微藻
Harmful Marine MICROALGAE in Hong Kong
Hong Kong Harmful Marine Microalgae in Hong Kong

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海洋裏有數以千種的微藻生長，它們都是構成食物網基層的初級生產者。大部份微藻均不會對人類、海洋生物或自然環境造成不良影響，只有少數微藻品種，即使在低細胞密度環境下，仍會造成危害，例如導致魚類死亡及海產污染等，這些現象稱為有害藻華。

在香港的浮游植物中，硅藻和甲藻是兩個最常見的組別，而許多引發紅潮的品種都屬於這兩個組別。硅藻（硅藻綱）是單細胞生物，長有黃褐色葉綠體及硅質細胞壁。細胞壁由兩片殼組成，兩者由側帶連合。硅藻分為兩類：(1) 圓心硅藻—殼面呈圓形，紋理為輻射形對稱，例如圓篩藻屬；(2) 羽紋硅藻—細胞壁較長，兩側對稱，例如擬菱形藻屬。硅藻一般根據其形狀和硅質細胞壁的樣式分類，直徑或長度通常介乎 20 至 200 微米不等，細胞可以是單一形態或組成群體。硅藻多分佈於淡水及海洋環境，此外亦可在泥土中生長。圖 1 顯示硅藻的形態。

Thousands of microscopic algal species are found in oceanic waters. They are primary producers which form the base of the food web. Most of them do not cause harm to humans, marine organisms, or the natural environment. Only a few algal species are known to have adverse impacts, such as fish kills and seafood contamination, even at low cell densities. Such phenomena are considered as harmful algal blooms (HABs).

Diatom and dinoflagellate are the two most common groups making up the phytoplankton assemblage in Hong Kong, and many of the known red tide causative species belong to these two groups. Diatom (Bacillariophyceae) is unicellular organism with yellow-brown chloroplast(s) and siliceous cell walls. The cell walls, called frustules, consist of two valves fitted together by a cingulum. There are two main groups of diatom: (1) the centrics whose frustules are circular with essentially radial symmetry, e.g. *Coscinodiscus* species; and (2) pennates whose frustules are more elongated with primarily bilateral symmetry, e.g. *Pseudo-nitzschia* species. The taxonomy of diatom is often based on the shape and design of the siliceous frustules. Diatom is commonly between 20 – 200 microns in diameter or length. The cell may be solitary or colonial, and they are found in fresh and marine habitats and even in soils. Figure 1 illustrates the morphology of diatoms.
Dinoflagellate (Dinophyceae) is microscopic, unicellular, free swimming organism with two flagella. The transverse flagellum may be contained in a groove-like structure around the equator of the organism, providing forward motion and spin, while the longitudinal flagellum that trails behind provides little propulsive force and mainly acts as a rudder. Most species are basically round in shape and some species can form chain. Dinoflagellates are commonly between 5 – 2000 micron in length or diameter. The majority of dinoflagellates species are marine, but they are also found in freshwater lakes, rivers and swamps-marshes. Dinoflagellates are often divided into: 1) armoured dinoflagellates (possessing a theca or cellulose plates), and 2) naked dinoflagellates (without a theca). Figure 2 illustrates the morphology and cellular structure of dinoflagellate.

1) Armoured dinoflagellates: The cell wall of many dinoflagellates is divided into cellulotic plates known as the theca. The taxonomy of these thecated dinoflagellates is mostly based on the number of arrangement, shape and structure of the theca e.g. *Alexandrium* spp.

2) Naked dinoflagellates: They have smooth and flexible cell walls and the taxonomy is mostly based on the shape and structure e.g. *Karenia* spp.
有些藻類或引發紅潮的藻類可製造毒素，毒素會慢慢積聚在攝食這些微藻的貝類體內，人類進食受污染貝類便有可能出現中毒症候。常見的貝類中毒包括可致命的神經紊亂麻痹性貝類中毒、引致腸胃不適的下痢性貝類中毒、引致腸胃不適和神經紊亂的神經性貝類中毒，以及引致腸胃及神經系統失調的失憶性貝類中毒，嚴重者可能致命。

只有少數藻類曾導致大量野生和養殖魚類死亡。魚類透過直接攝入受污染水體中的毒素或食物鍊造成生物積聚，均可能中毒死亡。此外藻類毒素亦會刺激魚鰓製造大量黏液，或直接堵塞魚鰓妨礙吸氧，令魚類窒息而死。大規模和高濃度的藻華會耗盡環境中的養份，令微藻下沉，細菌分解微藻導致底層氧氣枯竭，水中含氧量低於每公升 2 毫克時會出現低氧現象，當水中的含氧量接近零時便會出現缺氧。由於氧份極低，令底棲生物和網箱養殖的魚類窒息死亡。

Some algal / red tide causative species produce toxins which accumulate in shellfish that feed on these algae, resulting in shellfish poisoning in human consumers. Common shellfish poisoning include: Paralytic Shellfish Poisoning (PSP) – life-threatening neurological disorders; Diarrhetic Shellfish Poisoning (DSP) – gastrointestinal symptoms; Neurotoxic Shellfish Poisoning (NSP) – gastrointestinal and neurological disorders; and Amnesic Shellfish Poisoning (ASP) – life-threatening gastrointestinal and neurological disorders.

A few algal species have been known to cause catastrophic losses of wild and farmed fish populations. Fish could be affected or killed by algal toxins through direct uptake of the toxins from contaminated water or bioaccumulation through the food chain. Another possibility is the toxin in the algae irritates fish gills and results in over-production of mucilage, or the physical blocking of oxygen uptake by the gills filaments that leads to suffocation. In addition, dense blooms of algae may exhaust the ambient nutrients, causing them to sink and often resulting in
depletion of bottom oxygen due to decomposition of the algae by bacteria. This phenomenon where oxygen concentration in the water is < 2 mg/L is referred to as hypoxia or anoxia when oxygen concentration is near zero. Such low oxygen concentration leads to suffocation of bottom-dwelling organisms and caged fish.

**RED TIDES / HABS IN HONG KONG**

Red tides / HABs are natural phenomena in which rapid multiplication of microscopic, unicellular algae results in the discoloration of seawater. The massive growth of algal cells may turn the water pink, red, brown, reddish-brown, deep green or other colours. Red tide is initiated by a combination of natural factors (e.g. light intensity, temperature, salinity, nutrients, trace elements, water flow and motility of algal cells) and anthropogenic factors (e.g. discharge of organic or nutrient-enriched matters) that encourage the rapid and massive growth of algae. These factors may favor the growth and aggregation of an algal species and result in red tide or algal bloom. The continuation of any algal bloom is dependent on the dynamics of those factors.

The Agriculture, Fisheries and Conservation Department (AFCD) has been recording the occurrences of red tide since 1975. Between 1975 and 2012, there were a total of 867 red tide incidents in Hong Kong. With the exception of the 1988 peak, the number of red tide incidents in Hong Kong averaged from 20 to 30 per year (Figure 3).

There are approximately 330 aquatic organisms known to cause red tides in the world, of which 76 species are recorded in Hong Kong. Out of the 76 local red tide causative species, 19 species are recognized as HABs and some of these caused harmful effects to marine organisms. For instance, species of *Karenia digitata* developed into a red tide and caused a massive local fish kill in 1998 (AFCD, 1999 and Yang, 2000). Apart from the 19 HAB species, the AFCD routine phytoplankton monitoring programme also detected 31 other potential toxic algal species in Hong Kong waters.

This publication aims to provide simple identification guides for toxic and potentially toxic marine microalgae found in Hong Kong waters. Each of the recorded algal species is illustrated with photos, taxonomic description, and potential toxicity, distribution and time/season of occurrence.
香港紅潮 / 有害藻華管理工作

漁護署早於 1999 年便成立紅潮管理框架，務求增進紅潮管理工作的效益，將紅潮 / 有害藻華對海魚養殖業及人類健康造成的潛在影響減至最低。

紅潮督導委員會，成員分別來自食物及衛生局、環境局、食物環境衛生署 (食環署)、食物環境衛生署 (食環署)、環境保護署 (環保署) 及漁護署的代表，專責督導及指導紅潮監察及管理事務。紅潮跨部門小組，成員同樣來自多個政府部門，包括漁護署、食環署、衛生署、康文署、環保署、政府化驗所、海事處、香港天文台及政府新聞處，當中漁護署代表擔任協調角色，促進不同政府部門就紅潮/有害藻華個案的互相配合，採取適當的行動。此外，我們亦設有紅潮/有害藻華專家顧問小組，邀請專上學院及專業協會的非政府專家參與，就紅潮/有害藻華的管理及相關科學研究與發展提供意見。上述管理框架的組織結構及相關活動已列載於圖 4。

我們設有紅潮資訊網絡，接收在海上執勤的政府人員、養魚戶及市民通報在本港及華南海域發現的紅潮個案。在網絡的框架下，漁護署實施浮游植物監察計劃、促進探測有害藻華；食環署推行海產監察計劃，衛生署則推行健康監察計劃，藉此偵測藻類生物毒素和接收人類中毒的報告。

漁護署透過紅潮資訊網絡收集資訊，擔任協調的角色，將資訊發送到相關的政府部門，以便跟進。有關部門會展開調查，以評估每宗個案的風險，如有需要會及早向養魚戶發出警告。

除此之外，我們還設立專題網站：香港紅潮資訊網 (www.afcd.gov.hk/hkreotide/index.html)，內容每周更新，為公眾及養魚戶提供最新的紅潮/有害藻華概況；同時亦印製和派發海報及單張，宣傳紅潮/有害藻華可能對魚類養殖活動、海產食用安全及泳客於泳灘造成的影響，提高公眾對紅潮/有害藻華的知識。
RED TIDES/HABs MANAGEMENT IN HONG KONG

With a view to minimise the possible impacts of red tides/HABs on marine fish culture activities and human health in Hong Kong, the AFCD has established a red tide management framework since 1999 to enhance red tide management. A Red Tide Steering Group (RTSG), comprising representatives from the Food and Health Bureau (FHB), Environment Bureau (ENB), Food and Environmental Hygiene Department (FEHD), Department of Health (DH), Leisure and Cultural Services Department (LCSD), Environmental Protection Department (EPD) and AFCD, has been established to oversee and provide guidance on the monitoring and management of red tides. A Red Tide Interdepartmental Working Group (RTIWG) with representatives from AFCD, FEHD, DH, LCSD, EPD, Government Laboratory (GL), Marine Department (MD), Hong Kong Observatory (HKO) and Information Services Department (ISD) has also been set up, with AFCD acting as the coordinator, to facilitate coordination amongst various government departments on red tides/HABs occurrences. In addition, a Red Tide/HAB Expert Advisory Group (RTEAG) which involves non-government experts from tertiary institutions and professional associations provide advice on red tides/HABs management and related scientific research and development. Figure 4 illustrates the organizational structure of the above management framework and its activities.

An information network has been set up to receive reports of red tide sightings in local and southern Mainland waters by government department staff working at sea as well as mariculturists and the public. The network also consists of a phytoplankton monitoring programme run by the AFCD to facilitate detection of harmful algal blooms; a seafood surveillance programme by the FEHD, and a health surveillance programme by the DH aimed at detecting algal bio toxins and registering reports of human intoxication.

The AFCD acts as the coordinator and disseminates information received from the above network to relevant departments for their follow-up actions. Investigations will be carried out to assess the risk involved in each incident. Warnings will be issued to marine fish farmers at the earliest possible time whenever necessary.

The Hong Kong Red Tide Information Network (www.afcd.gov.hk/hkredtide/index.html), which is up-dated weekly, has also been established to inform the public and mariculturists about the latest situation of red tides/HABs. In addition, posters and leaflets about red tides/HABs, communicating their possible impacts on fish culture, implications on seafood safety and swimming at beaches, were produced and distributed to the public to increase awareness of red tides/HABs.
紅潮督導委員會
Red Tide Steering Group

指導 Guidance

紅潮跨部門小組
Red Tide Interdepartmental Working Group

意見 Advice

專家顧問小組
Expert Advisory Group

協調 Coordination

紅潮 / 有害藻華管理行動總計劃
Red Tides / HABs Management Operation Master Plan

資訊網絡 Information Network

● 浮游植物監察計劃
Phytoplankton Monitoring Programme
● 紅潮報告網絡
Red Tide Reporting Network
● 海產監察及人類中毒報告
Seafood Surveillance and Report of Human Intoxication

部門行動計劃
Departmental Action Plans

● 養殖行動計劃
Mariculture Action Plan
● 泳灘行動計劃
Beach Action Plan
● 藻類生物毒素行動計劃
Algal Biotoxin Action Plan
● 跨部門聯絡
Interdepartmental communication

其他行動 Other activities

● 公眾資訊交流及教育
Public Communication and Education
● 研究及發展
Research and Development

圖 4 紅潮 / 有害藻華管理框架
Figure 4. Red tide/HAB management framework


中國國家海洋局，2002。中國近海赤潮生物圖譜。

金德祥、程兆第、劉師成，1982。中國海洋底棲硅藻類，上卷，下卷。海洋出版社，北京。

金德祥、陳金環、黃凱歌，1965。中國海洋浮游硅藻類。上海科學技術出版社。
紅海束毛藻

Trichodesmium erythraeum  Ehrenberg 1830 ex Gomont 1892

門 Phylum : 藍藻門 Cyanobacteria
綱 Class : 藍藻綱 Cyanophyceae
目 Order : 顫藻目 Oscillatoriales
科 Family : 席藻科 Phormidiaceae

異名 Synonyms : Oscillatoria erythraeum (Ehrenberg) Geitler 1932, Skujaella erythraea (Ehrenberg) De Toni 1938, Trichodesmium ehrenbergii Mont 1844

描述 : 紅海束毛藻是熱帶絲狀藻，藻絲體直，平行排列成束狀。每條藻絲長約 60 – 750 微米；細胞長 4.5 – 11 微米，寬 6 – 15 微米，長度一般比寬度略短。頂端細胞呈半球形、錐形或凸面，藻絲末端有帽狀體，藻群呈紅色。

毒性：據外國文獻記載紅海束毛藻可導致魚類死亡，這種藻亦可能會產生微囊藻毒素，對游泳人士有害。香港藻株疑有毒性，但尚未能確定。

地區分佈：紅海束毛藻廣泛分佈於暖水區域，曾經在越南、泰國、日本、中國東海水域及中國南海水域包括香港形成紅潮。

紅海束毛藻常見於香港水域。曾於 1980 至 2009 年在香港南部至東部水域共引致 14 次紅潮，但並未造成魚類死亡。

Description: *Trichodesmium erythraeum* is a tropical filamentous alga with straight trichomes oriented parallel in bundles. The length of each trichome is around 60 – 750 μm; the cell is 4.5 – 11 μm long, 6 – 15 μm wide and usually shorter than width. The apical cells are hemispherical, conical or convex with calypters at the end of the trichomes. The colony form appears red in colour.

Toxicology: *T. erythraeum* is a toxic species which causes fish-kill and it is also suspected to produce microcystins that might be a nuisance to swimmers according to overseas findings. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: *T. erythraeum* is widely distributed in tropical waters and known to cause red tides in Vietnam, Thailand, Japan, East China Sea and South China Sea including Hong Kong. *T. erythraeum* is commonly found in Hong Kong waters. It caused 14 red tides from 1980 – 2009, reported from Southern to Eastern waters of Hong Kong. No fish kill was reported during the blooms.

參考文獻 References:
中國國家海洋局，2002。*中國近海赤潮生物圖譜*。
Trichodesmium erythraeum. Figures 1-3: Trichomes showing the individual cell usually wider than long. Figures 4-5: Trichomes are straight and oriented parallel in bundles. Figure 6: Apical cell hemispherical, conical or convex with calyptra (arrow).
鐵氏束毛藻
Trichodesmium thiebautii  Gomont 1892

門 Phylum : 藍藻門 Cyanobacteria
綱 Class : 藍藻綱 Cyanophyceae
目 Order : 顫藻目 Oscillatoriales
科 Family : 席藻科 Phormidiaceae

異名 Synonyms : Oscillatoria thiebautii(Gomont) Geitler 1932, Skujaella thiebautii(Gomont) De Toni 1939

描述: 鐵氏束毛藻是熱帶絲狀藻,群落形態差異極大,藻絲束既可纏繞成群,或成球狀,亦可呈繩索狀附以伸展藻絲等。藻絲直徑為 6 – 16 微米,長度可比寬度大兩倍,頂端細胞呈圓形或扁平,藻絲末端沒有帽狀體,藻群落一般浮於水面,大小約 1 – 3 毫米,顏色以金褐色為主,但亦有灰、褐及紅色。

毒性: 鐵氏束毛藻可引致神經中毒,該藻會產生一種神經毒素,引起症狀與魚腥藻毒素 -a 相似。香港的藻株疑有毒性,但尚未能確定。

地區分佈: 鐵氏束毛藻廣泛分佈於暖水區域,曾經在越南、日本、中國東海水域及中國南海水域包括香港形成紅潮。

鐵氏束毛藻常見於香港水域。曾於 2003 年在香港東南部海域引致紅潮,並未造成魚類死亡。

Description: Trichodesmium thiebautii is a tropical filamentous alga. The colony form of T. thiebautii is highly variable, ranging from bundles of trichomes wound together, spherical to rope-like form with radiating trichomes. The trichomes are 6 – 16 µm in diameter and can be twice as long as wide. The apical cells are round or flatted with no calyptras at the end of the trichomes. Colonies are usually buoyant and about 1 – 3 mm in size. They usually appear golden brown in colour but can also vary from grey, brown to red.

Toxicology: T. thiebautii can cause neurointoxication and may produce neurotoxin which has an impact similar to anatoxin-a. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: T. thiebautii is widely distributed in tropical water and known to cause red tide in Japan, Vietnam, East China Sea and South China Sea including Hong Kong.

T. thiebautii is commonly found in Hong Kong waters. A bloom was reported in the Southeastern waters in 2003 and no fish kill was reported during the bloom.

參考文獻 References:
中國國家海洋局，2002。中國近海赤潮生物圖譜。
Trichodesmium thiebautii. Figure 1: Trichomes slightly flexuous or well curled. Figures 2-3: Apical cells of trichomes are round or flatted without calyptras. Figure 4: Trichomes showing the individual cells usually longer than wide, and can be twice as long as they are wide. Figures 5-6: Trichomes forming radially arranged, spherical or rope-like colony, sometimes up to 3 mm in size.
靚紋擬菱形藻

**Pseudo-nitzschia calliantha**

Lundholm, Moestrup & Hasle 2003

**門** Phylum: 硅藻門 Bacillariophyta  
**綱** Class: 硅藻綱 Bacillariophyceae  
**目** Order: 硅藻目 Bacillariales  
**科** Family: 硅藻科 Bacillariaceae

**異名** Synonym: *Pseudo-nitzschia pseudodelicatissima* Hasle (Hasle) 1993

**描述:** 靚紋擬菱形藻的殼面觀呈直線長形，殼面近末端漸尖部份的殼環面觀極短。縱軸及橫軸為47 - 115微米及1.2 - 3.6微米，有中央間隙。每10微米內的肋紋間及船骨點數目分別為26 - 40及14 - 23。每行肋紋有一排孔紋，每1微米孔紋數目為4 - 6。孔紋的藻細胞膜分為7 – 10小孔，狀似花朵。

**毒性:** 靚紋擬菱形藻是可產生引致失憶性貝類中毒的軟骨藻酸。香港培殖的藻株並沒有發現釋出軟骨藻酸。

**地區分佈:** 靚紋擬菱形藻曾經在日本的西北水域形成紅潮，在香港水域有記錄，細胞濃度低，沒有在香港引致紅潮。

**Description:** *Pseudo-nitzschia calliantha* cell is straight and linear in valve view and the tapering parts of the valve towards the tips are very short in girdle view. The apical axis and transapical axis are 47 – 115 μm and 1.2 – 3.6 μm in size respectively, with large central interspace. The number of interstriae and fibulae in 10 μm are 26 – 40 and 14 – 23 respectively. There is one row of poroids per each striae and contain 4 – 6 poroids in 1 μm. The hymen of the poroid is divided into 7 – 10 sectors, resembling a flower pattern.

**Toxicology:** *P. calliantha* is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). However local cell cultures did not find to produce domoic acid.

**Regional distribution:** *P. calliantha* caused red tides in the northwestern sea of Japan. Low cell densities detected in Hong Kong waters but it has not caused red tide.

**參考文獻** References:


Cultured cells of *Pseudo-nitzschia calliantha*. Figure 1: Live cells in chain, girdle phase contrast. Figure 2: Live cells in chain, valve. Figure 3: Valve, lugol fixed cell. Figure 4: Valve, SEM. Figure 5: Acid cleaned frustule, valve with visible fibulae and central interspace, SEM. Figure 6: Tip of the valve, SEM. Figure 7: Overlapping of cells, girdle. Figure 8: High magnification showing the perforated membrane of the poroids. Figure 9: Middle part of the valve showing large central interspace, one row of poroids, SEM. Figures 1-2: scale bars = 20 μm. Figures 3-5 and 7: scale bars = 10 μm. Figure 6: scale bar = 1 μm. Figure 8: scale bar = 100 nm. Figure 9: scale bar = 1 μm.
柔弱擬菱形藻

*Pseudo-nitzschia delicatissima*

(Cleve) Heiden in Heiden & Kolbe 1928

門 Phylum: 硅藻門 Bacillariophyta

綱 Class: 硅藻綱 Bacillariophyceae

目 Order: 硅藻目 Bacillariales

科 Family: 硅藻科 Bacillariaceae

異名 Synonyms: *Nitzschia actydrophila* Hasle 1965, *Nitzschia delicatissima* Cleve 1897

描述: 柔弱擬菱形藻的殼面觀對稱, 一般呈彎曲狀, 接近末端漸尖, 末端圓角, 殼環面觀則略呈 S 形, 末端為直切邊。縱軸及橫軸分別為 30 – 80 微米及 1.1 – 2.0 微米, 細胞交疊位置佔總長度九分之一, 並有中央間隙。每 10 微米肋紋間及船骨點數目分別為 34 – 41 及 19 – 26。另有兩排孔紋, 每 1 微米孔紋數目為 10 – 14。

毒性: 柔弱擬菱形藻可產生引致失憶性貝類中毒的軟骨藻酸。香港培殖的藻株並沒有產生軟骨藻酸。

地區分佈: 柔弱擬菱形藻廣泛分佈於溫帶至熱帶水域, 常見於香港海域。這種藻在中國東海水域及中國南海水域引致紅潮, 曾於 2012 年在香港東南部及南部水域引發 2 宗紅潮, 但沒有造成魚類死亡。

**Description:** *Pseudo-nitzschia delicatissima* cell is symmetric, gently curved until some distance from the ends and pointed to the rounded ends in valve view. Slightly sigmoid and straight cut ends in girdle view. The apical and transapical axis are 30 – 80 μm and 1.1 – 2.0 μm respectively. The cells overlap by 1/9 of the total cell length. A central interspace is present. The number of interstriae and fibulae in 10 μm are 34 – 41 and 19 – 26 respectively. There are two rows of poroids and 10 – 14 poroids in 1 μm.

**Toxicology:** *P. delicatissima* is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). However local cell cultures did not find to produce domoic acid.

**Regional distribution:** *P. delicatissima* is widely distributed from tropical to temperate waters and caused red tides in East China Sea and South China Sea. It is commonly found in Hong Kong waters and caused 2 red tide incidents in the Southeastern and Southern waters in 2012 but no fish kill was reported during the blooms.

**參考文獻 References:**


Cultured cells of *Pseudo-nitzschia delicatissima*. Figure 1: Live cells in chain, girdle phase contrast. Figure 2: Live cells in chain, valve. Figure 3: Live single cell, pointed ends, valve. Figure 4. Acid cleaned frustule, valve with visible fibulae. Figure 5: Valve, SEM. Figure 6: Tip of the valve, SEM. Figure 7: Overlapping of cells, girdle. Figure 8: Middle part of the valve showing large central interspace. Figure 9: Middle part of the valve, two rows of poroids, SEM. Figures 1-5: scale bars = 10 μm. Figure 6: scale bar = 1 μm. Figure 7: scale bar = 5 μm. Figure 9: scale bar = 500 nm.
多紋擬菱形藻

**Pseudo-nitzschia multistriata** (Takano) Takano 1995

門 **Phylum:** 硅藻門 *Bacillariophyta*

綱 **Class:** 硅藻綱 *Bacillariophyceae*

目 **Order:** 硅藻目 *Bacillariales*

科 **Family:** 硅藻科 *Bacillariaceae*

異名 **Synonym:** *Nitzschia multistriata* Takano 1993

描述: 多紋擬菱形藻於殼面觀中殼面呈梭形線狀，沿末端收窄，殼環面觀則呈 S 形，兩端截尾。細胞縱軸及橫軸分別為 38 – 65 微米及 2.5 – 4.5 微米，每 10 微米肋紋間及船骨點數目分別為 37 – 46 及 23 – 30，另有兩至三排孔紋，每 1 微米孔紋數目為 10 – 11。沒有中央間隙，細胞交疊位置佔總長度三分之一。

毒性: 多紋擬菱形藻可產生引致失憶性貝類中毒的軟骨藻酸。香港培殖的藻株並沒有產生軟骨藻酸。

地區分佈: 多紋擬菱形藻分佈於亞熱帶水域，這種藻很少出現在亞洲水域，沒有在香港水域引致紅潮，於東部及東北部水域有記錄，細胞濃度低。

Description: *Pseudo-nitzschia multistriata* cell is fusiform, linear in middle valve and tapering towards the end in valve view. Sigmoid and truncated ends are observed in girdle view. The apical and transapical axis are 38 – 65 μm and 2.5 – 4.5 μm respectively. The number of interstriae and fibulae in 10 μm are 37 – 46 and 23 – 30 respectively. Two to three rows of poroids and 10 – 11 poroids in 1 μm are recorded. Central interspace is absent and the cells are overlapping by 1/3 of the total cell length.

Toxicology: *P. multistriata* is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). Local cell cultures did not find to produce domoic acid.

Regional distribution: *P. multistriata* is distributed in subtropical waters and it has very few occurrence record in Asia waters. Low cell densities were detected in Eastern and Northeastern waters and it has not casued red tide in Hong Kong.

參考文獻 References:


Cultured cells of *Pseudo-nitzschia multistriata*. Figure 1: Live cells in chain, girdle phase contrast. Figure 2: Live cells in chain, valve, phase contrast. Figure 3: Cell solitary, girdle. Figure 4: Cell solitary, valve. Figure 5: Girdle band. Figure 6: Valve, SEM. Figure 7: Tip of the cell, SEM. Figures 8-9: Middle part of the valve, 2 to 3 rows of poroids, SEM. Figures 1-6: scale bars = 10 μm. Figure 7: scale bars = 2 μm.
假柔弱擬菱形藻
Pseudo-nitzschia pseudodelicatissima (Hasle) Hasle 1993

門 Phylum：硅藻門 Bacillariophyta
綱 Class：硅藻綱 Bacillariophyceae
目 Order：硅藻目 Bacillariales
科 Family：硅藻科 Bacillariaceae

異名 Synonyms：Nitzschia delicatula Hasle 1965, Nitzschia pseudodelicatissima Hasle 1976

description: Pseudo-nitzschia pseudodelicatissima is straight and narrow at mid body until some distance from the ends when observed in the valve view. The ends are pointed in both valve and girdle view. The apical axis is 50 – 140 μm and transapical axis is 1.3 – 3.4 μm. Central interspace is present. The cell overlaps 1/6 of the total cell length. The number of interstriae and fibulae in 10 μm are 29 – 46 and 14 – 26 respectively. The cell has one row of poroids with 4 – 6 poroids per μm, and the poroid hymen divides into 2 large parts.

Toxicology: P. pseudodelicatissima is cabaple of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). Local cell cultures found to produce 0.0035 pg of domoic acid per cell.

Regional distribution: P. pseudodelicatissima is distributed in warm temperate and tropical waters and caused red tides in Japan, Taiwan, East China Sea and South China Sea including Hong Kong. It often occurs in Hong Kong waters. This species caused 4 red tide incidents, reported in the Tolo Harbour and Southern waters in 1988 and 1996 but no fish kill was reported during the blooms.

參考文獻 References:
Cultured cells of *Pseudo-nitzschia pseudodelicatissima*. Figure 1: Live cells in chain, valve view. Figure 2: Live cells in chain, girdle phase contrast. Figure 3: Live, valve. Figure 4: Acid cleaned frustule, valve with visible fibulae and central interspace. Figure 5: Valve, SEM. Figure 6: Tip of the valve, SEM. Figure 7: Middle part of the valve showing large central interspace, one row of poroids, SEM. Figure 8: High magnification showing the large central interspace and hymen of poroids divided into 2 large parts. Figures 1-5: scale bars = 10 μm. Figure 6: scale bar = 2 μm. Figures 7-8: scale bar = 1 μm.
尖刺擬菱形藻

*Pseudo-nitzschia pungens* (Grunow ex P. T. Cleve) Hasle 1993

門 Phylum: 硅藻門 Bacillariophyta

綱 Class: 硅藻綱 Bacillariophyceae

目 Order: 硅藻目 Bacillariales

科 Family: 硅藻科 Bacillariaceae

異名 Synonym: *Nitzschia pungens* Grunow ex Cleve 1897

描述: 尖刺擬菱形藻於殼面觀及殼環面觀細胞呈長線形或披針形，縱軸對稱，兩端尖小。縱軸及橫軸的大小分別為 74 – 174 微米及 1.8 – 6.5 微米，沒有中央間隙。每 10 微米肋紋間及船骨點數目分別為 9 – 16 及 9 – 20，細胞交疊位置約佔總長度四分之一。另有兩排孔紋，每 1 微米孔紋數目為 2 – 4。

毒性: 尖刺擬菱形藻可產生引致失憶性貝類中毒的軟骨藻酸。香港培殖的藻株並沒有產生軟骨藻酸。

地區分佈: 尖刺擬菱形藻廣泛分佈於溫帶及熱帶水域，曾經在日本、台灣、中國東海水域及中國南海水域包括香港形成紅潮。這種藻常見分佈於香港水域，曾於 1986 年，1994 及 1995 年在南部及吐露港水域引致 3 次紅潮，但沒有造成魚類死亡。

Description: *Pseudo-nitzschia pungens* is linear to lanceolate, symmetric along the apical axis and show pointed ends in valve and girdle views. The recorded ranges of apical axis and transapical axis are 74 – 174 μm and 1.8 – 6.5 μm respectively. Central interspace is absent. The numbers of interstriae and fibulae in 10 μm are 9 – 16 and 9 – 20 respectively. The cells overlap at about 1/4 of total cell length. The number of poroid rows is 2 and there are 2 – 4 poroids per μm.

Toxicology: *P. pungens* is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). Local cell cultures did not find to produce domoic acid.

Regional distribution: *P. pungens* is widely distributed in warm temperate and tropical waters and caused red tide in Japan, Taiwan, East China Sea, South China Sea including Hong Kong. This species is commonly found in Hong Kong waters and caused 3 red tide incidents in the Southern and Tolo Harbour waters in 1986, 1994 and 1995. No fish kill was reported during the blooms.

參考文獻 References:


Cultured cells of Pseudo-nitzschia pungens. Figure 1: Live cells in chain, valve, phase contrast. Figure 2: Live cells in chain, valve. Figure 3: Live cells in chain, girdle. Figure 4: Acid cleaned frustule with visible fibulae and interstriae. Figure 5: Valve, SEM. Figure 6: Overlapping of cells, girdle. Figure 7: Middle part of the valve. Figure 8: Tip of the valve, SEM. Figure 9: Middle part of the valve showing no central interspace, SEM. Figure 10: Middle part of the valve, two rows of poroids, SEM. Figure 1: scale bar = 50 μm. Figures 2-5: scale bars = 20 μm. Figures 6-7: scale bars = 10 μm. Figure 8: scale bar = 2 μm. Figures 9-10: scale bars = 500 nm.
疣突擬褐胞藻

*Pseudochattonella verruculosa* (Hara & Chihara) Hosoi-Tanabe et al. 2007

**異名 Synonyms:** *Chattonella verruculosa* Hara & Chihara 1994, *Verrucophora verruculosa* (Hara & Chihara) Eikrem 2007

**描述 Description:** "疣突擬褐胞藻是單一細胞藻，呈球形。細胞大小約 12 – 45 微米。兩根長度不等的鞭毛由細胞前端伸出。球狀細胞核位於細胞中央，細胞佈滿淺黃色或黃褐色葉綠體，體內嵌藏一個澱粉核。細胞周邊分佈著多個有子彈狀包體的大黏液泡，細胞表面可見疣突頂部。周邊細胞質沒有緊密的電子粒子 ( 嗜鋨性 )。"

**毒性 Toxicology:** 疣突擬褐胞藻是疑有毒性的藻類，根據外國文獻記載會造成魚類死亡。香港的藻株疑有毒害，但尚未能確定。

**地區分佈 Regional distribution:** 疣突擬褐胞藻於日本水域有記錄。這種藻常見於本港不同水域，不曾在香港水域導致紅潮，細胞濃度低。

**Description:** *Pseudochattonella verruculosa* is solitary, spherical and around 12 – 45 μm in size. The two unequal flagella emerge from the cell anterior. A spherical nucleus is situated in the center of the cell. The cell contains numerous pale yellow to yellowish brown chloroplasts with a single embedded pyrenoid. Several large mucocysts with bullet-shaped inclusions are distributed along the cell periphery. Verrucose protrusions of their heads are visible. No electron-dense (osmiophilic) particles are present in the peripheral cytoplasm.

**Toxicology:** *P. verruculosa* is a suspected toxic species that causes fish kill according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

**Regional distribution:** *P. verruculosa* has reported in Japan. It has not caused red tide in Hong Kong waters. Low cell densities were constantly detected in different water regions of Hong Kong.

**參考文獻 References:**


Pseudochattonella verruculosa. Figures 1-4: Live cells showing numerous small and discord yellowish-brown chloroplasts; several large mucocysts with bullet-shaped inclusions are distributed along the cell periphery; verrucose protrusions visible by light micrography (arrow). Figures 5-6: Lugol fixed cells in various shapes.
**Vicicitus globosus**

(Hara & Chihara) Chang et al. 2012

**Phylum:** 褐胞藻門 Ochrophyta  
**Class:** 硅鞭藻綱 Dictyochophyceae  
**Order:** 硅鞭藻目 Dictyochales  
**Family:** 硅鞭藻科 Dictyochaceae

**異名 Synonym:** *Chattonella globobsa* Hara & Chihara 1994

**描述:** *Vicicitus globosus* 是單一球狀細胞藻，直徑約 40 – 55 微米。細胞前側的淺凹有兩根不相等鞭毛伸出，一般不容易察覺。球狀細胞核位於細胞中央，大量淡褐或金褐色椭球形葉綠體分佈於整個細胞質內，沒有澱粉核。細胞周邊有多個大黏液泡，內有指甲狀包體。細胞沒有伸縮泡及眼點。

**毒性:** 根據外國文獻記載 *V. globosus* 可破壞魚類的呼吸系統。香港藻株疑有毒害，但尚未能確定。

**地區分佈:** *V. globosus* 於日本、東南亞、澳洲及加拿大水域有記錄。不曾在香港引致紅潮。這種藻在香港不同水域均有記錄，但細胞濃度低。

**Description:** *Vicicitus globosus* is solitary, spherical and around 40 – 55 μm in diameter. The two unequal flagella, emerging from the shallow depression at the cell anterior, are often invisible. A spherical nucleus is present in the centre of the cell. Many pale brown to golden brown ellipsoid chloroplasts without pyrenoid are located throughout the cytoplasm. Several large mucocysts with nail-shaped inclusions are distributed along the cell periphery. Contractile vacuoles and eyespot are absent.

**Toxicology:** *V. globosus* is toxic species that causes respiratory damage in fish according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

**Regional distribution:** *V. globosus* is recorded in Japan, Southeast Asia, Australia and Canada waters. It has not caused red tide in Hong Kong waters. It constantly occurs in different water regions of Hong Kong but only low cell concentrations were detected.

**參考文獻 References:**


**DICTYOCHOPHYCEAE**

*Vicicitus globosus.* Figures 1-2: Live cell showing nearly globose shape with a round and anterior to central located nucleus (N); numerous small and elliptical pale brown to golden brown chloroplasts; several large mucocysts with nail-shaped inclusions are distributed along the cell periphery which give the cell a ‘warty’ appearance at the surface. Figure 3: Live swimming cell with trailing flagellum; flagellar swelling (bulge) is clearly visible (arrow). Figures 4-6: This amoeba-like cell with a protrusion of pseudopodium (p) was photographed in time series (approx. 1 minute) from a globular, swimming cell; the amoeboid cell reverted to its regular globularform (fig. 6) within a split second. Figure 7: Mucus discharged from mucocysts of a cell being exposed to strong light. Figures 8-9: Lugol fixed cells.
**Alexandrium acatenella** (Whedon & Kofoid) Balech 1985

**Phylum:** Dinophyta  
**Class:** Dinophyceae  
**Order:** Gonyaulacales  
**Family:** Gonyaulacaceae


**Description:** *Alexandrium acatenella* occurs as a single cell which is small to medium-sized of 35 – 51 μm long and 26 – 44 μm wide. In ventral view, cell length is longer than width with a slightly angular outline. The epitheca is longer than hypotheca. The surface is clearly porulated. Two short antapical spines are present without apical horn. The first apical plate directly connects to apical pore plate (Po) and carries a small ventral pore. The Po is broadly oval and narrows ventrally. The elliptical nucleus is C-shaped and equatorial.

**Toxicology:** *A. acatenella* is capable of producing Paralytic Shellfish Poisoning (PSP) toxins. Toxicity of the Hong Kong strain is uncertain.

**Regional distribution:** *A. acatenella* is rarely recorded in Asia waters. It was only detected once in the Eastern waters of Hong Kong in 2003 without any red tide report.

**References:**
Alexandrium acatenella. Figures 1-2: Lugol fixed cells in ventral view showing epitheca slightly longer than hypotheca. Figures 3-4: The 1' plate with ventral pore and trichocysts. Figure 5: The anterior sulcal plate (sa) has a plica (arrow). Figures 6-7: Different cells in ventral view showing the 1' plate and different positions of ventral pore (vp) (arrow). Figure 8: The apical pore plate (Po) without an anterior attachment pore (aap).
Description: *Alexandrium catenella* occurs as single cell or more often in short chains of 2, 4 or 8 cells. The cells are round 20 – 48 μm long, 18 – 56 μm wide, with a rounded apex and a slightly concave antapex. The cells are slightly wider than long and the cell surface is lightly porulated. The apical pore plate (Po) is broadly triangular with a larger anterior connecting pore. The first apical plate directly connects to Po. Ventral pore is consistently absent. The apical pore plate houses the characteristic fishhook shaped foramen. In chains, both anterior and posterior attachment pores are present. The nucleus is large and U-shaped.

Toxicology: *A. catenella* is a strong Paralytic Shellfish Poisoning (PSP) toxins producer and toxicity of the Hong Kong strain is confirmed. The PSP toxins (C1 – C4 toxins, saxitoxins and gonyautoxins), transmitted via contaminated shellfish, can affect humans, other mammals and possibly fish.

Regional distribution: *A. catenella* is widely distributed in cold temperate coastal waters and caused red tides in Australia, Japan, East China Sea, South China Sea including Hong Kong and resulted in Paralytic Shellfish Poisoning in Australia and Japan.

Two red tide incidents were reported in Southeastern and Northeastern waters of Hong Kong in 1989 and 2011 but no fish kill was recorded. Low occurrence frequencies of *A. catenella* were observed around Hong Kong waters in 1990 – 1992, 1996, 2000 – 2004 while higher frequencies were detected since 2005.

References:


Alexandrium catenella. Figures 1-2: Lugol fixed cells. Figure 3: Cyst. Figures 4-5: Epitheca showing the 1’ plate without ventral pore. Figures 6-7: The apical pore plate (Po) with an anterior attachment pore (app). Figures 8-9: The posterior sulcal plate with a posterior attachment pore (pap). Figures 10-11: The posterior sulcal plate without a posterior attachment pore (pap).
**Phylum:** Dinophyta  
**Class:** Dinophyceae  
**Order:** Gonyaulacales  
**Family:** Gonyaulacaceae

**Synonyms:** *Gonyaulax excavata* (Braarud) Balech 1971 sensu Loeblich III & Loeblich 1975, non Balech 1971

**Description:** *Alexandrium fundyense* is small to medium size, almost nearly spherical, length is slightly longer than width ranging from 27 – 50 μm long. The cells occur in single or in pair, and less commonly in fours. Paired cells may contain an anterior attachment pore (aap) and a posterior attachment pore (pap). The thecal plates are thin and smooth. The first apical plate may directly connect to the apical pore plate (Po). A ventral pore is absent and a prominent mark present in 4” plate. Po houses a large fishhook shaped foramen and a small round aap.

**Toxicology:** *A. fundyense* is capable of producing paralytic shellfish poisoning (PSP) toxins. Toxicity of the Hong Kong strain is uncertain.

**Regional distribution:** *A. fundyense* has very few occurrence records in Asia waters and it has not caused red tide in Hong Kong. *A. fundyense* seldom occurs and only very low concentrations has been detected in Hong Kong.

**References:**
**DINOPHYCEAE**

Alexandrium fundyense. Figures 1-2: Ventral view of various cells. Figures 3-4: No ventral pore between 1' and 4' plates & 1' plate may or may not touch apical pore plate (Po) (arrow). Figures 5-6: Ventral view. Figure 7: Anterior portion of anterior sulcal plate (sa) penetrated into 1' plate (arrow). Figures 8-9: Anterior portion of sa plate does not penetrate into 1' plate (arrow). Figures 10-11: Apical pore plates. Figure 12: 4''' plate with prominent mark (arrow). Figure 13: Posterior sulcal plate (sp).
門 Phylum: 甲藻門 Dinophyta
綱 Class: 甲藻綱 Dinophyceae
目 Order: 膝溝藻目 Gonyaulacales
科 Family: 膝溝藻科 Gonyaulacaceae

廣野亞歷山大藻正面觀呈卵形或圓形，長度稍大於寬度，或長寬幾乎相等。一般長為 40 微米，寬 35 – 40 微米，介乎 18 – 75 微米。殼片表面有疏圓孔紋，頂孔甲 (Po) 為狹長方形，有鈎狀頂孔。第一片頂甲片不觸及頂孔甲 (Po)，有小腹孔，環溝位於中間，其上下位移只有一個環帶寬度。

毒性: 廣野亞歷山大藻會產生抗真菌物質，香港的藻株疑有毒性，但尚未能確定。

地區分佈: 廣野亞歷山大藻很少出現在亞洲海域，在香港水域亦為罕見，過去只錄得極低濃度，不曾在香港引致紅潮。

Description: *Alexandrium hiranoi* is ovoid to round in ventral view, length is slightly longer than width or subequal, length is usually 40 μm long, 35 – 40 μm wide, ranging from 18 – 75 μm. The thecal surface is sparsely porulated. The apical pore plate (Po) is narrowly rectangular with a hook like apical pore. The first apical plate does not directly connect to the apical pore plate (Po). A small ventral pore is present. The cingulum is median, displaying one girdle width.

Toxicology: *A. hiranoi* is capable of producing antifungal substances. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: *A. hiranoi* has very few occurrence record found in Asia waters and it has not caused red tide in Hong Kong. *A. hiranoi* seldom occurs and only very low concentrations has been detected in Hong Kong.

參考文獻 References:
**DINOPHYCEAE**

*Alexandrium hiranoi*. Figures 1-2: Lugol fixed cells. Figure 3: Ventral view showing the length of 6" plate > its width. Figure 4: Anterior ventral view showing the Po plate is not directly touching 1' plate. Figure 5: Anterior sulcal plate (sa) with an anterior list (arrow). Figure 6: Apical pore plate (Po). Figure 7: Left anterior lateral plate (ssa) is long and narrow (arrow). Figure 8: Posterior sulcal plate (sp).
微小亞歷山大藻
*Alexandrium minutum* Halim 1960

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描述 Description: *Alexandrium minutum* is small and varies from spherical to ellipsoidal in shape with some antapical flattening, ranging from 15 – 30 μm in diameter. The cells occur in single and rarely in pairs. The epitheca is hemielliptical conical with convex sides and larger than the hypotheca. The apical pore plate (Po) is oval to broadly triangular and pointed posteriorly with a wide comma-shaped foramen, and Po directly connects to the first apical plate. A small ventral pore is present. The distinctive sixth precingular plate (6") is long and narrow.

毒性 Toxicology: *A. minutum* is capable of producing paralytic shellfish poisoning (PSP) toxins (gonyautoxins). These toxins can affect humans, other mammals, birds and possibly fish. Toxicity of the Hong Kong strain is confirmed.

地區分佈 Regional distribution: *A. minutum* is widely distributed in coastal waters worldwide. It caused red tides in Australia, New Zealand and Taiwan and led to paralytic shellfish poisoning events. It has not caused red tide in Hong Kong waters. *A. minutum* rarely occurs and only low concentrations were detected in the Northeastern and Southern waters of Hong Kong.

參考文獻 References:
微小亞歷山大藻。圖1-4：不同細胞正面觀，顯示細胞形狀。圖5：後正面觀，顯示殼甲有不規則網紋。圖6：第一片甲片與前縱溝甲(sa)之間的間介帶(箭咀)。圖7：第一片甲片正面有小孔(vp)，第六片甲片長度> 寬度。圖8-9：頂孔甲(Po)大致呈三角形，後端尖小，透過薄縫帶間接結合(箭咀)。圖10：休眠包囊。

Alexandrium minutum. Figures 1-4: Different cells in ventral view showing the cell shapes. Figure 5: Posterior ventral view showing thecal plates with irregular aerolation. Figure 6: Intercalary bands between the 1’ plate and sa (arrow head). Figure 7: The 1’ plate with a small ventral pore (vp) and the length of 6” plate > its width. Figures 8-9: Apical pore plate (Po) broadly triangular and pointed posteriorly, and indirectly connected via a thin suture (arrow). Figure 10: Resting cyst.
**Alexandrium ostenfeldii (Paulsen) Balech & Tangen 1985**

**Phylum:** 甲藻門 Dinophyta  
**Class:** 甲藻綱 Dinophyceae  
**Order:** 膝溝藻目 Gonyaulacales  
**Family:** 膝溝藻科 Gonyaulacaceae


**描述** Description: *Alexandrium ostenfeldii* is a distinctive non-chained species. The cells are large and smooth, size ranging from 30 to 56 μm, with the largest specimen found measuring up to 71 μm. The thecal plates are thin with numerous and unevenly distributed pores. The first apical plate is narrow, asymmetrical and has a large ventral pore. The apical pore plate (Po) is relatively large with a large comma-shaped foramen.

**毒性** Toxicology: *A. ostenfeldii* is capable of producing paralytic shellfish poisoning (PSP) toxins and a neurotoxin, spirolide. Toxicity of the Hong Kong strain is uncertain.

**地區分佈** Regional distribution: *A. ostenfeldii* has very few occurrence record found in Asia waters. It has not caused red tide in Hong Kong. *A. ostenfeldii* rarely occurs and only low concentrations were detected in the Southern, Western and Northeastern waters of Hong Kong.

**參考文獻** References:


香港有害海洋微藻

奧斯亞歷山大藻。圖 1-4：不同細胞正面觀，顯示上殼片及下殼片大小相等，大致呈半球形，某些樣本的翼片非常狹小（箭咀）。圖 5：橫溝上下位移不足一個殼環帶寬度。圖 6-8：第一片甲片狹小，有大而長的腹面孔（vp）。圖 9-10：後縱溝甲（sp）。圖 11-13：頂孔甲有寬大逗號形狀頂孔（箭咀）。

Alexandrium ostenfeldii. Figures 1-4: Ventral view of various cells showing the epitheca and the hypotheca being equal in size and more or less hemispherical; some specimens have very narrow lists (arrow). Figure 5: Cingulum displacement less than one girdle width. Figures 6-8: The 1’ plate is narrow with a large elongated ventral pore (vp). Figures 9-10: Posterior sulcal plate (sp). Figures 11-13: The apical pore plates with a large comma-shaped foramen (arrow).
擬漆亞歷山大藻
Alexandrium pseudogonyaulax
(Biecheler) Horiguchi ex Yuki & Fukuyo 1992

Description: *Alexandrium pseudogonyaulax* is a medium to large and non-chained species. Width is greater than length. The epitheca is slightly shorter than the hypotheca with cell sizes in the range of 34 – 60 μm long, 39 – 69.5 μm wide. The thecal plates are thin and smooth with scattered minute pores. The first apical plate 1’ does not connect to Po and is pentagonal with large wide ventral pore on the 4’ plate margin. The apical pore plate (Po) is oval with a large comma-shaped foramen and a number of irregular pores.

Toxicology: *A. pseudogonyaulax* is capable of producing paralytic shellfish poisoning (PSP) toxins and unique phycotoxin, Goniodomin A (GA) which has an antifungal effect according to overseas findings. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: *A. pseudogonyaulax* is widely recorded in Vietnam and Japan waters. *A. pseudogonyaulax* occurred constantly around Hong Kong waters but the densities were low. It has not caused red tide in Hong Kong.

參考文獻 References:


Alexandrium pseudogonyaulax. Figures 1-3: Ventral view of various cells. Figures 4-5: Anterior ventral view showing the 1' plate does not connect to the apical pore plate (Po). Figures 6-7: The 1' plate is pentagonal with a large and round ventral pore (vp) (arrow). Figure 8: Thecal plates reticulated. Figure 9: The anterior part of anterior sulcal plate (sa) protrudes to epitheca (arrow). Figures 10-12: Different shape of the apical pore plates. Figure 13: Posterior sulcal plate.
塔馬亞歷山大藻

*Alexandrium tamarense* (Lebour) Balech 1985

**Phylum:** 甲藻門 Dinophyta

**Class:** 甲藻綱 Dinophyceae

**Order:** 膝溝藻目 Gonyaulacales

**Family:** 膝溝藻科 Gonyaulacaceae

**異名 Synonyms:**

Gonyaulax tamarensis Lebour 1925,
G. *excavata* (Braarud) Balech 1971,
Gessnerium tamarensis (Lebour) Loeblich & Loeblich 1979,
Protogonyaulax tamarensis (Lebour) Taylor 1979,
Alexandrium excavatum (Braarud) Balech & Tangen 1985

**描述 Description:**

Alexandrium tamarense is small to medium sized, nearly spherical, length is slightly longer than width with cell sizes in range of 22 – 51 μm long, 17 – 50 μm wide. The cells occur in single or in pairs, and less commonly in fours. Paired cells may contain an anterior attachment pore (aap) and a posterior attachment pore (pap). The thecal plates are thin and smooth. The first apical plate has a small ventral pore and directly connects to the apical pore plate (Po). Po houses a large fishhook-shaped foramen and a small round anterior attachment pore.

**毒性 Toxicology:**

*A. tamarense* is a paralytic shellfish poisoning (PSP) producer and toxicity of the Hong Kong strain is confirmed. The PSP toxins (gonyautoxins, neosaxitoxin and saxitoxin), transmitted via contaminated shellfish, can affect humans or other mammals and possibly fish.

**地區分佈 Regional distribution:**

*A. tamarense* is distributed in warm temperate waters and caused red tides in Japan, Philippines, Australia, Malaysia, East China Sea and South China Sea including Hong Kong. *A. tamarense* occurred constantly around Hong Kong waters but the densities were low. Two red tide incidents were reported in the Southeastern waters of Hong Kong in 1991 and 1993 but no fish kill was recorded.

**參考文獻 References:**


Hong Kong Harmful Marine Microalgae

Alexandrium tamarense. Figures 1-2: Lugol fixed cells in chain form. Figure 3: The anterior sulcal plate (sa) with a “plica” (arrow). Figure 4: Ventral view showing the sulcal plates. Figures 5-8: Apical view showing the apical pore plates with an anterior attachment pore (app) and the 1' plate with ventral pore (vp).
泰咪亞歷山大藻

Alexandrium tamiyavanichii Balech 1994

門 Phylum : 甲藻門 Dinophyta

綱 Class : 甲藻綱 Dinophyceae

目 Order : 膝溝藻目 Gonyaulacales

科 Family : 膝溝藻科 Gonyaulacaceae

異名 Synonyms : Alexandrium cohorticula (Balech) Balech 1985 sensu Ogata et al. 1990 non Balech 1985, Protogonyaulax cohorticula (Balech) Taylor 1979

描述: 泰咪亞歷山大藻是中至大型鍊狀藻，一般由 8 個或以上細胞串連成鍊狀，有時更會多至 150 個。細胞呈圓形，寬度稍大於長度，長 30 – 60 微米，寬 35 – 65 微米。殼片薄而有深刻圓孔紋，第一片頂甲有小腹面孔，與頂孔甲 (Po) 直接相連。頂孔甲寬闊，有前連接孔 (aap)，形狀大而圓，與頂孔甲毗連。兩片翅膀狀縱溝翼片向前伸展至末端，形成兩根尾刺。前縱溝甲 (sa) 有前橫溝區。後連接孔呈圓形，位於後縱溝甲 (sp) 中央。

毒性: 據外國文獻記載泰咪亞歷山大藻可產生烈性麻痹性貝類毒素 (膝溝藻毒素及蛤科毒素)。香港的藻株疑有毒性，但尚未能確定。

地區分佈: 泰咪亞歷山大藻分佈於泰國、菲律賓、日本水域。這種藻在日本有紅潮及貝類被麻痹性貝類毒素污染的報告。這種藻極少出現於香港水域而且錄得細胞濃度低，不曾在香港引致紅潮。

Description: Alexandrium tamiyavanichii is a medium to large chain-forming species, typically in chains of 8 cells or more, and sometimes up to 150 cells. Single cell is round, width is slightly greater than length which are 30 – 60 μm long and 35 – 65 μm wide in size. The thecal plates are thin and strongly porulated. The first apical plate has a small ventral pore and comes in direct contact with the apical pore plate (Po). The Po is broad with an anterior attachment pore (aap), which is large, round and adjacent to the Po. Two wing-like sulcal lists extend anteriorly towards the antapex to yield two antapical spines. The anterior sulcal plate (sa) has a pre-cingular part. The round posterior attachment pore is present in the center of the posterior sulcal plate (sp).

Toxicology: A. tamiyavanichii is capable of producing potent paralytic shellfish poisoning (PSP) toxins (gonyautoxins and saxitoxin) according to overseas findings. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: A. tamiyavanichii is found in Thailand, Philippines and Japan waters. It has been reported led to blooming and contamination of shellfish with PSP toxins in Japan. A. tamiyavanichii rarely occurs and only low concentrations were detected around Hong Kong waters. It has not caused red tide in Hong Kong.

參考文獻 References:

Alexandrium tamiyavanichii. Figure 1: Lugol fixed cell in ventral view. Figures 2-3: Chain-forming cells. Figure 4: The anterior sulcal plate (sa) with precingular part (p.pr). Figure 5: The apical pore plate (Po) with a large anterior attachment pore (aap). Figure 6: The 1' plate with ventral pore (vp). Figures 7-8: The posterior sulcal plate (sp) with a posterior attachment pore (pap). Figure 9: Anterior ventral view showing well developed sulcal lists (arrow).
門 Phylum：甲藻門 Dinophyta  
綱 Class：甲藻綱 Dinophyceae  
目 Order：裸甲藻目 Gymnodiniales  
科 Family：裸甲藻目 Gymnodiniaceae

Description: *Amphidinium carterae* has more or less oval cells flattened dorso-ventrally. The cell ranges from 12 – 18 μm long, 8 – 10 μm wide. The epicone is small, crescent or tongue-shaped, deflected to the left to describe a descending spiral which is displaced by 2-3 girdle widths. The cell has widely branched peripheral chloroplast with a large central pyrenoid. The crescent-shaped nucleus is located in the hyposome.

Toxicology: *A. carterae* is capable of producing hemolytic toxin according to overseas findings. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: *A. carterae* is distributed in temperate and tropical waters. *A. carterae* seldom occurs and only very low concentrations were detected in the Northeastern and Eastern waters of Hong Kong in 1993 and 1994. It has not caused red tide in Hong Kong waters.

References:  
強壯前溝藻。圖 1-3：活藻株顯示附加體細小而呈新月或舌形及向左偏斜。圖 4：以魯哥氏液固定的細胞正面觀。

*Amphidinium carterae.* Figures 1-3: Live cells showing the episome being small, crescent or tongue-shaped and deflected to the left. Figure 4: Lugol fixed cell in ventral view.
多環旋溝藻
Cochlodinium polykrikoides Margalef 1961

門 Phylum : 甲藻門 Dinophyta
綱 Class : 甲藻綱 Dinophyceae
目 Order : 裸甲藻目 Gymnodiniales
科 Family : 裸甲藻目 Gymnodiniaceae

異名 Synonym : Cochlodinium heterolobatum Silva 1967

描述: 多環旋溝藻是不具殼片甲藻。細胞細小，大致呈橢圓形而背腹稍扁平。殼環帶環繞細胞 1.8 – 1.9 周，末端有凹槽。這種藻細長成短鏈狀，一般串連的細胞數目不超過 8 個，每個細胞長 30 – 40 微米，寬 20 – 30 微米，有頂槽，圓形的上殼片頂部呈尖錐形，橫溝深陷，大約等於細胞長度 0.6 倍。細胞含有無數桿狀橢圓葉綠體。細胞核位於前方的上殼片。

毒性: 據外國文獻記載多環旋溝藻與魚類死亡有關，但香港並沒有因多環旋溝藻引致的紅潮而造成魚類死亡的記錄。

地區分佈: 多環旋溝藻廣泛分佈於暖溫帶及熱帶水域，曾經在日本、韓國及中國南海水域包括香港形成紅潮。這種藻在日本及韓國造成大量養殖魚類死亡。這種藻甚少出現且細胞濃度低，曾於 1984、1998 及 2011 年在香港吐露港、南部及東南部水域造成 5 宗紅潮，但藻華出現期間並沒有魚類死亡。

Description: Cochlodinium polykrikoides is an unarmoured species without thecal plate. The cells are small, more or less oval and slightly flattened dorso-ventrally. The girdle makes 1.8 – 1.9 turns around the cell, is notched at the antapex. This species often forms short chains of no more than 8 cells and individual cell ranges from 30 – 40 μm long, 20 – 30 μm wide. Apical groove is present. The epitheca is rounded and conical at the apex and the cingulum is deep and excavated, displayed at about 0.6 times the cell length. The cells contain numerous rod, ellipsoid-shaped chloroplasts. The nucleus is situated anteriorly in the epitheca.

Toxicology: C. polykrikoides is a toxic species and it associated with fish kills according to overseas findings, but there is no fish kill record in Hong Kong.

Regional distribution: C. polykrikoides is distributed in warm temperate and tropical waters and caused red tides in Japan, Korea, South China Sea including Hong Kong. This species is known to associate with extensive fish kills in Japan and Korea. Low occurrence frequencies and low concentrations of C. polykrikoides were detected in Hong Kong. Five red tide cases of C. polykrikoides were reported in the Tolo Harbour, Southern and Southeastern waters of Hong Kong in 1984, 1998 and 2011 and no fish kill was reported during the blooms.

參考文獻 References:
Cochlodinium polykrikoides. Figure 1: Live solitary cell in dorsal view. Figure 2: Live chained cells in dorsal view showing position of sulcus (arrowhead) and a red pigmented body (arrow) situated in the epicone. Figures 3-4: Surface view showing the chloroplasts in rod, ellipsoid-shaped (arrow) and the nucleus (N) situated in the epicone; Figure 5: Lugol fixed cells.
漸尖鰭藻

*Dinophysis acuminata* Claparède & Lachmann 1859

門 Phylum: 甲藻門 Dinophyta

綱 Class: 甲藻綱 Dinophyceae

目 Order: 鰭藻目 Dinophysiales

科 Family: 鰭藻科 Dinophysiaceae


描述 Description: 藻體兩側扁平，上殼片細小呈帽狀，下殼片較大。漸尖鰭藻的細胞屬小至中型，長38–58微米，背腹寬30–40微米，側面觀呈橢圓或更常見的狹長橢圓形。殼甲佈滿顯著的環形網紋，每個均有小孔。左縱清翼片 (LSL) 發育良好，伸展至越過細胞中點，由三根肋支撐。縱溝由四片不相等甲片組成，邊界有兩翼片翼：前橫溝翼片 (ACL) 及後橫溝翼片 (PCL)。細胞有大葉綠體、後澱粉核及大型中央細胞核。

毒性 Toxicity: 漸尖鰭藻產生的大田軟海綿酸可引致人類或其他哺乳類下痢性貝類中毒。香港的藻株疑有毒性，但尚未能確定。

地區分佈 Regional distribution: 漸尖鰭藻分佈於溫帶水域，很少在亞洲水域引致紅潮。這種藻常見於香港海域，細胞濃度低，不曾在香港水域引致紅潮。

Description: Species of *Dinophysis* are laterally compressed with a small, cap-like epitheca and a larger hypotheca. Cells of *Dinophysis acuminata* are small to medium, 38 – 58 μm in length and 30 – 40 μm in dorso-ventral width. They are oval or often narrow and elongated oval in lateral view. The thecal plates are covered with prominent circular areolae, each with a pore. A well-developed left sulcal list (LSL) extends beyond the midpoint of the cell and is supported by three ribs. The cingulum is made up of four unequal plates and bordered by two lists (anterior cingular list, ACL and posterior cingular list, PCL). The cells contain large chloroplasts, posterior pyrenoid, and large central nucleus.

Toxicology: *D. acuminata* is capable of producing okadaic acid that causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: *D. acuminata* is distributed in temperate waters and very few reports on blooms in Asia waters. It occurs constantly around Hong Kong waters and low cell densities were observed. This species has not caused red tide in Hong Kong.

參考文獻 References:


Dinophysis acuminata. Figure 1: Live cell in lateral view. Figure 2: Live cell in dorsal view. Figures 3-4: Lugol fixed cells showing the thecal plate covered with prominent circular areolae and large central nucleus (N).
具尾鰭藻

Dinophysis caudata Saville-Kent 1881

門 Phylum：甲藻門 Dinophyta

綱 Class：甲藻綱 Dinophyceae

目 Order：鰭藻目 Dinophysiales

科 Family：鰭藻科 Dinophysiaceae

異名 Synonyms：Dinophysis homunculus Stein 1883, D. diegensis Kofoid 1907

描述: 具尾鰭藻的細胞以單個或成對排列, 背面於下殼片最寬處接合。細胞大而長，呈不規則卵形，下殼片有長腹突體。細胞長 65 – 110 微米，背腹寬 30 – 50 微米。殼甲佈滿網紋，各有小孔。左縱溝翼片 (LSL) 伸展至接近細胞總長度一半位置，由三根間距相等的肋支撐。左縱溝翼片和右縱溝翼片均向前突出，前面為深的漏斗形結構，上殼片低且矮。下殼片有四片大甲片，佔細胞大部份面積，形狀狹長，腹端收窄為後突體。細胞有大葉綠體及大型後置細胞核。

毒性: 具尾鰭藻產生的大田軟海綿酸可引致人類或其他哺乳類下痢性貝類中毒。香港的藻株疑有毒性，但尚未能確定。

地區分佈: 具尾鰭藻廣泛分佈於溫帶至熱帶水域，曾經在日本、泰國、印度、中國東海水域及中國南海水域形成紅潮。這種藻曾在日本及泰國造成大量養殖魚類死亡。這種藻常見於香港海域，細胞濃度低，不曾在香港水域引致紅潮。

Description: Dinophysis caudata occurs in single or in paired cells, and is dorsally joined at the widest point of the hypotheca. The cell is large, long and irregularly subovate with a long ventral projection on the hypotheca. Cell size ranges from 65 μm to 110 μm in length and 30 – 50 μm in dorso-ventral width. The thecal plates are heavily areolated with a pore to each areole. A well-developed left sulcal list (LSL) extends to nearly half of the total cell length and is supported by 3 ribs spaced equally apart. The cingulum is narrow with two lists (anterior cingular list, ACL and posterior cingular list, PCL) and supported by many ribs. Both cingular lists are projected anteriorly and ACL forms a wide and deep funnel-like structure with very low epitheca on the bottom. The hypotheca, with four large plates, comprises the majority of the cell. It is long and narrows ventrally into a pointed posterior projection. The cell contains large chloroplasts and a large posterior nucleus.

Toxicology: D. caudata is capable of producing okadaic acid that which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: D. caudata is widely distributed in temperate to tropical waters and caused red tides in Japan, Thailand, India, East China Sea and South China Sea. It has been reported to cause massive fish kills in Japan and Thailand. It often occurs around Hong Kong waters but only low cell densities were detected. This species has not caused red tide in Hong Kong.

參考文獻 References:


Dinophysis caudata. Figures 1-2: Cells in lateral view showing long and irregularly subovate in shape with a long ventral projection on the hypothea. Thecal plate heavily areoated with a pore to each areole. Figures 3-4: Cells in pair.
鳍倒卵形

Dinophysis fortii Pavillard 1923

異名 Synonyms: Dinophysis intermedia Pavillard 1916, D. laevis (Bergh 1881) Pouchet 1883, D. ovum Schütt 1895 sensu Martin 1929

描述: 鰭藻屬的藻體兩側扁平，上殼片細小呈帽狀，下殼片較大。倒卵形鰭藻細胞屬大型藻，長 60 – 80 微米，側面觀呈長卵形，細胞底部形狀寬闊及偏圓。鰭甲佈滿顯著的環形網紋，每個均有小孔。左縱溝翼片 ( LSL) 發育良好，伸展至越過細胞中點，由三根肋支撐。橫溝由四片不相等甲片組成，邊界有兩片翼片:前橫溝翼片 (ACL) 及後橫溝翼片 (PCL)。細胞有大葉綠體、後澱粉核及大型中央細胞核。

毒性: 倒卵形鰭藻可產生的鰭藻毒素 (DTX-1)、扇貝毒素及大田軟海綿酸，可引致人類或其他哺乳類下痢性貝類中毒。香港的藻株疑有毒性，但尚未能確定。

地區分佈: 倒卵形鰭藻分佈於溫帶水域，曾經在澳洲、日本水域形成紅潮。這種藻不曾在香港水域引致紅潮，而且很少出現，本港水域只發現過極低濃度。

Description: Species of Dinophysis are laterally compressed with a small, cap-like epitheca and a larger hypotheca. The cell of Dinophysis fortii is large with 60 – 80 μm in length. They are subovate and long in lateral view and end with broadly rounded shaped. The thecal plates are covered with prominent circular areolae, each with a pore. A well-developed left sulcal list (LSL) extends beyond the midpoint of the cell and is supported by three ribs. The cingulum is made up of four unequal plates and bordered by two lists (anterior cingular list, ACL and posterior cingular list, PCL). The cells contain large chloroplasts, posterior pyrenoid, and large central nucleus.

Toxicology: D. fortii is capable of producing Dinophysistoxin-1 (DTX1), Pectenotoxin-2 (PTX2) and okadaic acid that which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: D. fortii is distributed in cold temperate waters and caused red tides in Australia and Japan. This species has not caused red tide in Hong Kong waters. It seldom occurs in Hong Kong waters and only very low concentrations have been detected in Hong Kong waters.

參考文獻 References:
Dinophysis fortii. Figures 1-2: Cells in lateral view showing long and subovate in shape. Figures 3-4: Thecal plate covered with prominent circular areolae, each with a pore.
矛形鰭藻
Dinophysis hastata
Stein 1883

異名 Synonym: Phalacroma hastatum Pavillard 1909

描述 Description: Dinophysis hastata is medium to large, and this subovate species possessing a conspicuous antapical spine on the hypotheca. Cells are generally around 42 – 90 μm long and 37 – 64 μm dorso-ventral wide. The thecal plates are covered with prominent circular areolae and each with a pore. A left sulcal list (LSL) extends to nearly two-third of the hypocone and is supported by three ribs that radiate outward. The third ribs is the longest. The cingulum is made up of four unequal plates, bordered by two well-developed lists (anterior cingular list, ACL and posterior cingular list, PCL), and supported by many ribs. The hypotheca, with four large plates, comprises the majority of the cell. The cell contains a large central nucleus without chloroplast.

毒性 Toxicology: D. hastata is a suspected toxic species that might produce okadaic acid which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

地區分佈 Regional distribution: D. hastata is distributed in tropical and subtropical waters. This species has not been reported to cause red tide in Hong Kong or other waters. It rarely occurs in Hong Kong waters and low cell densities were detected in the Northeastern, Eastern and Southern waters.

參考文獻 References:
DINOPHYCEAE

Dinophysis hastata. Figures. 1-3: Cell in lateral view showing subovate in shape with a conspicuous antapical spine on the hypotheca.
叉形鰭藻

*Dinophysis miles* Cleve 1900

門 Phylum : 甲藻門 Dinophyta

綱 Class : 甲藻綱 Dinophyceae

目 Order : 鰭藻目 Dinophysiales

科 Family : 鰭藻科 Dinophysiaceae

描述: 叉形鰭藻的細胞大而長，前後側伸長成為頗明顯的底端及背端長突體。細胞約 125 – 160 微米長。殼甲頗厚，呈圓形或棱角網狀。左縱溝翼片 (LSL) 伸展至接近下殼總長度三分之二位置，由三根肋支承。橫溝由四片不相等甲片組成，邊界有兩片發育良好的翼片：前橫溝翼片 (ACL) 及後橫溝翼片 (PCL)，另有多根肋支承，形成狹窄漏斗形結構，上殼片低且矮。下殼片腹部呈波浪形，背側凹陷，平滑地伸展至向後傾斜的背突體。背及後突體兩者呈 50 – 90 度角，由第三根肋底部開始突出。

毒性: 叉形鰭藻可產生引致人類或其他哺乳類下痢性貝類中毒的大田軟海綿酸。香港的藻株疑有毒性，但尚未能確定。

地區分佈: 叉形鰭藻廣泛分佈於溫帶、亞熱帶及熱帶水域，在菲律賓曾有貝類被下痢性貝類毒素污染。這種藻很少在香港海域出現，未有在香港水域形成紅潮，在南部水域有記錄，細胞濃度低。

Description: *Dinophysis miles* is large, long and anterio-posteriorly elongated with two fairly distinctive, long, antapical and dorsal projections. Cell is 125 – 160 μm long. The thecal plates are thick, round or angular areolated. A left sulcal list (LSL) extends to nearly two-third of the hypocone and is supported by three ribs. The cingulum is made up of four unequal plates, bordered by two well-developed lists (anterior cingular list, ACL and posterior cingular list, PCL), and supported by many ribs, forming a narrow funnel-like structure with very low epitheca on the bottom. Ventral side of hypotheca undulate and dorsal side concave and smoothly continues to the dorsal projection, which runs obliquely backwards. Angle between the dorsal and posterior projections is 50 – 90 degree, beginning at the base of the third rib.

Toxicology: *D. miles* is capable of producing okadaic acid which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: *D. miles* is widely distributed in warm temperate, subtropical and tropical waters. It has been reported led to shellfish contamination with diarrhetic shellfish poisoning toxins in Philippines. It seldom occurs in Hong Kong without red tide report and only low concentrations were detected in the Southern waters.

參考文獻 References:


叉形鰭藻。圖 1-4：細胞側面觀，可見下殼片有兩個頗明顯的底端及背端長突體。

*Dinophysis miles.* Figures 1-4: Cells in lateral view showing the hypothece with two fairly distinctive, long antapical and dorsal projections.
**Dinophysis rotundata** Claparède & Lachmann 1859

**門 Phylum:** 甲藻門 Dinophyta  
**綱 Class:** 甲藻綱 Dinophyceae  
**目 Order:** 鰭藻目 Dinophysiales  
**科 Family:** 鰭藻科 Dinophysiaceae

**異名 Synonyms:** Phalacroma rotundatum Kofoid & Michnener 1911, Dinophysis whittingae Balech 1971

**描述:** 圓形鰭藻的細胞屬中型，側面觀呈圓至橢圓形，頂面觀呈橢圓至圓形。細胞約 36 – 56 微米長，背腹寬 36 – 43 微米。殼甲佈滿孔紋及零散小孔。左縱溝翼片 (LSL) 常向後開闊，伸展至接近細胞總長度二分之一至四分之三位置，由三根肋支撐，頭兩根相隔甚近，横溝狹窄，有兩片平滑翼片：前橫溝翼片 (ACL) 及後橫溝翼片 (PCL)。下殼片有四片大甲片，佔細胞大部份面積，下殼片後部為圓形。細胞有後置細胞核，密佈食物泡，但沒有葉綠體。

**毒性:** 圓形鰭藻可產生鰭藻毒素 (DTX-1) 及引致人類或其他哺乳類下痢性貝類中毒的大田軟海綿酸。香港的藻株疑有毒性，但尚未能確定。

**地區分佈:** 圓形鰭藻分佈於寒帶及溫水區域。這種藻常見於香港海域，但細胞濃度低，不曾在香港水域形成紅潮。

**Description:** *Dinophysis rotundata* is medium in size, round to oval in lateral view, and ellipsoidal to round in apical view. The cells are 36 – 56 μm in length and 36 – 43 μm in dorso-ventral width. The thecal plate is covered with poroids and scattered pores. Left sulcal list (LSL), often widens posteriorly and extends nearly 1/2 to 3/4 of the total cell length. It is supported by 3 ribs and the first two ribs are spaced closer together. The cingulum is narrow with two smooth lists (anterior cingular list, ACL and posterior cingular list, PCL). The hypotheca, with four large plates, comprises the majority of the cell. The posterior region of the hypotheca is round. The cell contains posterior nucleus, numerous food vacuoles and without chloroplast.

**Toxicology:** *D. rotundata* is capable of producing Dinophysistoxin-1 (DTX1) and okadaic acid which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

**Regional distribution:** *D. rotundata* is widely distributed in cold and warm waters. It often occurs around Hong Kong waters but only low cell densities were detected. It has not caused red tide in Hong Kong.

**參考文獻 References:**  
DINOPHYCEAE

帽狀禿頂藻
Phalacroma mitra Schütt 1895

門 Phylum：甲藻門 Dinophyta

綱 Class：甲藻綱 Dinophyceae

目 Order：鰭藻目 Dinophysiales

科 Family：鰭藻科 Dinophysiaceae

異名 Synonyms：Dinophysis dolychopterygium (Murray & Whitting) Balech 1967, D. mitra (Schütt) Abé vel Balech 1967

描述：帽狀禿頂藻的細胞屬大型，闊大且呈楔形狀。細胞背腹長約 48 – 58 微米。殼甲頗厚及佈滿粗糙空隙孔。背側平滑微凸出，側面觀的下殼邊緣，由左縱溝翼片以下呈明顯凹陷。左縱溝翼片 (LSL) 短，只是細胞總長度二分之一。由三根肋支撐，頭兩根相隔甚近。上殼片清晰可見，側面觀微凸出。橫溝狹窄，有兩片平滑翼片，上側帶翼片呈水平狀。細胞有大細胞核及葉綠體。

毒性：帽狀禿頂藻可產生鰭藻毒素 (DTX-1) 及引致人類或其他哺乳類下痢性貝類中毒的大田軟海綿酸。香港的藻株疑有毒性，但尚未能確定。

地區分佈：帽狀禿頂藻分佈於溫帶至熱帶水域。這種藻常見於香港水域，但細胞濃度低，不曾在香港水域形成紅潮。

Description: Phalacroma mitra is large in size, broad and wedge-shaped. The cells are 48 – 58 μm in dorso-ventral width. The thecal plate is thick and coarsely areolated. The dorsal side is smoothly convex and the ventral hypotehcal margin is distinctly concave below the left sulcal list (LSL). The LSL is relatively short, only half of the total cell length. It is supported by 3 ribs and the first two ribs are spaced closer together. The epitheca is visible showing slightly convex in lateral view. The cingulum is narrow with two smooth lists and the upper cingular list displays in horizontal. The cell contains large chloroplasts and a large nucleus.

Toxicology: P. mitra is capable of producing Dinophysistoxin-1 (DTX1) and okadaic acid which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: P. mitra is widely distributed in warm temperate to tropical waters. It often occurs around Hong Kong waters but only low cell densities were detected. It has not caused red tide in Hong Kong.

參考文獻 References:
Phalacroma mitra. Figures 1-4: Cells in lateral view showing broad and wedged in shape with the thecal plate thick and coarsely areolated. Figures 5-6: Ventral view. Figure 7: Antapical view.
Gymnodinium catenatum
Graham 1943

門 Phylum: 甲藻門 Dinophyta
類 Class: 甲藻綱 Dinophyceae
目 Order: 裸甲藻目 Gymnodiniales
科 Family: 裸甲藻科 Gymnodiniaceae

描述: 鏈狀裸甲藻是不具殼片甲藻，沒有殼片，通常由4、8或16個細胞串連成鏈狀，偶有多達64個細胞串連成鏈。在惡劣環境下，細胞鏈可分成單一細胞個體或成非鏈狀的無性繁殖細胞群。單一及鏈狀細胞形狀多變，單一或成對細胞一般呈長橢圓形，背腹略為扁平。細胞長34 – 65微米，寬27 – 43微米。鏈狀細胞呈方橢圓形，前後端扁平，頂部有獨特的馬蹄形頂槽環繞，殼環帶呈下行旋渦狀，其上下位移最遠可達細胞長度五分之一位置。縱溝十分深，從末端伸展至有半圓頂環圍繞的頂端。細胞密佈黃褐色葉綠體和明顯的澱粉核，大細胞核位於中央。

毒性: 鏈狀裸甲藻可產生麻痹性貝類毒素，香港的藻株已確定有毒。這種藻是唯一可產生麻痹性貝類毒素的不具殼片甲藻。

地區分佈: 鏈狀裸甲藻廣泛分佈於溫帶水域，曾於澳洲、紐西蘭、日本、中國東海水域形成紅潮。這種藻在澳洲、紐西蘭、日本曾有貝類被麻痹性貝類毒素污染。這種藻常見於香港水域，但細胞濃度低，不曾在香港水域形成紅潮。

Description: Gymnodinium catenatum is an unarmoured species without thecal plate. The cells are in chain of 4, 8 or 16 cells but occasionally up to 64 cells. Chain may break into single cells and non-chain forming clones under unfavorable conditions. Single and chain-forming cells vary in shape. Single or paired cells are often elongate to ovoid with slight dorso-ventral compression. Size ranges from 34 – 65 μm long, 27 – 43 μm wide. Chain formers are squarish to ovoid, anteriorly and posteriorly compressed. A characteristic horseshoe-shaped apical groove encircles the apex. The girdle describes a descending spiral, which is displaced up to 1/5 of the cell length. The sulcus is deep and extends from the antapex to the apex, which is surrounded by a semicircular apical ring. The cells contain numerous yellow-brown chloroplasts, conspicuous pyrenoids, and a large centrally located nucleus.

Toxicology: G. catenatum is capable of producing paralytic shellfish poisons (PSP) toxins and toxicity of the Hong Kong strain is confirmed. This species is the only unarmoured dinoflagellate known to produce PSP toxins.

Regional distribution: G. catenatum is widely distributed in temperate waters and caused red tides in Australia, New Zealand, Japan, East China Sea. It has been reported to cause widespread shellfish contamination with PSP toxins in Japan, Australia and New Zealand. It occurs constantly around Hong Kong waters but only low cell densities were detected. This species has not caused red tide in Hong Kong.
**Gymnodinium catenatum.** Figures 1-2: Live solitary or paired cells in ventral view showing elongate-ovoid shape. Figure 3: Live cultured cells showing the formation of hyaline membrane under unfavourable condition. Figure 4: Live chain-forming cells in ventral view. Figure 5: Live chain-forming cells with hyaline membrane. Figures 6-8: Lugol fixed cells in various shapes.
Harmful Marine Microalgae in Hong Kong

Heterocapsa circularisquama

Horiguchi 1995

Phylum: Dinophyta
Class: Dinophyceae
Order: Peridiniales
Family: Peridiniaceae

Description: Heterocapsa circularisquama is a small, solitary, armoured species. The cell is pear-shaped with conical epitheca and hemispherical hypotheca. Size ranges from 20 – 29 μm long and 14 – 20 μm wide. The species is named for the diagnostic body scales with six radiating ridges on a circular basal plate. The thecal plates are thin. The cell has yellowish brown chromatophores and a deep girdle, comparatively shallow sulcus and sharp apex.

Toxicology: H. circularisquama is a toxic species which causes mass mortality of shellfish. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: H. circularisquama caused red tides in Japan, East China Sea and South China Sea including Hong Kong. It has been reported to cause mass mortality of bivalves in Japan. There were 16 red tide cases of H. circularisquama reported in the Tolo Harbour and Northeastern waters from 1983 to 2004 and no fish kill was reported during the blooms. It occurs constantly around Hong Kong waters but only low cell densities were detected.

References:
Heterocapsa circularisquama. Figure 1: Live cell in ventral view showing a small hyaline area at apex. Figure 2: Live cell in dorsal view. Figure 3: Scanning electron micrograph. Figure 4: Cells showing a large pyrenoid. Figure 5: Epitheca in ventral view showing thecal plates arrangements and anterior sulcal plate (as). Figure 6: Epitheca in dorsal view. Figures 7-9: Thecal plates stained with fluorescent brightener.
雙揳凱倫藻
*Karenia bicuneiformis* Botes, Sym & Pitcher 2003

門 Phylum: 甲藻門 Dinophyta
綱 Class: 甲藻綱 Dinophyceae
目 Order: 裸甲藻目 Gymnodiniales
科 Family: 凱倫藻科 Kareniaceae

異名 Synonym: *Karenia bidigitata* Haywood & Steidinger 2004

描述: 雙揳凱倫藻是不具殼片甲藻，為單一細胞藻，背腹扁平，細胞長16–40 微米，寬18–43 微米。下殼呈W形，上殼錐形，令棱角細胞外形特別分明，細胞核為球形或近橢圓形，位於下殼中方。葉綠體形狀可變異或呈盤狀，呈黃綠色。

毒性: 雙揳凱倫藻可產生導致人類或其他哺乳類神經性貝類中毒的神經性雙鞭甲藻毒素。香港的藻株疑有毒性，但尚未能確定。

地區分佈: 雙揳凱倫藻絕少於亞洲水域出現，這種藻罕有在香港出現，不曾在香港引致紅潮，在東北部及東南部海域有記錄；細胞濃度十分低。

Description: *Karenia bicuneiformis* is an unarmoured species without thecal plate. The cell is solitary and dorso-ventrally flattened, size ranges from 16 – 40 μm long and 18 – 43 μm wide. Hypocone is W-shaped and epicone is conical, giving the cell a markedly angular outline. The nucleus is spherical to slightly oval in shape and located in the left hypocone. Chloroplasts are variable to disc shape and yellowish green in color.

Toxicology: *K. bicuneiformis* is capable of producing neurotoxic brevetoxins that causes neurotoxic shellfish poisoning (NSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: *K. bicuneiformis* rarely occurs in coastal areas in Asia. It rarely occurs in Hong Kong without any red tide record, only very low cell densities were detected in the Northeastern and Southeastern waters.

參考文獻 References:

**Karenia bicuneiformis.** Figures 1-3: Typical view of cells showing the W-shaped hypocone; chloroplasts are variable to disc shape; the spherical to slightly oval nucleus is located in the left hypocone (arrow). Figure 4: Lateral view showing dorso-ventrally flattened shape.
短溝凱倫藻
Karenia brevisulcata (Chang) G. Hansen & Moestrup 2000

門 Phylum：甲藻門 Dinophyta
綱 Class：甲藻綱 Dinophyceae
目 Order：裸甲藻目 Gymnodiniales
科 Family：凱倫藻科 Kareniaceae

異名 Synonym：Gymnodinium brevisulcatum Chang 1999

描述 Description：短溝凱倫藻是不具殼片甲藻，為細小的單一細胞，略為扁平，長13 – 25 微米，寬10 – 25 微米。每個均有直短頂槽，位於縱溝軸右方，正面伸展至上殼長度三分之一至二分之一位置，後面伸展至上殼長度三分之一位置。上殼有細小三角形縱溝延伸體。細胞核呈圓形或橢圓形，由下殼左側伸展至右側。葉綠體很長，呈黃綠色。

毒性 Toxicology：據外國文獻記載短溝凱倫藻可引致魚類死亡。香港的藻株疑有毒害，但尚未能確定。

地區分佈 Regional distribution：短溝凱倫藻曾在紐西蘭形成紅潮及造成水生生物死亡。這種藻絕少在香港出現，在東北部及南部海域曾有記錄，細胞濃度俱低，不曾在香港引致紅潮。

Description: Karenia brevisulcata is an unarmoured species without thecal plate. The cell is solitary, small, slightly flattened. Size ranges from 13 – 25 μm long and 10 – 25 μm wide. Each cell has a straight, short apical groove, located to the right of the sulcal axis and extends 1/3 to 1/2 on the ventral side and 1/3 down the dorsal side of epicone. A small triangular sulcus extension occurs in the epicone. The nucleus is round to elliptical in shape and extends from the left to right hypocone. Chloroplasts are elongated and yellowish green in color.

Toxicology: K. brevisulcata is a toxic species that causes fish kill according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

Regional distribution: K. brevisulcata caused red tide in New Zealand and led to morality of marine life. This species rarely occurs in Hong Kong and only very low cell densities were observed in the Northeastern and Southern waters. It has not caused red tide in Hong Kong.

參考文獻 References:
**Karenia brevisulcata.** Figure 1: Live cell in ventral view showing elongated chloroplasts (arrow). Figures 2-4: Lugol fixed cells in ventral view showing slight indentation at apex (arrow); displacement of cingulum and the right deflected sulcal extension (se) onto the epicone (arrow). Figures 5-6: Lugol fixed cells in ventral view showing horizontally reniform nucleus (N) extending from left to right lobe of the hypocone; characteristic short apical groove (arrow).
**Karenia digitata**

*Yang, Takayama, Matsuoka & Hodgkiss 2000*

**Phylum:** Dinophyta  
**Class:** Dinophyceae  
**Order:** Gymnodiniales  
**Family:** Kareniaceae

**Description:** *K. digitata* is an unarmoured species without thecal plate. The cell is solitary, small, globular or ovoid, and almost circular but slightly flattened dorso-ventrally. Cell ranges from 10 – 26.3 μm long and 10 – 22.5 μm wide. The epicone is hemispherical or broadly conical, the hypocone is round to hemispherical, and the antapex is not concave. The cell has a linear apical groove, which lies to the right of the sulcal axis. The nucleus is large, spherical to ovoid, and located in the hypocone centrally. Chloroplasts are yellowish green to yellowish brown and irregular in shape.

**Toxicology:** *K. digitata* is a toxic species that caused massive fish kill. The toxicity of the Hong Kong strain is confirmed.

**Regional distribution:** *K. digitata* is known to cause red tides in Japan and South China Sea including Hong Kong. It bloomed twice in Hong Kong. The first bloom was reported in the Tolo Harbour, Northeastern, Southeastern and Southern waters in 1998 and caused massive fish kill. The second bloom was recorded in Southern waters in 2009, no fish kill was reported. It occurs around Hong Kong waters and only very low cell densities were observed.

**References:**
Karenia digitata. Figure 1: Live cell in ventral view; apical groove (ag) and sulcal extension (se) on the epicone; sulcal curvature (sc) on the hypocone. Figures 2-5: Lugol fixed cells in ventral view showing the nucleus allocated at the hypocone (arrow). Figure 6: Lugol fixed cell in antapical view showing the nucleus (arrow). Figures 7-9: Scanning electron micrograph.
米氏凱倫藻

*Karenia mikimotoi* (Miyake & Kominami ex Oda) G. Hansen & Moestrup 2000

**門** Phylum: 甲藻門 Dinophyta

**綱** Class:  甲藻綱 Dinophyceae

**目** Order:  裸甲藻目 Gymnodiniales

**科** Family: 凱倫藻科 Kareniaceae


**描述**
米氏凱倫藻是不具殼片甲藻，為單一細胞，外形多變，多為卵形至近圓形。細胞背腹扁平，細胞長18 – 40 微米，寛14 – 35 微米。殼環帶寬闊呈下行旋渦狀，其上下位移至約細胞長度五分之一位置。縱溝觸及上殼少許，然後在縱溝侵入段附近直線伸延，橫越頂部，再伸展至細胞背側少許。細胞核呈橢圓形，位於下殼左側。細胞有含澱粉核的橢圓形葉綠體。

**毒性**
米氏凱倫藻可產生溶血性毒素及魚毒素，本地藻株釋出的毒素可引致魚類死亡。

**地區分佈**
米氏凱倫藻廣泛分布於溫帶和熱帶水域，曾經在日本、韓國、澳洲、紐西蘭、中國東海水域、渤海、及中國南海水域包括香港形成紅潮。這種藻是日本水域的主要有害赤潮藻之一。在日本、澳洲、紐西蘭及中國（包括香港）曾造成養殖魚類死亡的記錄。

米氏凱倫藻是香港常見的紅潮品種，由1980 年至今於吐露港、東北部及東南部水域共引發11次紅潮，其中在1980 至1983年期間發生的4次紅潮，造成魚類死亡。

**Description:** *Karenia mikimotoi* is an unarmoured species without thecal plate. The cell is solitary, cell outline is variable, usually from ovate to almost round. The cells are dorso-ventrally flattened and ranges from 18 – 40 μm long and 14 – 35 μm wide. The girdle is wide with a descending spiral which is displaced about one fifth of the cell length. The sulcus continues for a short distance onto the epicone where an apical groove extends in a straight line from near the sulcal intrusion across the apex and a short distance down on the dorsal side of the cell. The nucleus is ellipsoidal on the left side of the hypocone. The cell has oval chloroplasts with pyrenoids.

**Toxicology:** *K. mikimotoi* is capable of producing both hemolytic and ichthyotoxins. It is known to associate with fish kill locally.

**Regional distribution:** *K. mikimotoi* is widely distributed in temperate and tropical waters and known to cause massive blooms in Japan, Korea, Australia, New Zealand, East China Sea, Bohai, South China Sea including Hong Kong. It is a dominant harmful red tide species in Japan and reported to cause fish kill in Japan, Australia, New Zealand, and China (including Hong Kong).

*K. mikimotoi* is a common red tide causative species in Hong Kong. There were eleven red tide incidents of *K. mikimotoi* reported in the Tolo Harbour, Northeastern and Southeastern waters since 1980. Fish kills were reported during the four blooms happended in 1980 to 1983.

**參考文獻 References:**
DINOPHYCEAE

Karenia mikimotoi. Figure 1: Live cultured cell. Figure 2: Live ventral view showing the short anterior extension of the sulcus (arrow). Figure 3: Spherical chloroplast (arrow) with pyrenoid. Figure 4: Live ventral view showing the apical groove (arrow) extended to the epicone. Figure 5: Lugol fixed cell showing slight nucleus (N) situated on the left side of the cell. Figure 6: Nucleus (N) located in the hypocone.
微疣凱倫藻
*Karenia papilionacea* Haywood & Steidinger 2004

描述：微疣凱倫藻是不具殼片甲藻, 為單一細胞, 呈橢圓形, 細胞背腹略扁平, 腹側顯著凹陷, 背側凸出, 細胞長18 – 32 微米, 寬18 – 48 微米。細胞前端有尖削的頂突。頂槽很短，大約伸展至背側上殼三分之一位置，縱溝伸展至頂端及頂槽左方。細胞核呈球形或近卵圓形，位於左下殼。下殼右方有一紅色體。葉綠體位於周邊，呈圓或腎形，黃綠色。

毒性：微疣凱倫藻可產生導致人類或其他哺乳類神經性貝類中毒的神經性雙鞭甲藻毒素。香港的藻株疑有毒性，但尚未能確定。

地區分佈：微疣凱倫藻首次記錄於紐西蘭，其後在韓國亦有記錄。這種藻在2010年於香港東南部水域引發1宗紅潮，但沒有造成魚類死亡。在香港水域偶有記錄，但出現頻率及細胞濃度俱低。

Description: *Karenia papilionacea* is an unarmoured species without thecal plate. The cell is solitary and elliptical in shape, moderately dorso-ventrally compressed. The ventral is markedly concave and dorsal is convex, ranging from 18 – 32 μm long, 18 – 48 μm wide. The cell has a pointed apical protrusion at the anterior end. The apical groove is short and extends to approximately the upper third of the dorsal epicone. The sulcus extends to the left of the apex and apical groove. The nucleus is spherical to slightly oval in shape located in the left hypocone. A red accumulation body is located on the right side of hypocone. Chloroplasts are peripheral, round to reniform in shape, and yellowish green in color.

Toxicology: *K. papilionacea* is capable of producing neurotoxic brevetoxins that causes neurotoxic shellfish poisoning (NSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: *K. papilionacea* is firstly recorded in New Zealand and also reported from Korea. A bloom of *K. papilionacea* was reported in the Southeastern waters of Hong Kong in 2010 and no fish kill was reported during the bloom. Low occurrence frequencies and low concentrations of *K. papilionacea* were occasionally detected in Hong Kong waters.

參考文獻 References:


**Karenia papilionacea.** Figure 1: Live cell in ventral view showing chloroplasts are peripheral, round to reniform in shape, and yellow-green in colour; apical groove (ag) and sulcus extension (se). Figure 2: Live cell in dorsal view showing the presence of red accumulation body on the right side of hypocone (arrow). Figures 3-4: Lugol fixed cells in ventral view showing the spherical to slightly oval nucleus (N) located on the left side of hypocone. Figure 5: Wide cell in ventral view. Figure 6: Cell in apical view.
劇毒卡爾藻
*Karlodinium veneficum* (Ballantine) Larsen 2000


描述：劇毒卡爾藻是不具殼片甲藻，為單一細胞，細胞細小呈橢圓或圓形，長8 – 18 μm，寬7 – 14 μm。頂槽畢直，殼環帶凹陷顯著，呈下行旋渦狀，其上下位移至近細胞長度由七分之一至三分之一位置。縱溝的間橫溝區大幅偏斜，伸展至上殼。細胞核大而圓，位於左邊下殼或細胞中央。細胞有兩個至八個金褐色葉綠體，大部份4個葉綠體，平均分佈於上殼及下殼。

毒性：劇毒卡爾藻可產生karlotoxins毒素引致大量魚類死亡。香港的藻株疑有毒性，但尚未能確定。

地區分佈：劇毒卡爾藻曾在澳洲引致紅潮。在2003年香港東北部海域曾引發一宗紅潮，但期間沒有造成魚類死亡。這種藻絕少在本港水域出現，細胞濃度俱低。

Description: *Karlodinium veneficum* is an unarmoured species without thecal plate. The cell is solitary, small, and oval to round in shape and around 8 – 18 μm long, 7 – 14 μm wide. The apical groove is straight. The girdle is deeply incised, describing a descending spiral which is displaced almost from 1/7 to 1/3 of the cell length. The sulcus is strongly deflected in the inter-cingular region and extends on to the epicone. The nucleus is large, round and located on the left side of hypocone or centrally of the cell. The cells contain two to eight goldenbrown chloroplasts, usually four, equal number in epicone and hypocone.

Toxicology: *K. veneficum* is capable of producing karlotoxins that cause mass mortality of fish. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: *K. veneficum* caused red tide in Australia. A bloom of *K. veneficum* was reported in the Northeastern waters in 2003 but no fish kill was recorded. It rarely occurs around Hong Kong waters and only low cell densities were detected.

參考文獻 **References:**


**DINOPHYCEAE**

*Karlodinium veneficum*. Figure 1: Live cell in ventral view showing four golden brown chloroplasts. Figure 2: Lugol fixed cell in ventral view showing the large chloroplasts; slight indentation at the apex caused by apical groove (arrow). Figures 3-4: Nucleus (N) large, rounded and located on the left side of the hypocone or centrally. Figure 5: Cell in surface focus showing apical groove (arrow) and sulcal intrusion (arrow head); cingulum boarded, deeply excavated and displaced three times of its own width. Figure 6: Cell showing four large autofluorescing chloroplasts.
多邊舌甲藻
*Lingulodinium polyedrum* (Stein) Dodge 1989

門 Phylum：甲藻門 Dinophyta  
綱 Class：甲藻綱 Dinophyceae  
目 Order：膝溝藻目 Gonyaulacales  
科 Family：膝溝藻科 Gonyaulacaceae

異名 Synonym：*Gonyaulax polyedra* Stein 1883

描述：多邊舌甲藻正面觀呈棱角形或多面體形，細胞體長40 – 55 微米，寬42 – 54 微米。沒有頂角及底部短刺。環溝位於細胞中心位置，其上下位移有一至兩個殼環帶寬度。細胞表面有明顯的網狀殼片，網狀殼片有多個小凹陷穴。殼環帶及縱溝的邊緣有翼片。

毒性：多邊舌甲藻會產生蝦夷扇貝毒素 (YTX)，根據外國文獻記載毒素會積聚在雙貝類體內，毒素可導致老鼠死亡。香港的藻株疑有毒性，但尚未能確定。

地區分佈：多邊舌甲藻分佈於溫帶及亞熱帶水域，在香港水域亦為罕見，過去只錄得極低濃度，不曾在香港引致紅潮。

Description: *Lingulodinium polyedrum* is angular to polyhedral-shaped in ventral view, size ranging from 40 – 55 μm long and 42 – 54 μm wide. The apical horn and antapical spines are absent. The cingulum is located equatorial of the cell and is displaced by 1 - 2 girdle widths. The thecal surface is strongly reticulated with pores in the depressions. Girdle and sulcus are bordered by lists.

Toxicology: *L. polyedrum* is capable of producing yessotoxins (YTX) which might accumulate in bivalves and is toxic to mice according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

Regional distribution: *L. polyedrum* is distributed in warm temperate and subtropical waters and it has not caused red tide in Hong Kong. This species rarely occurs in Hong Kong and only very low concentrations were detected in Hong Kong.

參考文獻 References:
多邊舌甲藻。圖 1-2：細胞正面觀顯示呈多面體形；環溝位於細胞中心位置。圖 3-4：網狀殼片有多個小凹陷穴。

*Lingulodinium polyedrum*. Figures 1-2: Ventral view of various cells showing polyhedral in shape; cingulum equatorial. Figures 3-4: Thecal plates strongly reticulated with pores in the depressions.
牡蠣甲藻

Ostreopsis lenticularis  Fukuyo 1981

門 Phylum : 甲藻門 Dinophyta
綱 Class : 甲藻綱 Dinophyceae
目 Order : 膝溝藻目 Gonyaulacales
科 Family : 牡蠣甲藻科 Ostreopsidaceae

Description: Ostreopsis lenticularis is an armoured, benthic dinoflagellate. The cell is lenticulate to broadly oval and slightly pointed towards the sulcus. The dorso-ventral distance ranges from 60 to 100 μm and the transdiameter ranges from 45 to 80 μm. The surface plate is smooth and covered with large round pores. The 1’ plate is large, hexagonal and situated in the center. The lipped cingulum is narrow and shallow with a smooth edge. A ventral plate (Vp) with a ventral pore (Vo) and an adjacent curved rigid plate is present within the cingulum. The sulcus is small and hidden.

Toxicology: O. lenticularis is capable of producing 2 neurotoxins, Ostreotoxin – 1 and Ostreotoxin – 3. Toxicity of the Hong Kong strain is uncertain.

Regional distribution: O. lenticularis can be found from tropical shallow waters to offshore reefs and commonly associated with macroalgae, attaching to soft coral or sand grains. It has not caused red tide in Hong Kong waters. It rarely occurs and low cell densities were observed in the Northeastern waters.

參考文獻 References:

Ostreopsis lenticularis. Figures 1-2: Apical view showing the cell lenticulate to broadly oval. Figure 3: Theca plate covered with numerous large pores (approximately 0.4 μm in diameter). Figures 4-5: Lugol fixed cells in left lateral view. Figure 6: Dorsal view. Figure 7: Ventral view.
Prorocentrum lima (Ehrenberg) Stein 1878

Description: Prorocentrum lima is an armoured benthic dinoflagellate. The cell is oblong to ovate, small to medium-sized, pear-shaped in valve. Size ranges from 30 – 50 μm long, 20 – 30 μm wide. A conspicuous pyrenoid is present at the center of the cell and the nucleus is located posteriorly. The valve surface is smooth and scattered with surface pores other than the central area. The periflagellar area is a shallow V-shaped depression on the right valve which is made up of eight platelets and two pores (a larger flagellar pore and a smaller auxiliary pore).

Toxicology: P. lima is capable of producing several different types of toxins such as fast-acting toxin (FAT), prorocentrolide, and diarrhetic shellfish poisoning (DSP) related toxins including okadaic acid (OA), Dinophysistoxin-1 (DTX1), Dinophysistoxin-2 (DTX2) and Dinophysistoxin-4 (DTX4). Toxicity of the Hong Kong strain is uncertain.

Regional distribution: P. lima is widely distributed temperate and tropical waters. P. lima has not caused red tide in Hong Kong waters. It seldom occurs in Hong Kong waters and only very low concentrations have been detected in Hong Kong waters.

References:
Prorocentrum lima. Figures 1-3: Cells obovate to oblong in valve view. Figure 4: Thecal plate scattered with thecal pores except for the central areas. Figure 5: Pyrenoid (P) present at the centre of cell. Figure 6: Anterior end of right valve showing the v-shaped depression (arrow).
微小原甲藻

*Prorocentrum minimum* (Pavillard) Schiller 1933

**屬 Phylum**: 甲藻門 Dinophyta

**綱 Class**: 甲藻綱 Dinophyceae

**目 Order**: 原甲藻目 Prorocentrales

**科 Family**: 原甲藻科 Prorocentraceae


**描述 Description**: *Prorocentrum minimum* is small, laterally fattened and the shape is variable from triangular to oval, round or heart-shaped. Size ranges from 10 – 23 μm long, 10 – 15 μm wide. A short apical spine is present. The thecal surface is covered with numerous short spines and small scattered pores. The broad anterior end is truncate with a small, shallow, broadly V-shaped depression located apically on the right valve, slightly off-centre and made up of eight platelets and two pores (a larger flagellar pore and a smaller auxiliary pore). The nucleus is broadly ellipsoidal and posteriorly situated. A large pyrenoid and two pusules are present.

**毒性 Toxicology**: *P. minimum* is capable of producing venerupin (hepatotoxin) which causes shellfish poisoning resulting in gastrointestinal illnesses or death in humans. Toxicity of the Hong Kong strain is uncertain.

**地區分佈 Regional distribution**: *P. minimum* widely distributed in coastal waters. It is a common red tide causative species in Japan, Australia, East China Sea, South China Sea including Hong Kong. It has been reported to cause fish kill in China and shellfish kills in Japan.

It is a common red tide causative species in Hong Kong. A total of 46 red tides cases of *P. minimum* were reported in the Tolo Harbour and Northeasten waters since 1986 and fish kills were reported during the blooms in 1995 and 1998.

**參考文獻 References**:


**DINOPHYCEAE**

Prorocentrum minimum. Figures 1-2: Cells in apical view showing presence of a short apical spine (arrow). Figure 3: Anterior end of right valve showing the V-shaped depression (arrow). Figure 4: Scanning electron micrograph showing thecal surface covered with numerous short spines.
門 Phylum : 甲藻門 Dinophyta
綱 Class : 甲藻綱 Dinophyceae
目 Order : 原甲藻目 Prorocentrales
科 Family : 原甲藻科 Prorocentraceae

描述: 慢原甲藻的側面觀大致呈橢圓形至長方形，細胞體長 25 – 40 微米，寬 20 – 27 微米。圍鞭毛區有一翼狀頂刺。殼片表面平滑，有呈放射形排列的刺絲泡小孔。細胞核位於細胞下方部份。細胞沒有澱粉核及邊緣孔。

毒性: 慢原甲藻可產生溶血毒素及快速反應毒素。香港的藻株疑有毒性，但尚未能確定。

地區分佈: 慢原甲藻分佈於熱帶及亞熱帶水域，不曾在香港及其他水域引致紅潮。這種藻極少在香港海域出現，過去只錄得極低濃度。

Description: *Prorocentrum rhathymum* is ovoid to oblong in valve view. Size ranges from 25 – 40 \( \mu \text{m} \) long, 20 – 27 \( \mu \text{m} \) wide. A winged apical spine is present at the periflagellar area. The thecal surface is smooth with trichocyst pores radially ranged. The nucleus is located in the posterior part of the cell. Pyrenoid and marginal pores are absent.

Toxicology: *P. rhathymum* is capable of producing haemolytic and fast-acting toxin (FAT). Toxicity of the Hong Kong strain is uncertain.

Regional distribution: *P. rhathymum* is widely distributed in tropical and and subtropical waters and it has not caused red tide in Hong Kong. This species rarely occurs in Hong Kong and only a very low concentration has been detected in Hong Kong.

參考文獻 References:
Prorocentrum rhathymum. Figures 1-2: Cells in valve view showing oval in shape; nucleus located in the posterior part of the cell (N). Figure 3: Trichocyst pores radially arranged. Figure 4: Periflagellar area with well developed winged apical spine (arrow).
網狀原角藻  
*Protoceratium reticulatum* (Claparède & Lachmann) Bütschli 1885

門 Phylum：甲藻門 Dinophyta  
綱 Class：甲藻綱 Dinophyceae  
目 Order：膝溝藻目 Gonyaulacales  
科 Family：膝溝藻科 Gonyaulacaceae

異名 Synonyms：*Peridinium reticulatum* Claparède & Lachmann 1859,  
*Gonyaulax grindleyi* Reinecke 1967,  
*Peridiniopsis reticulata* (Claparède & Lachmann) Starmach 1974,  
*Protoceratium aceros* Bergh 1881

描述 Description:  
*Protoceratium reticulatum* is solitary, small to medium size, almost spherical to oval. Size ranges from 28 – 53 μm long and 25 – 45 μm wide. The cingulum is located anterior to the cell midpoint and is displaced about one cingular width. The hypotheca is longer than epitheca. The thecal surface is densely reticulated and each reticulation with pore at the center. The first apical plate is angular shaped with a prominent ventral pore.

毒性 Toxicology:  
*P. reticulatum* is capable of producing yessotoxins (YTX) which might accumulate in bivalves and is toxic to mice according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

地區分佈 Regional distribution:  
*P. reticulatum* has very few occurrence record found in Asia waters and it has not caused red tide in Hong Kong. *P. reticulatum* seldom occurs and only very low concentrations had been detected in Hong Kong.

參考文獻 References:  
**DINOPHYCEAE**

Protoceratium reticulatum. Figures 1-2: Ventral view of various cells showing thecal surface densely reticulated; hypotheca larger than the epitheca. Figure 3: First apical plate angular, with parallel long sides and a prominent ventral pore (arrow). Figure 4: Each reticulation with pore at the center (arrow).
厚甲原多甲藻

Protoperidinium crassipes (Kofoid) Balech 1974

門 Phylum：甲藻門 Dinophyta

綱 Class：甲藻綱 Dinophyceae

目 Order：多甲藻目 Peridinales

科 Family：原多甲藻科 Protoperidiniaceae

異名 Synonym：Peridinium crassipes Kofoid 1907

描述: 厚甲原多甲藻屬大型藻，細胞體長 80 – 100 微米，寬 70 – 100 微米。上殼片有一頂角而下殼片有 2 底部短角；左邊底部短角較右邊闊長。環溝上下位移有一至兩個殼環帶寬度。細胞表面有網狀殼片。

毒性: 厚甲原多甲藻可積聚原多甲藻酸貝類毒素 (AZAs)，是一種導致貝類中毒。這種毒素所引致的徵狀與下痢性貝類中毒相似，如噁心，嘔吐，腹瀉，胃痙攣。香港的藻株疑有毒性，但尚未能確定。

地區分佈: 厚甲原多甲藻很少出現在亞洲海域，在香港水域亦為罕見，過去只錄得極低濃度，不曾在香港引致紅潮。

Description: Protoperidinium crassipes is a large species. Size ranges from 80 – 100 μm long and 70 – 100 μm wide. Epitheca has a apical horn and hypotheca has 2 antapical horns, the left antapial horn is broader than longer than the right. The cingulum is slightly displaced by 1 - 2 girdle widths. The thecal surface is reticulated.

Toxicology: P. crassipes might accumulate Azaspiracids (AZAs) which are group of Shellfish Poisoning toxins causing azaspiracid poisoning. These toxins are characterized by symptoms similar to those of Diarrhetic Shellfish Poisoning (DSP) such as nausea, vomiting, diarrhea and stomach cramps. The harmful effect of the Hong Kong strain is uncertain.

Regional distribution: P. crassipes has very few occurrence record found in Asia waters and it seldom occurs and only very low concentrations had been detected in Hong Kong. It has not caused red tide in Hong Kong.

參考文獻 References:

**Protoperidinium crassipes.** Figure 1: Ventral view of cell showing left antapical horn broader and longer than the right. Figure 2: Left lateral view. Figure 3: Apical view. Figure 4: Theca surface reticulate. Figures 5-6: Plate configuration showing 1'=meta & 2a=quadra.
**Takayama pulchella**
(J. Larsen) de Salas, Bolch & Hallegraeff 2003

**Phylum:** Dinophyta  
**Class:** Dinophyceae  
**Order:** Gymnodiniales  
**Family:** Kareniaceae

**Synonyms:** Gymnodinium-Type 84K sensu Onoue et al. 1985, Gymnodinium pulchella J. Larsen 1994

**Description:** *Takayama pulchella* is an unarmored species without thecal plate. The cell is solitary in form and the cell outline is obovate and slightly dorso-ventrally flattened. Size is 13 – 27 μm long and 12 – 25 μm wide. The apical groove is S-shaped sigmoid, encircling the cell apex counter-clockwise. The epicone is hemispherical, and hypocone is truncated and incised. In ventral view, a sharp finger-like sulcal intrusion extends shortly into the epicone. Sulcus is wider in the hypocone than the intercingular region. A large nucleus is ellipsoidal and located on the left side of the cell. The cell has several irregularly shaped chloroplasts with central pyrenoids.

**Toxicology:** *T. pulchella* is a toxic species which causes fish kill according to overseas findings. Toxicity of the Hong Kong strain is uncertain.

**Regional distribution:** *T. pulchella* caused red tides in Australia, Japan and South China Sea. A bloom of *T. pulchella* was reported in the Tolo Harbour of Hong Kong in 2011 and no fish kill was reported during the bloom. It often occurs around Hong Kong waters and only low concentrations were detected.

**References:**
**DINOPHYCEAE**

*Takayama pulchella.* Figures 1-2: Live cells in ventral view showing sharp fingerlike sulcal intrusion extending into epicone (arrow); chloroplasts with individual pyrenoids. Figures 3-4: Different lugol fixed cells showing nucleus (N) large, ellipsoidal and on the left side of the cell. Figure 5: Left lateral view showing nucleus (N) close to the dorsal surface. Figure 6: S-shaped sigmoid apical groove encircling the cell apex (arrow).
**Takayama tasmanica** de Salas, Bolch & Hallegraeff 2003

**Phylum:** 甲藻門 Dinophyta  
**Class:** 甲藻綱 Dinophyceae  
**Order:** 裸甲藻目 Gymnodiniales  
**Family:** 凱倫藻科 Kareniaceae

**Description:** *Takayama tasmanica* is an unarmoured species without thecal plate. The cell is solitary in form and the cell outline is ovoid and slightly dorso-ventrally flattened. Size is 16 – 34 μm long and 14 – 32 μm wide. The apical groove is S-shaped sigmoid, encircling the cell apex counter-clockwise. The epicone is hemispherical, and hypocone is truncated and incised. In ventral view, a sharp finger-like sulcal intrusion extends shortly into the epicone. Sulcus is wider in the hypocone than the intercingular region. A large and multi-lobed C-shaped nucleus is occupied the entire epicone of the cell. The cell has several irregularly radiating chloroplasts, branching peripherally, with central pyrenoids.

**Toxicology:** *T. tasmanica* is a toxic species which causes fish kill according to overseas findings. Toxicity of the Hong Kong strain is uncertain.

**Regional distribution:** *T. tasmanica* has records in India and Australia waters. It has not caused red tide in Hong Kong waters and low cell densities were detected in Northeastern waters of Hong Kong.

**References:**


**Takayama tasmanica.** Figures 1-2: Live cells in ventral view showing finger-like sulcal intrusion into epicone (arrowhead), pore or slit on cingular end of apical groove (arrow); irregular radiating chloroplasts. Figures 3-5: Different lugol fixed cells showing nucleus (N) large and occupied the entire epicone of the cell. Figure 6: S-shaped sigmoid apical groove encircling the cell apex (arrow).
**球形棕囊藻**

*Phaeocystis globosa* Scherffel 1899

**描述：**球形棕囊藻組成球狀膠質群落，直徑最大可達 1 厘米。細胞分佈於群落表面，被黏液包圍，大小約 3 – 9 微米。每個細胞均有兩個側生黃褐色葉綠體，但一般沒有鞭毛及定鞭毛。這種藻的生命周
期最少有兩個不同階段 ( 群落形態及一個或多個單細胞形態 )。單細胞態有雙鞭毛和一根極短的定鞭毛，細胞可製造線狀物質，近側部份排列成五角形。

**毒性：**球形棕囊藻是可製造泡沫的藻類，對魚類有害。它可產生刺激物質 ( 丙烯酸 ) 和黏液，堵塞魚鰓造成危害。藻華出現期間，膠質群落亦會在海灘產生大量泡沫，減低景觀及康樂價值。

**地區分佈：**球形棕囊藻廣泛分佈於溫帶沿海和海洋水域，曾經在香港形成紅潮。這種藻在越南造成養殖龍蝦及中國養殖魚類死亡的記錄。

球形棕囊藻在香港海域引發 11 宗紅潮，但沒有引致魚類死亡。在本港不同水域有記錄，但出現頻率及濃度俱低。

**Description:** *Phaeocystis globosa* forms spherical, gelatinous colonies which can be up to 1 cm in diameter. Cells are distributed on the surface layer of the colony. The cells, embedded in mucilage, are around 3 – 9 μm. Each cell contains 2 parietal yellowish brown chloroplasts but usually lack flagella and haptonema. There are at least 2 different stages in the life cycle (colony-forming phase and one or more unicellular stage). The unicellular stage is a biflagellate with a very short haptonema. The cell can produce thread-like material and the proximal part is arranged in pentagonal.

**Toxicology:** *P. globosa* is a genus of foam-producing species that cause harmful effect to fish. It can generate irritant substances (acrylic acid) and mucilage, which clog fish gills. During blooms, the gelatinous colonies can also form huge mass of foams on beaches which degrades aesthetic and recreational values.

**Regional distribution:** *P. globosa* is widely distributed in temperate coastal and oceanic waters and known to cause red tides in Vietnam, East China Sea and South China Sea including Hong Kong. It has been reported to cause mortality of caged lobster in Vietnam and fish kill in China.

This species caused 11 red tide incidents reported in Hong Kong but no fish kill was reported. Low occurrence frequencies and low concentrations of *P. globosa* were detected in different water regions of Hong Kong.

**參考文獻 References:**


**PRYMNESIOPHYCEAE**

*Phaeocystis globosa.* Figure 1: Live spherical colony (8 mm in diameter). Figure 2: Live cultured colony (95 μm in diameter). Figure 3: Individual cell scattered on the surface of the colony. Figures 4-5: Lugol fixed cells. Figures 6-7: Live non-motile cell showing two yellowish-brown chloroplasts and no flagellum. Figure 8: Live motile cell (zooid) showing two flagella and one heptonema (arrow).
**Ocean Chattonella**

*Chattonella marina* (Subrahmanyan) Hara & Chihara 1982

**Kingdom** Phylum: 褐胞藻門 Ochrophyta

**Class**: 針胞藻綱 Raphidophyceae

**Order**: 褐胞藻目 Chattonellales

**Family**: 褐胞藻科 Chattonellaceae

**Synonym**: *Hornellia marina* Subrahmanyan 1954

**Description**: *Chattonella marina* is solitary, oblong to obovoid in shape with a tiny posterior tail. Cell is asymmetrical in lateral view and slightly flattened, ranging from 30 – 70 μm long and 12 – 33 μm wide. The two subequal flagella are approximately equal to the cell length and emerge from the bottom of an anterior depression. The teardrop-shaped nucleus is situated in the center of the cell. Many green to yellowish brown, ellipsoid chloroplasts are arranged radially with a naked pyrenoid located on the inner pole of the chloroplasts. Electron-dense (osmiophilic) particles are present in the peripheral cytoplasm. Contractile vacuoles, eyespots and mucocysts are absent.

**Toxicology**: Overseas research reported that *C. marina* is capable of producing neurotoxic, hemolytic and hemagglutinating compounds, resulting in fish kills.

**Regional distribution**: *C. marina* is known to cause red tides in Japan, Yellow Sea and South China Sea including Hong Kong. It has been reported to cause fish kill in Japan.

Five red tide cases of *C. marina* were reported in the Northeastern, Southeastern and Southern waters of Hong Kong in 2001, 2003, 2004 and 2012, and fish kill was reported during the bloom in 2001. Low occurrence frequencies and low concentrations of *C. marina* were detected in the Northeastern, Eastern and Southern waters in Hong Kong.

**References**:


Chattonella marina. Figures 1-2: Live cells showing numerous green to yellowish-brown ellipsoidal chloroplasts arranged radially; a tail-like protrusion at the posterior end. Figure 3: Live cultured cell. Figure 4: Cell starting to round off after ceasing to swim. Figure 5: Cell surface covered with numerous electron-dense (osmiophilic) particles. Figures 6-8: Lugol fixed cells in various shapes.
海洋褐胞藻卵形變種

*Chattonella marina var. ovata* (Hara & Chihara) Demura & Kawachi 2009

門 Phylum: 褐胞藻門 Ochrophyta

綱 Class: 針胞藻綱 Raphidophyceae

目 Order: 褐胞藻目 Chattonellales

科 Family: 褐胞藻科 Chattonellaceae

異名 Synonym: *Chattonella ovata* Hara & Chihara 1994

描述 Description: *Chattonella marina var. ovata* is solitary, ovoid or obovoid, fairly flattened, ranging from 39 – 100 μm long and 24 – 50 μm wide. The two subequal, heterodynamic flagella emerge from the bottom of an anterior depression in the cell. The cell contains numerous yellowish brown ellipsoid chloroplasts arranged radially with vacuoles among chloroplasts. A pyrenoid is located at the inner pole of the chloroplasts. Electron-dense (osmiophilic) particles are present in the peripheral cytoplasm. Contractile vacuoles, eyespot and mucocysts are absent.

毒性 Toxicology: Overseas research reported that *C. marina var. ovata* is capable of producing oxygen radicals and hydrogen peroxide compounds, resulting in fish kills.

地區分佈 Regional distribution: *C. marina var. ovata* is known to cause red tides in Japan and South China Sea including Hong Kong. It has been reported to cause fish kill in Japan. Four red tide cases of *C. marina var. ovata* were reported in the Northeastern and Southern waters of Hong Kong in 1991 and 2001, and fish kill was reported during the bloom in 2001. Low occurrence frequencies and low concentrations of *C. marina var. ovata* were detected in the Northeastern, Eastern and Southern waters in Hong Kong.

參考文獻 References:


RAPHIDOPHYCEAE

*Chattonella marina var. ovata.* Figures 1-3: Live cells showing numerous yellowishbrown ellipsoid chloroplasts arranged radially; vacuoles located among chloroplasts (arrow); a large teardrop-shaped nucleus at the cell center. Figures 4-5: Live cells starting to round off after ceasing to swim. Figure 6: Cell surface covered with numerous electron-dense (osmiophilic) particles. Figures 7-10: Lugol fixed cells in various shapes.
針胞藻

*Fibrocapsa japonica* Toriumi & Takano 1973

門 Phylum : 褐胞藻門 Ochrophyta

綱 Class : 針胞藻綱 Raphidophyceae

目 Order : 褐胞藻目 Chattonellales

科 Family : 褐胞藻科 Chattonellaceae

異名 Synonym : *Chattonella japonica* (Toriumi & Takano) Loeblich III & Fine 1977

描述：針胞藻是單一細胞藻，呈卵形，細胞略為扁平，長 20 – 30 微米，寬 15 – 17 微米。前鞭毛與細胞長度相同，後鞭毛是細胞長度 1.2 倍，兩根鞭毛均由細胞前端的小溝伸出。細胞核位於細胞中央，細胞密佈盤狀黃褐色或金褐色葉綠體，體內各有一澱粉核。細胞後端有數個桿狀黏液泡，密集排列，沒有伸縮空泡及眼點。

毒性：針胞藻可產生五種神經毒素複合物，毒性作用與雙鞭甲藻毒素相似，根據外國文獻記載曾引致魚類死亡。香港的藻株疑有毒害，但尚未能確定。

地區分佈：針胞藻分佈於溫帶近岸水域，曾經在日本、澳洲、紐西蘭及香港形成紅潮。這種藻曾於日本造成魚類死亡。

針胞藻在 2008 年於香港南及東南部水域引發 2 宗紅潮，但沒有造成魚類死亡。這種藻在本港水域偶有記錄，但出現頻率及濃度俱低。

Description: *Fibrocapsa japonica* is solitary, ovoid in shape, slightly flattened, and around 20 – 30 μm long, 15 – 17 μm wide. The anterior flagellum is as long as the cell and the posterior one is 1.2 times the cell length, both emerge from an anterior gullet. The nucleus is situated in the center of the cell. Many discoid, yellowish brown to golden brown chloroplasts are densely packed in the cell and a pyrenoid is present in each chloroplast. A number of rod-shaped mucocysts are concentrated at the posterior end of the cell. Contractile vacuoles and eyespot are absent.

Toxicology: *F. japonica* is capable of producing 5 neurotoxic compounds similar to brevetoxins which cause fish kill according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

Regional distribution: *F. japonica* is distributed in temperate coastal waters and known to cause red tides in Japan, Australia, New Zealand and Hong Kong. It has been reported to cause fish kill in Japan.

There were two red tide cases of *F. japonica* reported in the Southern and Southeastern waters of Hong Kong in 2008 but no fish kill was reported during the bloom. Low occurrence frequencies and low concentrations of *F. japonica* were occassionaly detected in Hong Kong waters.

參考文獻 References:


**Fibrocapsa japonica.** Figures 1-3: Live cells showing ovate to obovate shape with numerous discord, golden-brown chloroplasts; a number of rod-shaped mucocysts concentrated at the posterior end of the cell (arrow). Figure 4: Many electron-dense particles scattered on the cell surface. Figure 5: Cell undergoes division. Figures 6-7: Lugol fixed cells showing each chloroplast containing a pyrenoid (arrows).
赤潮異彎藻
Heterosigma akashiwo (Hada) Hara & Chihara 1987

門 Phylum：褐胞藻門 Ochrophyta
綱 Class：針胞藻綱 Raphidophyceae
目 Order：褐胞藻目 Chattonellales
科 Family：褐胞藻科 Chattonellaceae

異名 Synonyms：Olisthodiscus carterae Hulburt 1965, Heterosigma carterae (Hulburt) Taylor 1992

描述：赤潮異彎藻是細小的單一細胞藻，呈馬鈴薯形，細胞背腹略為扁平，長 8 – 25 微米，寬 6 – 15 微米。兩根長度相約的鞭毛呈不同活動模式，由前側坑槽伸出，呈螺旋游動狀，細胞內部佈滿盤狀黃褐色葉綠體，體內各有一濾粉核。涇珠形細胞核位於細胞中央，沒有伸縮空泡及眼點，黏液泡則沿細胞周邊分佈。以魯哥氏液固定的細胞呈獨特的紅莓狀。

毒性：赤潮異彎藻可能產生神經毒素，根據外國文獻記載會破壞魚鰓，導致魚類死亡。香港的藻株疑有毒性，但尚未能確定。

地區分佈：赤潮異彎藻廣泛分佈於溫帶和亞熱帶近岸水域，曾經在日本、中國東海水域及中國南海水域包括香港形成紅潮。這種藻是日本最主要的赤潮生物之一。

這種藻也是香港常見的紅潮品種，自 1987 年至今先後在吐露港、東北部及西部水域形成 22 宗紅潮，但沒有引致魚類死亡。

Description: Heterosigma akashiwo is solitary, small, potato-shaped, slightly dorso-ventrally compressed. Size ranges from 8 – 25 μm long and 6 – 15 μm wide. The two subequal, heterodynamic flagella emerge from an antero-lateral groove and exhibit a spiraling swimming pattern. Cell contains numerous disc-shaped yellowish brown chloroplasts, each with a pyrenoid. A teardrop-shaped nucleus is situated in the center of the cell. Contractile vacuoles and eyespot are absent, while mucocysts are present along the cell periphery. Cell preserved in Lugol’s solution often attain a characteristic raspberry shape.

Toxicology: H. akashiwo might be capable of producing neurotoxins and cause fish kill by gill damage according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

Regional distribution: H. akashiwo is widely distributed in temperate and subtropical coastal areas and known to cause red tides in Japan, East China Sea and South China Sea including Hong Kong. It is a dominant red tide causative species in Japan.

This species is also a common red tide causative species in Hong Kong. There were 22 red tide cases of H. akashiwo reported in the Tolo Harbour, Northeastern and Western waters since 1987 but no fish kill was reported during the blooms.

參考文獻 References:
**Raphidophyceae**

*Heterosigma akashiwo*. Figure 1: Live cell in lateral view showing slightly dorsoventrally compressed shape; numerous disc-shaped yellowish-brown chloroplasts, each with pyrenoid. Figure 2: Live cell in dorsal view. Figure 3: Aged cultured cell. Figures 4–6: Lugol fixed cells.
失憶性貝類中毒：有潛在致命的疾病，典型病徵是腸胃不適及神經紊亂，包括失憶。貝類攝食可產生軟骨藻酸毒素的硅藻（以羽紋硅藻為主），人類進食受有毒藻類污染的貝類導致中毒。

Amnesic Shellfish Poisoning (ASP): A potential life-threatening illness caused by consumption of contaminated shellfish that fed on toxin (domoic acid) producing diatoms (mainly pennates). It is characterized by gastrointestinal and neurological disorders, including loss of memory.

末端：細胞末端。
Antapex: The posterior end of the cell.

底端部：細胞尾端部份。
Antapical: The posterior part of the cell.

頂部：細胞頂端部份。
Apical: The anterior part of the cell.

橫溝：甲藻的橫溝是在細胞表面的水平或螺旋形槽溝，位於鞭毛之上。
Cingulum: A horizontal or spiral groove on the cell surface which lies on a flagellum in dinoflagellates.

伸縮胞：收縮泡囊可注入或排出細胞液。
Contractile vacuole: A rhythmically contracting vesicle, which fills in or expels fluid from the cell.

藍藻綱：大型多樣化光合微生物類群，前稱藍綠藻。藍藻綱品種可為單細胞或絲狀。光合機制與藻類及植物葉綠體相似，但細胞為原核性，而藻類和植物的細胞均為真核性。
Cyanophyceae: A large and heterogeneous group of photosynthetic microorganisms formerly referred to as blue-green algae. Species may be unicellular or filamentous. Their photosynthetic mechanism is similar to that of algal and plant chloroplasts, but the cells are prokaryotic whereas the cells of algae and plants are eukaryotic.

下痢性貝類中毒：下痢性貝類中毒不會致命，食用曾攝食可產生多種毒素，包括大田軟海綿酸、鰭藻毒素及扇貝毒素的鰭藻或原甲藻等甲藻的貝類，導致腸胃不適。
Diarrhetic Shellfish Poisoning (DSP): DSP is not life-threatening. It is an illness caused by eating shellfish that fed on Dinophysis or Prorocentrum dinoflagellates which produce a suite of toxins, including okadaic acid, dinophysistoxins and pectenotoxins, resulting in gastrointestinal disorders.

硅藻：硅藻是主要的真核藻類，長有硅質細胞壁，由兩個對稱部份交疊而成。大部份硅藻均為單細胞，但有些品種會組成群落（例如串連成鏈狀）。硅藻分為兩類：筆狀的羽紋硅藻和圓筒形的橫紋硅藻。
**Diatom:** Diatom is a major group of eukaryotic algae with siliceous cell walls (called frustule) consisting two overlapping symmetrical parts. Most diatoms are unicellular, but some species can form colonies (e.g. chains of cells). There are two different groups of diatoms: the pennate which is pen-shaped and the centrics which is cylindrical.

**甲藻:** 甲藻是單細胞原生物，有兩根大小不同的鞭毛，可在水體遊動。橫鞭毛位於細胞對分的槽溝中（橫溝）。縱鞭毛與横鞭毛成直角，向後端伸展。甲藻分為兩類：具有殼片甲藻（有細胞殼）和不具殼片甲藻（無細胞殼）。甲藻可透過異養、自養、寄生或共生攝取營養。

**Dinoflagellate:** Dinoflagellate is unicellular protist with two flagella (transverse and longitudinal) of unequal sizes which allow it to swim in the water column. The transverse flagellum is located in a groove (cingulum) that divides the cell into two parts. The longitudinal flagellum is perpendicular to the transverse flagellum and extends towards the posterior. There are two types of dinoflagellates: armoured (with cellulose plates) and unarmoured (naked). Dinoflagellates can be heterotrophic, autotrophic, parasitic, or symbiotic.

**上殼:** 甲藻細胞橫溝以上的部份。
**Epicone:** The portion of a dinoflagellate cell anterior to cingulum.

**上殼片:** 甲藻細胞橫溝以上的殼片。
**Epitheca:** The portion of cell theca lying anterior to cingulum in dinoflagellates.

**頂孔:** 位於頂孔甲殼面上的一個比較大的逗號形空腔（某種亞歷山大藻或呈魚鈎狀）。
**Foramen:** A relatively large comma-shaped cavity (or sometimes fishhook shaped in some Alexandrium species) on the apical pore plate (Po). It is a diagnostic feature of the apical pore complex (APC).

**定鞭毛:** 不等鞭毛類的鞭毛狀結構，由鞭毛附近的細胞頂端長出，內有數根微管。定鞭毛的作用是輔助細胞黏附、攝食或作出躲避反應。
**Haptonema:** A flagellum-like structure in haptophytes which arises from the cell apex near the flagella and contains several microtubules. It facilitates cell attachment, feeding and avoidance responses.

**下殼:** 甲藻細胞橫溝後以下的部份。
**Hypocone:** The portion of a dinoflagellate cell posterior to cingulum.

**下殼片:** 甲藻細胞橫溝以下的殼片。
**Hypotheca:** The portion of cell theca lying in the posterior part, below the cingulum.

**肋紋間:** 兩條肋紋之間的無孔硅質部份。肋紋由一排或多排網紋、小孔或窩泡組成。
**Interstriae:** The non-perforate siliceous strip between two striae. Striae are single or multiple rows of areolates, pores or alveolus.
Microalgae: Microscopic plant (single-celled or colonies of cells) comprises a diverse group of photosynthetic and heterotrophic protists which is commonly found in both freshwater and marine environments. There is a high diversity within the taxonomic classes, such as Bacillariophyceae, Ciliophora, Chlorophyceae, Cryptophyceae, Cyanophyceae, Dictyoophyceae, Dinophyceae, Raphidophyceae, Prymnesiophyceae, Euglenophyceae, Prasinophyceae etc.

Microcystin: Microcystin is cyclic non-ribosomal peptide produced by cyanobacteria. It is cyanotoxin and can be highly toxic to plants and animals, including humans. Their hepatotoxicity may cause serious damage to animal livers.

Mucocyst: An ejective organelle, a sac-like structure that emerges through pores of the cells release mucous or mucous threads.

Neurotoxic Shellfish Poisoning (NSP): A non-fatal illness caused by consumption of shellfish that accumulated brevetoxin and its derivatives. The major symptoms include tingling and/or numbness of lips, tongue, throat, hands and feet.

Paralytic Shellfish Poisoning (PSP): A life-threatening illness caused by consumption of shellfish which has been contaminated by saxitoxin and/or its derivatives. Neurological symptoms include tingling, numbness and burning sensation in lips and fingertips. In severe cases, respiratory paralysis can cause death within 24 hours.

Poroid: Shallow surface depressions of valve surface.

Pre-cingular plate: In thecated species, the plate touching the cingulum in the epitheca.

Raphidophyceae: A small group of eukaryotic algae that includes both marine and freshwater species. All raphidophytes are unicellular and possess a pair of flagella without cell wall.
澱粉核：位於葉綠體內的蛋白體，一般作用是促進形成儲存化合物。

Pyrenoid: A protein organelle lying inside certain types of chloroplasts which is commonly associated with the formation of storage compounds.

定鞭藻綱：單細胞鞭毛藻其中一類，長有兩根平滑的鞭毛和「定鞭毛」，定鞭毛是絲狀附器，可長或短而呈鞭狀。定鞭毛在生命周期中某階段會藏於被膠質鞘包裹的鈣質甲（鞭藻鱗片）。

Prymnesiophyceae: A class of unicellular, flagellated algae with two smooth flagella and a haptonema. Haptonema is a filamentous appendage which may be short or long and whip-like, and at least at some stage in their life cycle covered by calcareous plates (coccoliths) embedded in a gelatinous sheath.

S形：彎曲呈S字形。

Sigmoid: Curve and S-shaped.

縱溝：甲藻細胞正面的縱向坑紋或凹陷，位於鞭毛縱側。有甲殼品種的縱溝由縱溝小板組成。

Sulcus: A longitudinal furrow or depression on the ventral side of a dinoflagellate cell which lies on the longitudinal part of the flagellum. In thecated species, the sulcus is made up of sulcal platelets.

藻絲：一束絲狀群體。

Trichome: A bundle of filament

液胞：細胞內的細胞質膜空腔，主要用作消化、儲存、分泌或排泄功能。

Vacuole: A cytoplasmic membrane-bound cavity within a cell that function in digestion, storage, secretion or excretion.
承蒙紅潮 / 有害藻華專家顧問小組提供寶貴的指導意見輔助本冊子的研究、紅潮相關資訊及論述工作，我們謹此致謝。此外並要特別鳴謝就本冊子提供專業意見的 Yasuwo Fukuyo 教授和東京大學亞洲環境科學研究中心的同儕。我們並在此向香港城市大學生物及化學系區慧婷博士致謝，感謝她協助環境掃描電子顯微鏡鑑定工作，以及多謝政府化驗所的曹秀青女士提供液相色譜 - 質譜聯用儀進行軟骨藻酸分析。最後，我們想借此機會多謝所有向漁農自然護理署報告紅潮及提供紅潮資料和輔助鑑定的人士。

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