砂岩）所構成。
8. 海拱與海蝕崖均雄偉，以龍洞規模最大，該洞經海蝕已貫穿小岬，成為典型之拱門。
9. 龍洞岬附近綿延約1公里的海岸岩壁，高度約30公尺至上百公尺不等，為一天然的攀岩場地。
10. 龍洞也可看到風化紋，造成的原因是雨水或海水沿著岩石的破裂面，使得含有鐵質礦物的部分產生氧化作用，形成氧化鐵的帶狀花紋。
11. 龍洞灣下可見到地壘與地塹的地形。

record, which the other areas lack.

7. Longdong is formed from the most ancient and hardest sandstone in the north coast.
8. The impressive marine arch and marine cliff in Longdong are the largest on the north coast, and the cave forms the largest marine arch in Taiwan, which reaches of a height 3.8 meters.
9. The coast palisade stretches one kilometer beyond the Longdong, with height range from 30 meters to hundred meters, and is regarded as a natural rock climbing field.
10. Weathering patterns can also be seen in Longdong. The reason is the rain and sea water moving along the surface breach oxidized the iron minerals, and forms a ferric oxide pattern.
11. The topography of uplifted horst and wedge-shaped graben can be seen in Longdong.









## 三貂角-大里 地質公園

# San Diego Cape - Dali Geopark

—— 貂角在臺灣島上的地理位置具有  
—— 特殊意義，是雪山山脈極北端與海相連的地方，也是雪山山脈東側的邊界—梨山斷層（或稱匹亞南斷層）離開本島的地點。該斷層線沿著礁溪海岸、蘭陽溪中上游的河谷、梨山、霧社，一路延伸到玉山的東北方，幾乎將臺灣本島從中央的部分切成兩半。

萊萊的位置在臺北縣貢寮鄉東邊，海岸線非常平直，海蝕平臺發展良好。我們在海蝕平臺上到處可以看見發達的線形圖案（狀似洗衣板），這是由於岩層傾斜，受到波浪切割成海蝕平臺之後，就會呈現一列列平行排列的線型圖案。

北關擁有東北角沿岸形勢最險要、規模最大的單面山，又有外形最整齊的豆腐岩，以及風小浪平的小海岬。

San Diego cape lies where the northern most part of Sheishan mountains meet the sea. The shape is controlled by the Piyanan fault which is one of the most important structural line of the island. It extends along Jiaosi stream, the river vally of the upper and middle parts of the Langyang stream, Lishan, Wushe, and reaches the northeastern side of Yushan. This line almost cuts the island into two halves.

Lai-Lai is in the east of Giungliau town of Taipei county. The coastline is very straight, and the shore platform is very well developed. We can see line-shaped patterns everywhere on the platform, the form is like washing board. This is because of the slope the variable strength of the rock stratum. Beiguan possesses a large scale cuesta from bean-curd-shaped rocks and a small sea cape in the northeast coast.





▲ 萊萊鼻  
Lailai Headland

### □ 三貂角-大里地質公園的特色

1. 是雪山山脈東側的邊界－梨山斷層離開本島的地點。
2. 萊萊鼻波蝕棚十分發達，寬度在100公尺左右，由高數十公分之單斜小地形所組成。
3. 波蝕棚上有海蝕門，洞門頂部為離水波蝕棚面，海拔高約6公尺。
4. 萊萊鼻附近的萊萊村有寬廣的巨礫灘，巨礫長徑達3~4公尺。
5. 出現火成岩切穿地層，豎立地面的岩脈，看起來很像一堵岩牆，可以觀察火成岩侵入活動造成的景觀。
6. 三貂角燈塔（建於民國24年），是台灣極東燈塔，同時也是太平洋區的重要指標，堪稱臺灣的眼睛。
7. 北關在古時候被稱為「蘭陽之鎖」，是重要的交通樞紐，所以清廷在西元1819年時在這裡設置關卡，一方面可以鎮守噶瑪蘭，另一方面可以保護過往商旅的安全。
8. 北關擁有東北角沿岸規模最大且形勢最險要的單面山，又有外形最整齊的豆腐岩，及風小浪平的小海岬。



### □ San Diego Cape - Dali Geopark

1. The headland of San Diego is located where the Sheishan mountain and the ocean meet.
2. The wave-cut platform from Lailai to Yangliaobi is 100 meters wide.
3. Above the wave cut platform is a marine arch, and the height is about six meters.
4. The dike is an observation site for magma intrusion.
5. The famous light house, built in 1913, is once considered the eye of Taiwan in the Pacific Ocean.
6. The Lailai platform is the most attractive head land in the North East Coast.
7. Beikuan used to be called "a key to Yilan". As an important traffic cross-section, the Qing dynasty set a check point here to stabilize political power and to protect the visitor's safety.
8. Beikuan is also famous for the largest cuesta and chessboard rock and the sea cliff in the northeast coast.





三貂角-大里海岸地質公園五萬分之一地質圖  
Geological Map of San Diego-Dali Geopark (scale:1/50000)

圖例	LEGEND
全新世 HOLOCENE	沖積層 ALLUVIUM
中新世 MIOCENE	石底層 SHIHTI FORMATION
大寮層 TALIAO FORMATION	砂岩及頁岩 Sandstone and shale
中寮段 AOTI FORMATION	砂岩及頁岩互層,含煤層 Alternations of sandstone and shale, intercalated coal seams
澳底層 AOTI FORMATION	厚砂岩及頁岩 Thick sandstone and shale
媽崗段 MAKANG FORMATION	硬頁岩夾薄至厚層砂岩 Argillite intercalated with thin - to thick-bedded sandstone
大桶山層 TATUNGSHAN FORMATION	硬頁岩夾薄至厚層砂岩 Argillite intercalated with thin - to thick-bedded sandstone
新世 OLIGOCENE	乾溝層 KANKOU FORMATION
龍洞砂岩 LUNGUNG FORMATION	硬頁岩夾薄至厚層砂岩 Think-bedded or massive, white, medium-to very coarse-grained quartzite and argillite
更新世 PLEISTOCENE	火成岩類 IGNEOUS ROCKS
安山岩 Andesite	安山岩質集塊岩 Andesite agglomerate

(資料來源：經濟部中央地質調查所)  
(Source: The Central Geological Survey, MoEA)



▲北關海潮公園  
Beikuan Tides Park



## 龜山島地質公園

# Turtle Island Geopark



▲ 龜山島尾  
"Tail" of Turtle Island

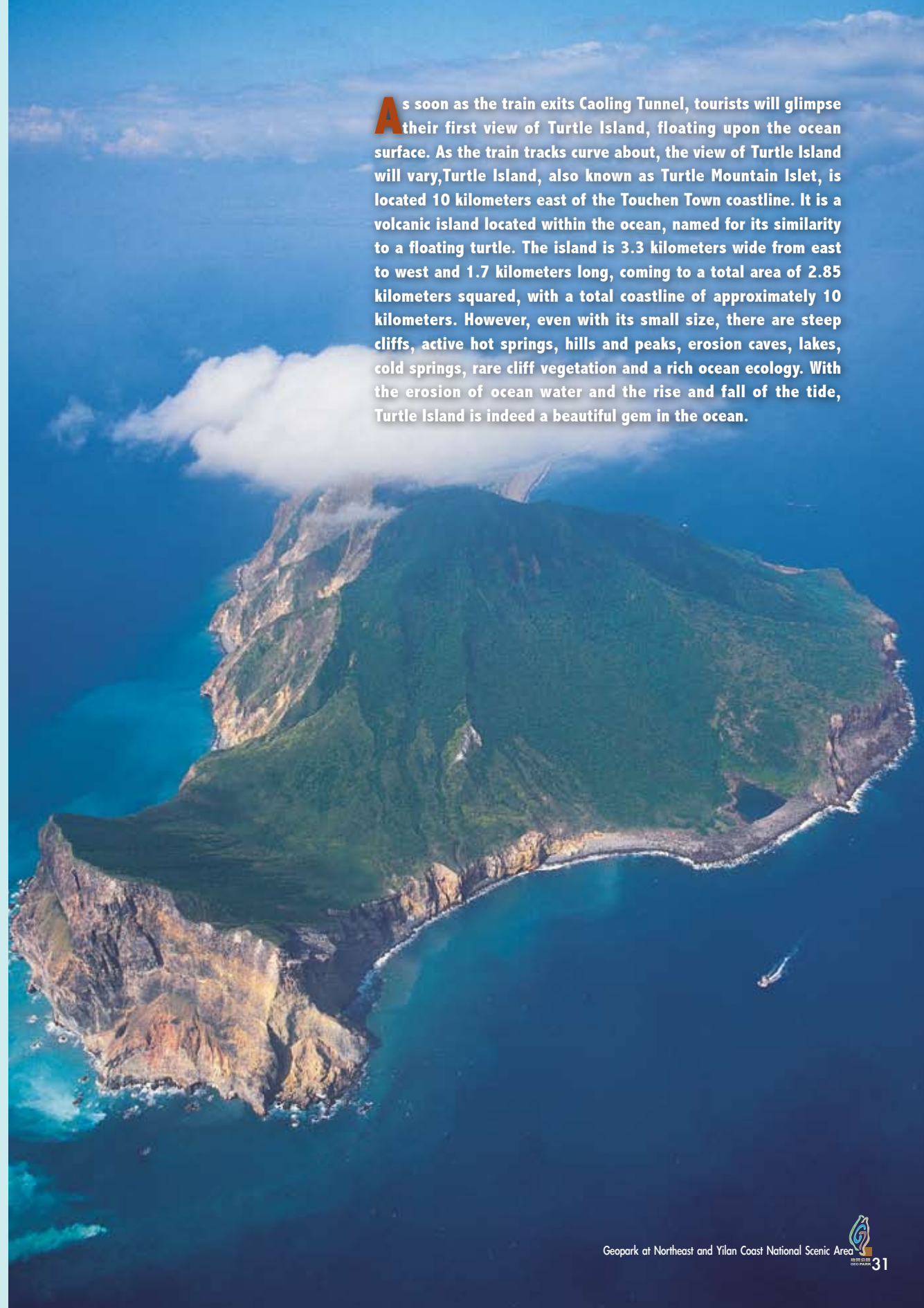
龜山島一名龜山嶼，位於宜蘭東方約十公里之海域，為孤懸於海中的火山島嶼，外貌酷似浮龜而得名，屬宜蘭縣頭城鎮所轄。全島東西長3.3公里，南北長1.7公里，面積只有2.85平方公里，而海岸線長約十公里。

龜山島外形似烏龜，主要由兩座火山體組成龜首和龜甲，龜尾部位是一片細長的礫石沙洲，隨著潮水漲落，就像是烏龜擺尾。龜山島在地體構造環境上，則位於沖繩海槽和琉球火山弧的交會點。

龜山島地處黑潮暖流終年北流之通道，海域內的海洋生物非常豐富。本海域為臺灣三大漁場之一，是近海漁撈的主要作業區域，盛產蝦、蟹、花枝、小卷、赤鯿、馬頭魚等高經濟性魚類。由於許多洄游性魚類往來洄游經過，主要漁獲有旗魚、鯊、鯖、鰹、飛魚等，使得本海域亦為鏢、釣漁業的良好漁場。

龜山島是個活火山島，海藻種類組成與臺灣東部、南部的海藻較相似，但與臺灣北部海藻相比較，則差異較大，其中有十種海藻是臺灣北部所未發現的。如此可佐證黑潮暖流行經路線是經過龜山島，從而轉向東北，偏離臺灣北部。

As soon as the train exits Caoling Tunnel, tourists will glimpse their first view of Turtle Island, floating upon the ocean surface. As the train tracks curve about, the view of Turtle Island will vary. Turtle Island, also known as Turtle Mountain Islet, is located 10 kilometers east of the Touchen Town coastline. It is a volcanic island located within the ocean, named for its similarity to a floating turtle. The island is 3.3 kilometers wide from east to west and 1.7 kilometers long, coming to a total area of 2.85 kilometers squared, with a total coastline of approximately 10 kilometers. However, even with its small size, there are steep cliffs, active hot springs, hills and peaks, erosion caves, lakes, cold springs, rare cliff vegetation and a rich ocean ecology. With the erosion of ocean water and the rise and fall of the tide, Turtle Island is indeed a beautiful gem in the ocean.







According to records, the first residents of the island arrived from Fujian and Taiwan during the reign of Qing Emperor Guangxu. In 1977, the residents of Turtle Island decided to move together to the Gueishandao Community located in Dashi Neighborhood, Touchen Town, and allow the island to become a restricted area with only soldiers stationed by the military. On August 1st, 2000, the island was officially opened to tourists, and the Northeast Coast Administrative Center began the planning, development, and management of this island. With its unique, rich and relatively untouched ecological resources, the administrative center decided to designate it as an outer seas ecological park. This not only added a new recreational spot for the Northeast Coast, but also encouraged the development of the marine tourism industry.

島上除龜尾和北岸為礫石灘外，全島許多地方都是崩落堆積而成的崖堆、峭壁和海蝕洞，海底亦是以崩落的大礁石為主。

龜山島的珊瑚礁位在龜尾東北岸，大約分布於岸邊水深1公尺以下到6公尺左右，長度約150公尺，種類繁多且多采多姿的無脊椎動物，和五顏六色的珊瑚礁魚類在此棲息。與臺灣南部珊瑚礁的規模相比較，此處屬於範圍較小的珊瑚礁區。根據調查結果顯示，其珊瑚大多都生長在大礁石上，水深超過六公尺處即為沙泥底，珊瑚群體無法附著。

#### □ 龜山奇景—靈龜擺尾

龜尾潭周圍延伸一公里至龜尾潭的「砂嘴」，會因為冬、夏季風向和海流的變化，而南北移動，主要是由於海流的作用方向變化所造成。

#### □ 龜山奇景—龜島磺煙

龜首的硫磺礦藏量頗多，噴氣孔噴出大量的硫化氫和二氧化碳，形成龜島磺煙。

#### □ 龜山奇景—海底溫泉

在龜山島東部海域，可見到白色氣泡從海裡湧出，是一種後期火山作用的噴氣現象。



▲ 龜山島頭 "Head" of Turtle Island

Turtle Island is open to tourists beginning from the 1st of March to November the 30th, from 9AM~4PM. During June, July and August, the hours are extended from 9AM~5PM.





▲ 龜尾湖 Lake at the Tail of Turtle Island



▲ 龜尾島 Islet at the Tail of Turtle Island

## □ 龜山島地質公園的特色

1. 龜山島在地體構造環境上，位於沖繩海槽和琉球火山島弧的交會點。
2. 龜山島東方約50到100公里的海域內，最少分布六、七十座的海底火山，座落於1,300公尺至2,000公尺的深海海床上，而龜山島是唯一出露在海平面以上的一座火山。
3. 海水面下普遍都蘊藏著豐富的熱泉和噴氣，有些噴氣可向上達300~400公尺高，形成所謂的「黑煙囪」，和全世界深海中洋脊擴張中心附近的景象相似，顯示在此地區的地殼底下還有活躍的岩漿活動。
4. 龜山島地處黑潮暖流終年北流的通道上，海域內的海洋生物非常豐富，目前也是賞鯨豚的著名海域。
5. 許多洄游性魚類洄游經過，主要漁獲有旗魚、鯊、鯖、鰹、飛魚等，使得本海域亦為鏢、釣漁業之良好漁場。
6. 龜首海域下的硫磺礦藏量頗多，並由噴氣孔噴出大量的硫化氫和二氧化硫，形成龜島磺煙。

## □ The Turtle Island

1. The Turtle Island is located at the Okinawa oceanic trough and the Okinawa island arcs.
2. On the east part ocean of the Turtle Island, within 50 to 100 kilometers, lies at least 60~70 oceanic volcano and at the depth range from 1300 meters to 2000 meters. The Turtle Island is the only oceanic volcano that emerged.
3. The peak of the Turtle Island has abundant hot springs, with certain springs reaching 300~400 meters, forming so called "Black Chimney". volcanic, like most mid-ocean canyons around the world, the lava activity is still active.
4. The sea current from the south is transporting warm, tropical water northward toward the polar region. The Turtle Island is on its path and results in a good fishing industry and whale watching tourism.
5. The fishing migration in this area mainly is *Istiophoridae*, *Selachimorpha*, *Mylopharyngodon piceus*, and *Exocoetidae*. The place is an ideal fishing field.
6. The upper part of the Turtle Island is abundant in sulfur minerals, and the fumaroles blasts excessive hydrogen sulfide and sulfur dioxide to form smog.

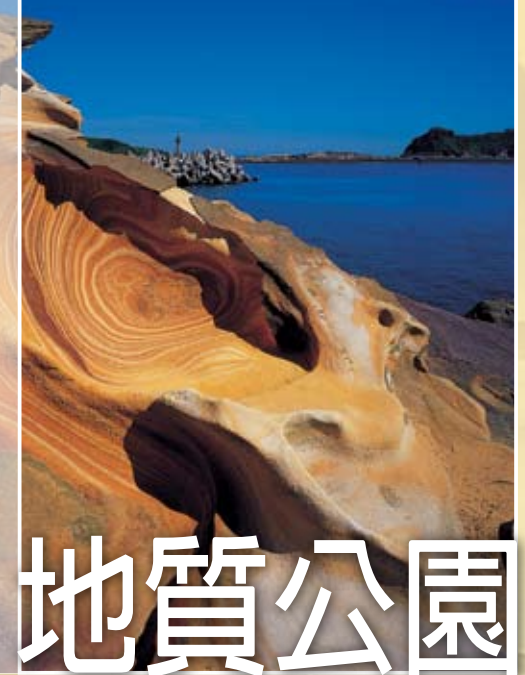


龜山島地質公園五萬分之一地質圖  
Geological Map of Turtle Island Geopark (scale:1/50000)

圖	例	LEGEND
全新世 HOLOCENE	沖積層 ALLUVIUM	礫石、砂及黏土 Gravel, sand, and clay
中新世 MIOCENE	石底層 SHIHTI FORMATION	砂岩及頁岩互層，含煤層 Alternations of sandstone and shale, intercalated coal seams
	大寮層 TALIAO FORMATION	砂岩及頁岩 Sandstone and shale
	枋寮段 AOTI FORMATION	砂岩及頁岩互層，含煤層 Alternations of sandstone and shale, intercalated coal seams
	澳底層 AOTI FORMATION	厚砂岩及頁岩 Thick sandstone and shale
	媽崗段 MAKANG FORMATION	厚砂岩及頁岩 Thick sandstone and shale
漸新世 OLIGOCENE	大桶山層 TATUNGSHAN FORMATION	硬頁岩夾薄至厚層砂岩 Argillite intercalated with thin - to thick-bedded sandstone
	乾溝層 KANKOU FORMATION	硬頁岩夾薄至厚層砂岩 Argillite intercalated with thin - to thick-bedded sandstone
	龍洞砂岩 LUNGUNG FORMATION	硬頁岩夾薄至厚層砂岩 Think-bedded or massive, white, medium-to very coarse-grained quartzite and argillite
更新世 PLEISTOCENE	火成岩類 IGNEOUS ROCKS	安山岩 Andesite
		安山岩質集塊岩 Andesite agglomerate

(資料來源：經濟部中央地質調查所)  
(Source: The Central Geological Survey, MoEA)





# 地質公園

小地質地形景觀

Landscapes of Geopark

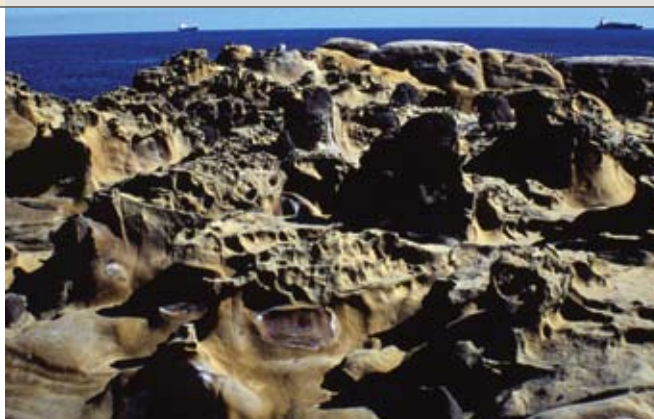


## 蕈狀岩

### Mushroom rock

蕈狀岩又稱為蕈岩、擎柱石、蘑菇石。因為岩塊上下岩性的不同，上層含有較多的碳酸鈣，質地較硬，抵抗風化侵蝕作用較強，下層相對較弱，形成上粗下細，酷似蕈狀而得名。

This formation is characterized by their mushroom-like shape, with relatively thin stems topped by larger rocks. The cap of the mushroom rocks are rich in Calcium Carbonate ( $\text{CaCO}_3$ ) and are therefore relatively more resistant to weathering than the stem. Through time, the stem becomes narrower and narrower because of differential erosion.



## 交錯層

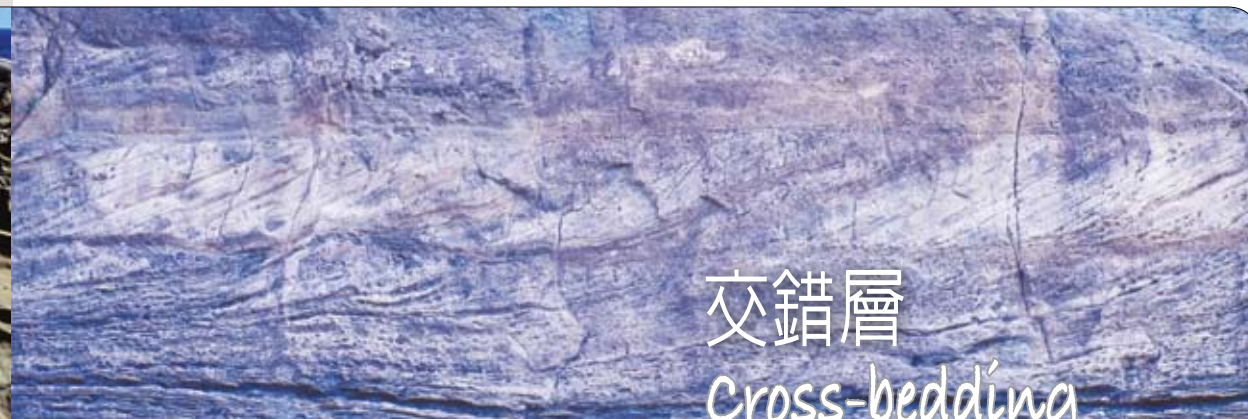
### Cross-bedding

砂岩中經常發現呈弧形的斜面，這些互相平行的斜面與上下的層面呈斜交，這種紋理稱為交錯層。在野外推測古沉積環境的水流方向時，交錯層是最佳判斷水流方向的工具，其斜面傾斜方向表示水流的流動方向。鼻頭角的交錯層在同一個剖面上出現許多層面，顯示本區海水面是不穩定的狀態。



Cross-bedding structures are formed in bedforms such as ripples and dunes by the motion of sediment due to the flowing fluid. Sediment grains bounce up the windward/upstream side of a ripple, and then tumble down the lee side.

Cross-bedding is an indicator of past climate and drainage patterns. Sand dunes preserve the prevalent wind directions, and the pattern of ripples indicate the flow directions of the rivers.





## 生痕化石 Trace fossil



鼻頭角、龍洞地區的岩層中，可以看到許多生物痕跡的化石。砂岩中有各式各樣的管狀或條狀的花紋，這些奇怪的花紋是由淺海海底或濱海的生物造成的。海底的生物在海床表面爬行或鑽入砂層時，會遺留下牠們活動的痕跡，這些痕跡就被完整的保存在岩層中，形成生物的遺跡化石，稱為生痕化石。沙棒是最具代表性的一種，有助於我們瞭解這個地區過去的沉積環境。

The northeastern coastline is famous as a rocky coast for its variety of tilting sedimentary rocks, which contain many fossils and trace fossils. Within the rock bedding, there are plenty of fossils and trace fossils that were laid down with the original deposition. These provide evidence of the original shallow sea environment. Sand pipes are the most common trace fossils here, but the creatures that formed them have long disappeared.



豆腐岩又稱棋盤岩，岩體常有兩組節理，其中一組的方向與岩層走向平行，另外一組則大約與岩層的走向垂直。堅硬的岩層被兩組節理切割後的破裂面，漸漸地被侵蝕而擴大，形成了一塊塊類似豆腐外型的岩塊，因此被稱為豆腐岩。

## 豆腐岩 Chessboard rock



Chessboard rock, also known as bean curd rock, is formed in sandstone where two parallel sets of joints cross at an angle of about  $90^\circ$  with a dip slope of  $15-20^\circ$ . Weathering processes and wave erosion separate these into small blocks.





## 蜂窩岩 Honeycomb rock

蜂窩岩因岩石表層呈現蜂窩狀、窗櫺狀的外形而得名。其表面凹凸不平的原因，為生物在岩石上挖掘出小凹穴，加上海水積蓄在這些凹穴中，沿著凹穴的四周產生風化侵蝕；或是鹽結晶的生長與海水重複乾濕作用所產生之化學、物理風化所致。其中，鼻頭角亦有來自砂岩中的泥糝被侵蝕所形成之蜂窩岩。



Honeycomb rock is a unique landscape to the area. It is the result of differential erosion on sandstone. The arrangement and abundance of depressions in the rock surface resembles a honeycomb.



## 風化紋 Weathering rings

Weathering rings form as a result of differential erosion between the softer original rock and the harder iron oxide that is periodically redeposited on the rocks.

A weathering ring is caused by the redeposition of iron oxide ( $\text{Fe}_2\text{O}_3$ ) on the rock.

Some of the  $\text{Fe}_2\text{O}_3$  is harder than the original rock and this has caused differential erosion resulting in numerous weathering patterns on the surface of the rocks.

自然界中的水和空氣，常常會沿著岩石的裂縫(節理)進行風化作用，若水中或岩石內含有鐵質，長期作用的結果，鐵質會氧化生成氧化鐵，顏色也轉為褐色或咖啡色。氧化作用越完全，顏色也越深，形成風化紋。風化紋又稱鏽染紋，有時風化後的氧化鐵會和旁邊岩石內的小沙粒，或其他物質再結合、膠結，使得岩石硬度變得比周圍的大。



▲ 江惠美 攝  
Photography by Jiang Hwei-Mei

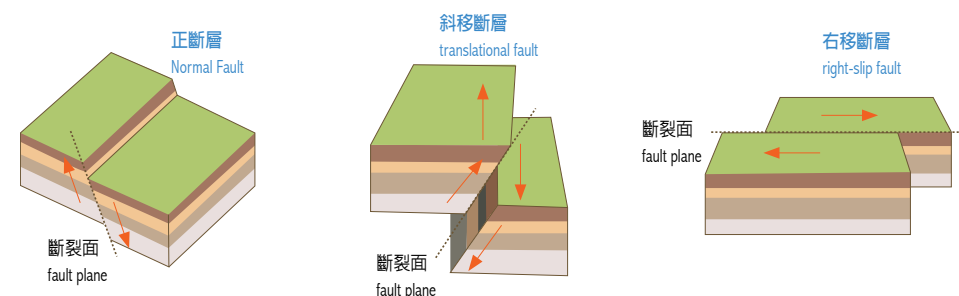


## 節理 Joint

節理是岩石的裂隙，節理與斷層的差異在於節理的塊體並無相對移動。節理越發達，岩塊越破碎，也越容易被風化、侵蝕。節理是地下水容易進出的地方，當地下水把岩層中的鐵質溶解、攜帶至節理處沉澱時，氧化鐵的膠結物對抗侵蝕的作用較強，形成許多風化紋路的特殊地景。

A joint is a cleavage in a rock, and the difference between a fault and a joint is that there is no relative movement between blocks in a joint.

Generally speaking, a joint is a planar surface, but sometimes it becomes a curved surface. A joint is also a discontinuity where the rock can be eroded easily because water and air can move more easily and increase the rate of weathering. The joints can intersect at different angles and can result in the formation of unique tiny landscapes; for example, chessboard rock is the product of the weathering of two sets of perpendicular joints.



## 斷層 Fault

A fault is a fracture of the crust which causes the adjacent stratifications to move along the fault line. There are three kinds of faults. Normal faults are the result of tensions within the crust, and the hanging wall will slide downwards along the fault plane to the foot wall. Thrust faults are the, compression of both sides of the crust, and the hanging wall slides over the foot wall along the fault plane. Faults and folds often appear at the same time.

Strike-slip faults result from the relative movement of two blocks along the strike directions and produce a wrench fault from the compressional forces. Longdong cape has many small normal faults resulting from tension forces.

斷層是岩層形成斷裂，並產生錯移。其種類通常根據兩斷層面相對移動的關係，分為上盤對下盤形成相對向下移動的正斷層、上盤對下盤形成相對向上推移的逆斷層及上下盤在水平面上相對之位移，而無上下垂直移動的平移斷層三種。

數百萬年前，龍洞岬的砂岩在造山運動時，岩層產生褶皺作用。堅硬的砂岩在褶皺時發生被拉張的現象，因此砂岩就形成了許多的正斷層以及節理構造。





## 褶皺 Fold

造山帶的岩層經擠壓變形產生波狀、盆狀、鐘形等彎曲型態，稱褶皺或褶曲。東北角海岸有許多海蝕平臺，都展示著岩層褶皺的現象。

岩層發生褶皺，其岩石中的礦物組成或顆粒結晶排列有可能經過重新調整。

Folds are formed within sedimentary strata that have undergone deformation. Sedimentary folds are the result of slumping of sedimentary material before it is lithified. Folds distributed on a regional scale constitutes a fold belt, a common feature of orogenic zones.

At the North East Scenic Area, there are many folded sedimentary features, and some of these may be observed on the wave cut platforms.



## 向斜與背斜構造 Syncline and Anticline



岩層經褶皺，若中心部位向上拱起，兩翼岩層各自朝相反的方向傾斜，愈近褶皺中心，其地層年代愈老，稱為背斜。若中心部位擠壓向下凹陷，兩翼岩層朝同一中心傾斜，愈近褶皺中心，其地層愈來愈年輕者，稱為向斜。褶皺的形狀常變化多端，褶曲角度亦不相同，鼻頭角便是一個接近向斜中心軸部的地方，岩層展開接近水平。

A syncline is a part of a folded structure and is a geological structure that has resulted from compression of the landscape. The strata bends and the younger strata is at the downward part.

As seen in a vertical section, a fold may have an upwards (antiform) or downwards (synform) morphology. Bitou cape is a typical axis of syncline structure. The strata is close to horizontal.



鼻頭角和龍洞的

## 沉積岩

Sedimentary rock

龍洞的岩石主要是由石英砂岩所組成，因富含石英，所以此地的岩石和臺灣北部的岩石相比較為堅硬，屬於第三紀漸新世。在陽光的照射之下，白色的石英砂岩反射出富有質感的景觀。因砂岩的強度較大，使得本區有許多組因構造運動所形成的節理，這些特色也吸引國內外許多攀岩好手來此活動。

鼻頭角的岩石主要由砂頁岩互層所形成，而本區的交錯層也顯示古水流的方向與海平面的變化。



The rocks at Longdong consist mainly of quartz sandstone. The good cementation of the quartz at Longdong results in rocks that are harder than rocks in other parts of Taiwan. These rocks are Miocene in age. Under the sunshine, the white quartz sandstone reflect the high quality of the landscapes.

Because of the strength of the sandstone, there are several sets of joints formed from the tectonic movement of the landscape. These characteristics make the landscapes attractive to rock climbing activities.

The rock at Bitou cape is mainly quartz sandstone with shale layers. A series of cross bedding structure also demonstrate the ancient of water currents and sea level changes.



## 海水作用

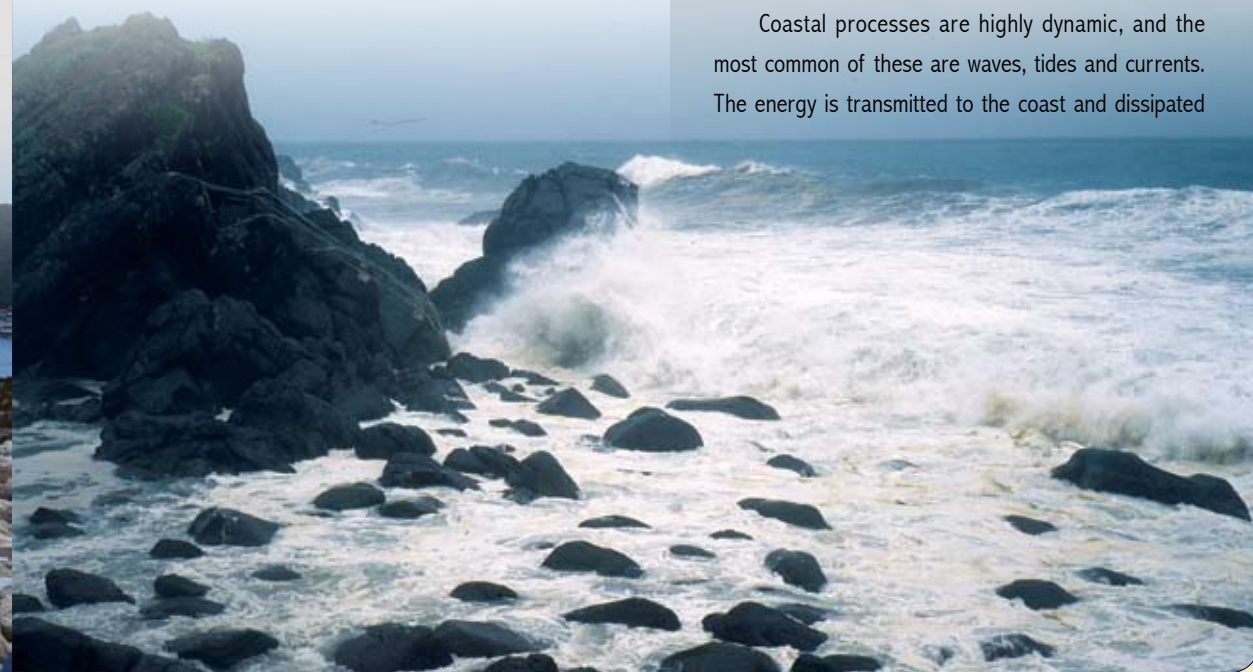
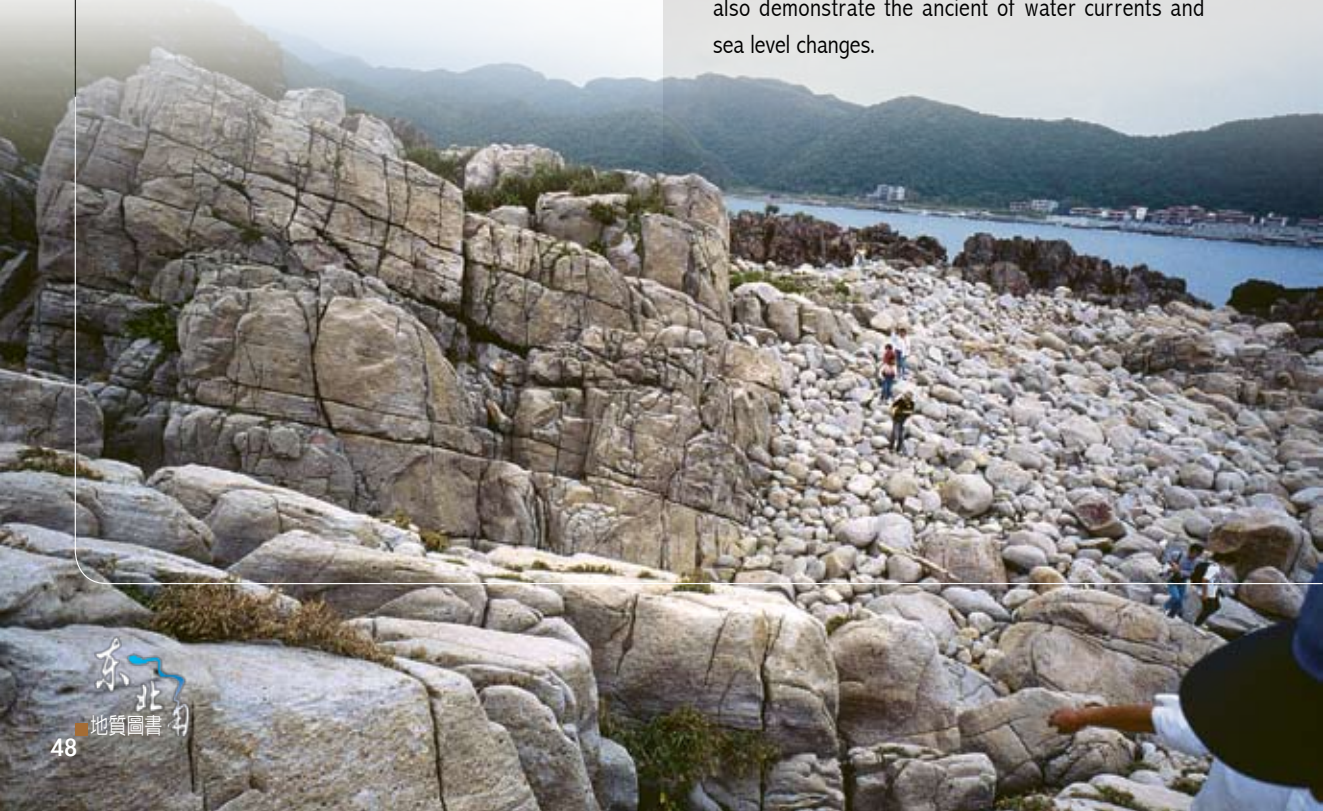
(波浪、海流、潮汐)

Coastal Processes

on the shore often with huge impacts, resulting in coastal erosion. The effects of waves on rocks can cause dramatic coastal retreat. Over a long time scale, even with no sea level change, a coastal area can be eroded into a wave-cut platform. Different coastal processes create erosional and depositional landscapes, but apart from the action of currents and tides, tectonic movements can also shape the landscape. The sea cliffs on the north east coast are both varied and beautiful.

海水被風吹送，不停的沖刷拍打岩岸，對岩石裂縫(節理)造成強大壓力，也會夾帶小石塊磨蝕岩石，加速侵蝕作用；而海水中的鹽結晶使岩石崩解、溶蝕；海水每天規則的漲退，主要是因為海水受到月球和太陽引力作用的緣故，通常每天漲落兩次。海水因潮汐作用而發生垂直升降，雕塑出獨特的地貌，也影響了在海邊活動生長的生物。

Coastal processes are highly dynamic, and the most common of these are waves, tides and currents. The energy is transmitted to the coast and dissipated





## 侵蝕作用與 差異侵蝕

## Erosion processes and Differential Erosion Processes



雨水、河水、地下水、波浪、冰河、風、生物等對地表的破壞作用，稱為侵蝕作用。廣義的侵蝕作用包括搬運作用和堆積作用。在砂岩與頁岩互層的岩層裡，由於砂岩較頁岩來得堅硬，經過一段時間的風化作用或流水侵蝕之後，砂岩的岩層較為凸出，而頁岩的岩層則凹陷進去，明顯的凹凸情形，此稱為差異侵蝕。

There are many strange rocks in the northeast coast and the shapes of these rocks tell us that each has a different hardness. In fact, the hardness is related to the type of sediment and its bonding, the degree of weathering, and the degree of jointing. The joints are formed when the crust is deformed and if there are many joints the rock is easily eroded. This difference in rock hardness is the main reason for the variety of rock forms which makes the landscape so beautiful.

地表的岩石暴露在空氣中，慢慢的開始變色，質地由硬變軟且破碎，最後變成土壤的過程，稱為風化作用。東北角地區地處副熱帶，氣候溫和且潮濕，一年中約有半年承受強烈的東北季風吹拂，加以海浪侵蝕作用，風化作用進行得較快速，讓岩石色彩變化更加豐富，因而生成各色各樣的奇岩怪石。

## 風化作用

## Weathering Processes



Weathering is a process by which rock eventually becomes soil. There are many factors that can enhance weathering processes such as salt weathering which can cause chemical alteration to the rock structures and cement. Weathering processes can increase the rate of erosion of rock by increasing the susceptibility to wave attack. Because of the hot and humid climate, weathering rates are very high in Taiwan. Apart from

the strange shape, the rock is colorful. The color is partly due to its mineral composition and partly due to the weathering that changes the color, especially the surface color. When the rocks are wetted by the waves they sparkle and shine in the sun light.



## 海蝕平臺 Marine platforms

海崖形成後，進一步侵蝕，使海崖後退，經長時間侵蝕，海崖底部變平坦，稱為海蝕平臺。漲潮時，海蝕平臺會被潮水所淹蓋，只在退潮時才露出水面。隨著海蝕平臺增寬及被抬升，波浪愈來愈難侵蝕海蝕崖底部，而脫離海水侵蝕的範圍。

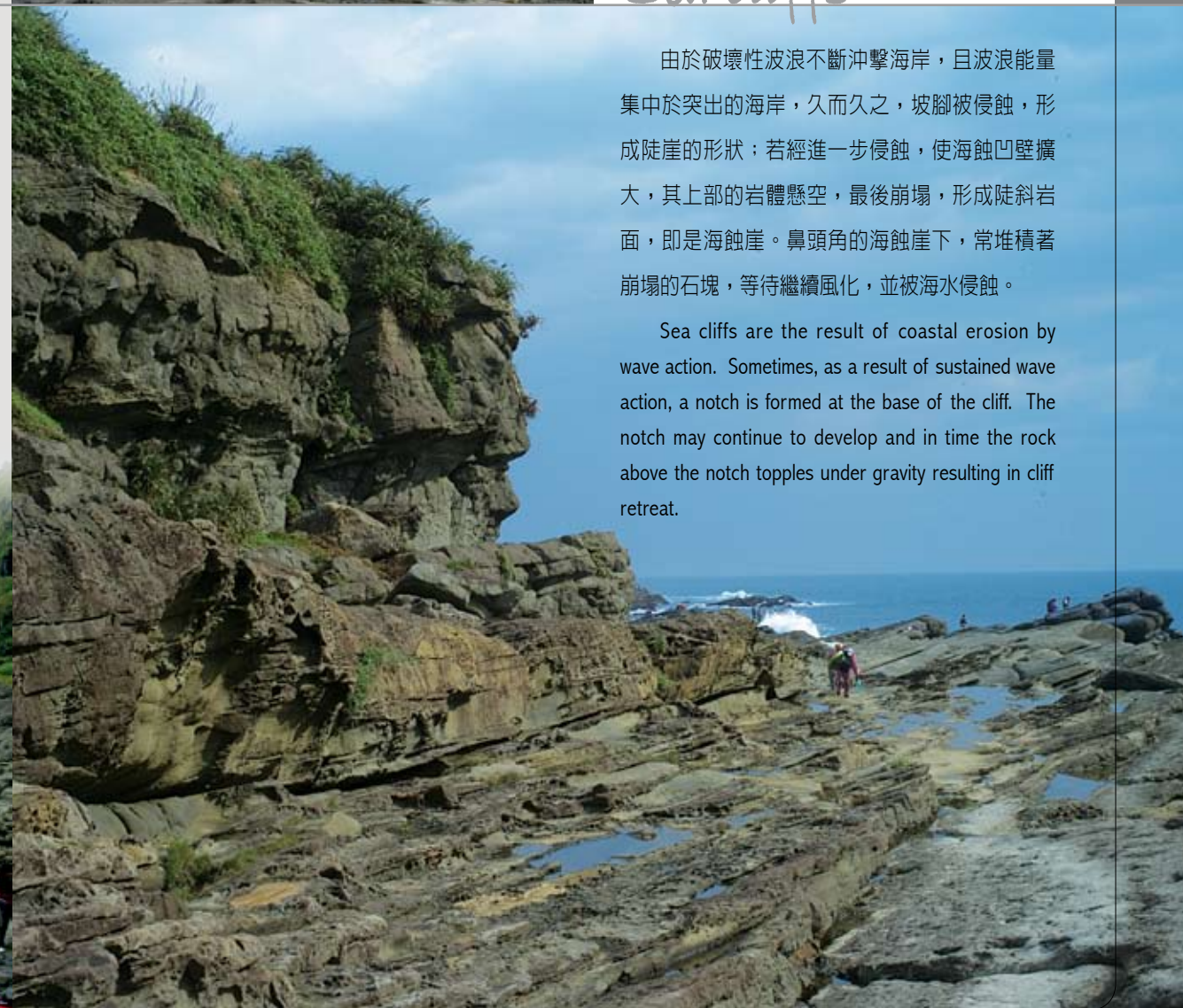
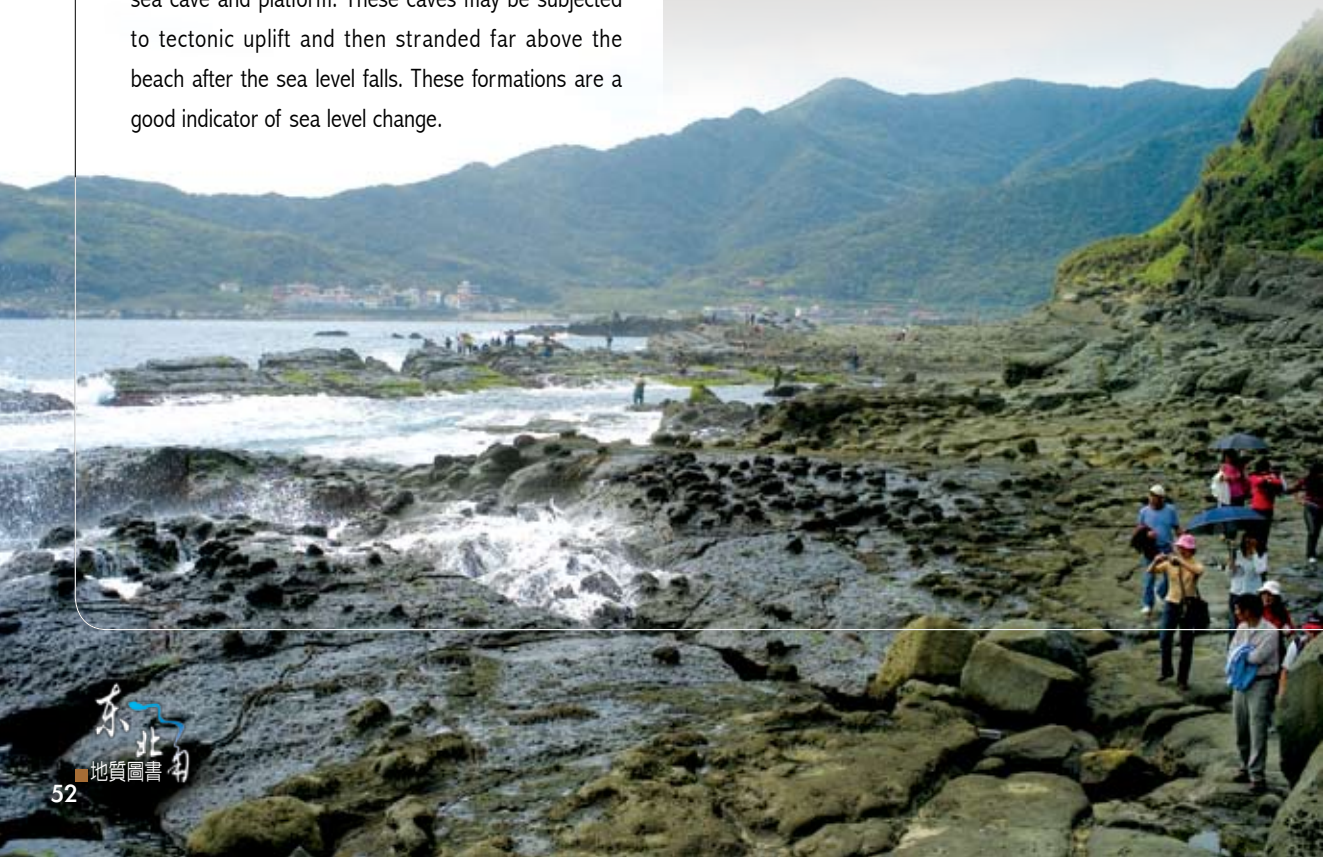
Marine platforms are formed by wave erosion. Constant wave attack at the same location over a long time period can eventually result in the formation of a sea cave and platform. These caves may be subjected to tectonic uplift and then stranded far above the beach after the sea level falls. These formations are a good indicator of sea level change.



## 海蝕崖 Sea cliffs

由於破壞性波浪不斷沖擊海岸，且波浪能量集中於突出的海岸，久而久之，坡腳被侵蝕，形成陡崖的形狀；若經進一步侵蝕，使海蝕凹壁擴大，其上部的岩體懸空，最後崩塌，形成陡斜岩面，即是海蝕崖。鼻頭角的海蝕崖下，常堆積著崩塌的石塊，等待繼續風化，並被海水侵蝕。

Sea cliffs are the result of coastal erosion by wave action. Sometimes, as a result of sustained wave action, a notch is formed at the base of the cliff. The notch may continue to develop and in time the rock above the notch topples under gravity resulting in cliff retreat.





## 海階（小階地）

### Marine terrace

沿海岸的階狀地形，稱為海岸階地，簡稱海階；係因海水面相對下降，原有的波蝕棚、海蝕平臺或堆積平臺離開水面而成。鼻頭角的海階分布高度不同，代表著海水面曾經停留在某個高度較長的時間。

Marine terraces are wave cut platforms that have been uplifted by tectonic movement or relative sea level fall.



## 海岬

### Sea cape

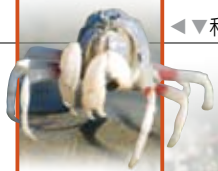
海岸受到海水的侵蝕，呈現凹凸的海岸線，形成岬灣地形。海灣與海岬是因為岩石有軟硬的差別，遭受海浪衝擊，而形成的海岸景觀。海岬的岩石比海灣堅硬，一般由厚層的砂岩所構成，在海浪長期侵蝕之下，特別堅硬的岩石就會凸出海岸，形成海岬。龍洞灣就是龍洞斷層通過的地方，岩石會產生破碎帶，逐漸的凹入陸地，形成海灣。

Because of differential erosion, the rocks along the coastal line retreat at different rate and form the sea cape and gulf.

Between Bitou cape and Longdong cape lies the Longdong fault that has evolved into the Longdong gulf.







◀▼和尚蟹 monk crabs

## 生態資源

# Ecology - A Variety of Various Species

東北海岸的自然生態和地質一樣，也受到東北季風的影響。冬、春二季降雨最多，充沛的雨水使得海岸潮間帶滋生了適應於低水溫的藻類，而這些藻類植物吸引了不少魚、貝、蝦、蟹來此覓食棲息，約38種的冬候鳥也於此時到東北角過冬，豐富的鳥類讓樸實的田野、河邊成了賞鳥人的最愛。

植物生態方面，海面氣流所帶來的雨量，使生長在這裡的植物較不為冬季乾旱缺水所苦，而擁有豐富的植物生態，其中包括：海濱植物、沙丘植物、低海拔植被以及人工植被。

北部海岸位於東海與太平洋海域的交會處，也同時是親潮與黑潮兩股洋流的交會點，因此浮游生物豐盛，是臺灣重要的漁場之一。東北海岸具有太平洋海洋生態，可以看到一群群瓶鼻海豚、飛旋海豚、花紋海豚、弗氏海豚、熱帶斑海豚跳躍海面；是故，此區域除了具有特殊的地質地景，海洋生態亦具備多樣性。

東北角暨宜蘭海岸國家風景區雨量充沛，生態環境未受重大破壞，除了茂盛的植物生態之外，也相當適合野生動物的棲息和繁衍。除具有臺灣纓口鰱、烏龜怪方蟹等特殊物種外，數量上亦非常豐富。



▶小白鷺  
Little Egret

### □陸上動物

常見的哺乳類動物有野豬、野兔、白鼻心等。

### □昆蟲

本區昆蟲資源經調查，其種類至少有404種陸生與水生昆蟲，其組成以鞘翅目、鱗翅目為主；其中大白斑蝶、大紋白蝶、蟻獅、臺灣大蟋蟀及塘沼型水棲昆蟲更是獨具特色。

### □野生鳥類

野生鳥類的種類與數量相當豐富，包括 149 種，分屬於 39 科。除了陸棲鳥類以外，還可見到鸕科的水鳥、燕鷗、海鷗等海鳥。老鷹、紅隼、鳳頭蒼鷹、大冠鷲、魚鷹等猛禽類，也是本區的鳥類特色。

區內規劃有鼻頭區、過港區、龍門區、田寮洋區、得心宮區、馬崗區、北關區等賞鳥據點，可配合鳥類解說手冊從事鳥類之辨識與鳥種生態、行為習性之觀察。

宜蘭海岸線由於河口堆積的泥沙混合許多有機物質，形成一個複雜的生態系，每年吸引了大批水鳥過境或度冬，歷年來已記錄了兩百三十六種以上鳥種，尤其常有機會發現臺



▲小水鴨 Green-winged Teal



▲台灣藍鵲  
Formosan Blue Magpie



▼磯鷸  
Common Sandpiper

The Northeast and Yilan Coast National Scenic Area receives abundant rainfall. With the ecology generally undisturbed, in addition to a rich flora, this area is also well-suited for animal inhabitation and breeding. The Hillstream Loach, Leopard Cat, hydrothermal vent crab *Xenograpsus testudinatus* and other various rare species are all commonly seen here.

### □Mammals

Commonly seen mammals include the wild boar, wild rabbit, Formosan gem-faced civet, snakes and lizards.

### □Insects

The *Idea leuconoe clara*, *Talbotia naganum karumii*, antlion and *Brachytrupes portentosus* (Taiwan Giant Cricket) are distinguishing species commonly seen here.

### □Wild Birds

There is also abundance in both numbers and species of wild birds, including 149 species and 39 families. Besides land birds, there are also waders of the Scolopacidae family, terns, seagulls and other sea birds. Eagles, common kestrel, crested goshawk, crested serpent eagle, osprey, and other birds of prey are also a feature of this area.

### □Ocean Animals

The Northeast and Yilan coast also offers a rich underwater ecosystem. Between Bitou Cape and Longdong Cape, visitors will find a stretch of colorful and diverse corals. There are also surfperches (family Embiotocidae), the Bombay Duck (family Harpodontidae), species of the families Chaetodontidae, Acanthurus, and Apogonidae, barrier reef fishes, sea urchins, sea cucumbers, shellfish, sea snails and sea stars.

### □Shore Critters

Influenced by the tide, animals that live at the intersection of land and ocean usually develop unique characteristics that add to the richness of the ecological scenery. According to investigation, there are more than 60 species of large algae, around 290 species of shellfish, 70 or more species of Crustaceans, almost 40 species of Echinodermata, and almost 100 species of sponges, sea anemones, organisms of the class Polychaeta, sea squirts, and other shore animals.



灣少見的珍稀鳥種，包括丹頂鶴、白頭鶴、白額雁、小天鵝等。冬季常見的候鳥有蒼鷺、大白鷺、黑腹濱鵲、紅嘴鷗等。目前河口也豎立許多賞鳥看板，方便鳥友辨認鳥種。

## □海底生物

東北角暨宜蘭海岸的海底世界蘊藏豐富的生態景觀，鼻頭角至龍洞岬間有五顏六色、種類繁多的美麗珊瑚，還有許多像雀鯛、龍頭魚、蝶魚、粗皮鯛、天竺鯛等海洋生物，以及岩礁魚類、海膽、海參、貝螺類、海蝸牛與各種海星等。

## □海濱生物

由於受潮汐的影響，生活在海陸交界處的各種生物演化出某些特殊本領，而呈現豐富的生態景觀。據調查統計，本風景區有60種以上的大型藻類、約290種貝類、70種以上的甲殼類、近40種棘皮動物及100種以下的海綿、海葵、水母與海鞘等海濱生物。

本風景區的海岸多屬砂岩海岸，其中海蝕平臺佔絕大多數，在海蝕平臺高潮線（海水漲潮最高位處）附近生活的海濱生物，以吸附在岩石上的玉黍螺、青螺和笠螺等為主，中潮帶是許多石蓴、藤壺、牡蠣、蟹類和螺類的棲所，而低潮線（海水退潮最低位處）附近的岩表上則是各種藻類、水螅、海綿和海鞘聚集生長的地方，另在石塊底部或縫隙亦可發現海葵、螺類、陽燧足、寄居蟹等生物蹤跡。

## □鯨豚

在龜山島及南方澳海域，夏秋兩季可發現鯨豚群聚出現，如瓶鼻海豚、花紋海豚及飛旋海豚等，是搭乘遊艇或娛樂漁船出海賞鯨之最佳海域，搭配龜山島獨特的地質及海底火山景觀，形成臺灣特有的賞鯨、地質及海底火山觀察之休閒知性旅遊行程。

## □魚類

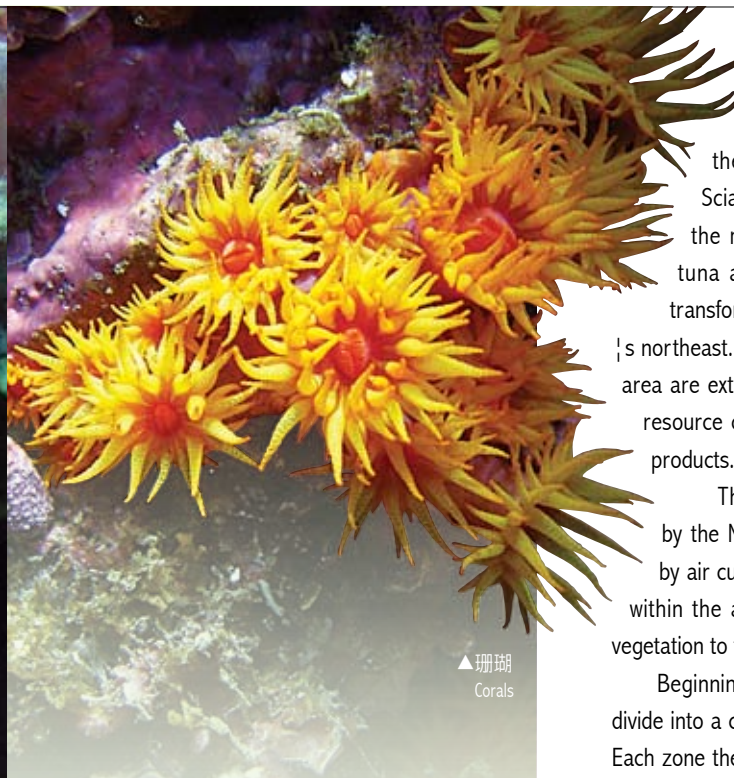
本風景區海域北有東海陸棚水，東有黑潮流經，除有鯛科、鱸科及石首魚科等沿岸定棲性之魚類外，亦有如鯖魚、鰹魚、鰯魚、旗魚及鮪魚等洄游性魚類，魚類生物多樣豐富，形成臺灣東北部重要漁場，漁業經濟及漁村文化活動活絡，呈現漁村生活、生態及生產多面向的觀光遊憩資源。



▲海鞘 Sea Squirts



▲海豚 Dolphins



▲珊瑚 Corals

## □Cetaceans

During summer and autumn, many Cetaceans, such as the Bottle Nose Dolphin, Risso's Dolphin and Spinner Dolphin can be seen within the waters surrounding Turtle Island and Nanfangao. This is a great area to take a ride on a cruiser or hop onto a fishing boat and go whale watching or dolphin watching. Together with the unique geology of Turtle Island and underwater volcanic scenery, the combination of whale watching, geological features and underwater volcanos has allowed this area to become Taiwan's distinguished recreational and intellectual tourism area.

## □Fishes

The Northeast Coast and Yilan National Scenic Area is surrounded by the

waters of the East China Sea Continental Shelf in the north and the Kuroshio Current in the west. Besides coastal dwelling fish such as members of the families Sparidae (breams), Percidae (perches), Sciaenidae (croaches) and etc., migratory fish such as the mackerel, bonito, Spanish mackerel, swordfish and tuna also appear annually. The rich variety of fish has transformed this area into a crucial fishing ground of Taiwan's northeast. The fishing economy and fishing village culture of this area are extremely active, presenting a multi-dimensional tourism resource consisting of fishing village life, fish ecology and fish products.

The Northeast and Yilan coast are distinctly influenced by the Northeast Monsoon. Fortunately, rain carried ashore by air currents from the ocean assists the vegetation growing within the area to evade the aridity of winter, allowing a rich vegetation to thrive.

Beginning from the coastline and moving inland, the land is divide into a coastal vegetative zone and a hillside vegetative zone. Each zone then expresses different species and numbers of plants



▲紫管蟲 Purple Tube Worm



## 遊憩活動

## Recreational Activities

### □點沙成金創意無限～沙雕

「小時候玩過堆沙堡嗎？」、「全臺灣最適合堆沙堡的地方在哪？您知道嗎？」臺灣東北角的貢寮鄉從鹽寮到福隆一帶，被世界沙雕協會鑑定為臺灣最適合雕沙的場所，這一帶的黃金海岸綿延三公里，金黃色的沙質柔軟細密，和水後可塑性佳，大人小孩都可以在這方天地裡，塑造自己的小國度。

### □銀穗妝點秋意～賞芒花

風起兮白雲飛，芒花隨風翩然搖曳、美麗的花穗，仰挺於天空，隨風舞動，整個山谷芒花隨風翻滾，宛如銀色浪花一般。「草嶺古道芒花季」活動的推動，讓民眾享受東北角豐富的自然生態與人文藝術饗宴、體驗優雅的休閒時光。

### □輕車踩踏自然～自行車行

近年來臺灣單車運動結合休閒旅遊的風氣蓬勃發展，以東北角暨宜蘭海岸國家風景區管理處結合中華民國自行車騎士協會及貢寮、雙溪二鄉公所舉辦的「東北角峰迴路轉－貢寮雙溪自行車賽」及「東北角海濱山水親子騎遊」等二項無汙染、無噪音的健康自行車活動最享盛名，也喚起國人節約能源、重視環保的意識。

青山綠水、百年古道，人文風貌和自然景觀兼具，山區有寧靜的農村聚落和碧溪翠谷；還有碧海金沙、灣岬奇岩、沿海特殊的沙岸地形，得天獨厚的景致，正是東北角暨宜蘭海岸國家風景區地質公園最大的資產，熱切展臂歡迎您的造訪。

◀ 沙雕活動  
The Sand Sculpting Activity

### □ Sand Sculpting Festival

"Have you ever made a sand castle when you are a child?" "Do you know where the most suitable place to make a sand castle is?" From Gongliao village to Fulong in Northeast coast in Taiwan is evaluated as the most suitable place for sand sculpture in Taiwan by World Sand Sculpting Association (WSSA). This golden coast is 3 km long, and the quality of the golden sand



▲ 草嶺古道芒花季  
Caoling Historic Trail: The Season of Silver Grass



▲ 龜山島賞鯨豚  
The Whale Watching Cruise on Turtle Island



▲ 龍門自行車追風  
The Exciting Cycling Activity in Longmen

is soft and fine which is easily shaped after mixing with water. Adults and children can shape their own small kingdoms in the coast here.

### □ Silver Grass

White waves' appearance in the mountains of Northeast coast represents that silver grasses start to blossom in fall. In this season, the administration will hold an activity called "Caoling Historic Trail: The Season of Silver Grass" in November each year. Its contents include ecology tour of silver grasses viewing, stamp collections exchange for souvenir and traditional crafts teaching.

Entrance of river and marsh are the places where migratory birds stop in their migrations in spring and fall and also the excellent habitats where water birds spend the wintertime. In this season, people who love birds can be found to take their telescopes

and cameras to capture the picture of water birds. Meanwhile, fall is the season in which wild coreopsis blossoms in Yilan. It is the best choice to have a country trip in this time.

### □ The Exciting Cycling Race

The greatest of joy of outdoors recreation comes from the sightseeing, the wind, sweat and sunshine!

In recent years, the trend of integration of cycling and tourism booms in Taiwan. Among them, the most famous activities are the following two unpolluted and noiseless cycling activities: "Path Winding along Mountain Ridges : Northeast Coast – Cycling Race in Gongliao and Shuangsi" and "Northeast Scenery and Seashore: Parent and Children Cycling and Tourism" co-held by Taiwan Cyclist Federation and Office of Gongliao Township and Office of Shuangsi Township. These activities also can arouse national's attention to energy saving and environmental protection.

Green hills and clear water, ancient paths, local customs, natural sights, peaceful rural villages, green valleys, blue ocean and golden sands, bays and unique rocks, special sand coast, and rich natural sceneries are the greatest assets of Northeast scenic area.



## 注意事項

## Notice

### □ 遊客注意事項

一、地質公園區內整體清潔有賴全體遊客共同維護，以保持優質的旅遊環境。期望全體遊客遵守：

1. 不隨地吐痰、丟棄紙屑、煙蒂、口香糖、瓜果或其皮、核、汁、渣或其他一般廢棄物。
2. 不污染地面、水質、空氣、牆壁、樑柱、樹木、道路、橋樑或其他土地定著物。
3. 不製造噪音、焚燬、破壞花草樹木。
4. 不張貼廣告物及噴漆文字於設施上。

二、本風景區屬地形地質景觀保護區，期盼全體遊客珍惜自然資源，不得於區內從事下列行為：

1. 採集岩石、魚、貝、珊瑚、藻類標本。
2. 新闢水產養殖、墾地種植。
3. 刻畫圖、文於設施或岩石上。

三、本風景區四面環海，曾發生多起意外事故，請遊客謹防範：

1. 周圍海域浪大，暗流、漩渦多，禁止戲水游泳。
2. 景觀遊憩請留意告示牌，以防落海。
3. 冬季易生青苔，步道濕滑，敬請小心慢行。
4. 海崖邊易有落石，請小心通過，避免久留。

謝謝您的珍惜維護，  
為後代子孫留下一片清淨的海洋及珍貴的自然景觀。

More than three million visitors per year visit the Northeast and Yilan Coast all with different interests. Most of them will be amazed at the different types of landscapes, some visit for bird watching or fishing and a delicious meal in the sea food restaurant. A series of landscapes with a rich diversity of marine life exist around the Northeast and Yilan Coast. They are also part-of the earth heritage of Taiwan. Some of the landscapes are rare and vulnerable, some of them are impossible to recover. All of these landscapes need special attention by all visitors.

**To keep this scenic area clean and beautiful, please observe the following rules.**

1. Do not spit or litter.
2. Do not pollute or generate excessive noise.
3. Do not destroy the vegetation.
4. Do not post advertisements.

**The scenic area is a protected area and the following activities are prohibited.**

1. Collection of rock, fish, shell or coral samples.
2. Fishing and collection of plants.
3. Sculpturing of rock.

**For your safety, please observe the following.**

1. No swimming in the dangerous currents.
2. The footpaths and trails are slippery when wet.

Thank You For Your Help. The Northeast and Yilan Coast is a place for tourists, as a place of escape from the city, for students as an out door classroom, and also a place for visitor from all over the world. Enjoy the beauty of the Northeast Coast, but please look after it as a special place for sustainable development.





# 參考網站 Information

東北角暨宜蘭海岸國家風景區管理處

Northeast and Yilan Coast National Scenic Area Administration :

<http://www.necoast-nsa.gov.tw/>

交通部觀光局

Tourism Bureau: <http://www.taiwan.net.tw>



▲南雅海狗石 / 利勝章 攝

The Seal Stone in Nanya/Photography by Li Shen-Jang



發行者：東北角暨宜蘭海岸國家風景區管理處

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設計印刷：舜程印刷有限公司 04-23214125

發行日期：中華民國98年4月

## The Bitou Cape - Longdongwan Geopark Guidebook

**Publisher** : Northeast and Yilan Coast National Scenic Area Administration

**Author** : Lin Jiun-Chuan

**Editor** : Chen Yi-Chun

Taiwan Geomorphological Research Unit,  
Department of Geography, National Taiwan University.

**Printing** : Shun Cheng Printing Co., Ltd. Tel:886-4-2321-4125

**First Ed** : April 2009

▲龍洞灣岬 / 郭炳東 攝

Longdongwan Cape/Photography by Guo Bing-Dong