

Stanley P.C. LAW

Fion Y.K. LEE



香港有害海洋

Harmful Marine

微藻

MICROALGAE

in Hong Kong



漁農自然護理署
Agriculture, Fisheries and
Conservation Department

香港有害海洋微藻

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香港特別行政區政府
漁農自然護理署
2013

AGRICULTURE, FISHERIES AND CONSERVATION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG SPECIAL
ADMINISTRATIVE REGION
2013

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序言

INTRODUCTION

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，矽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。矽藻（矽藻綱）是單細胞生物，長有黃褐色葉綠體及矽質細胞壁。細胞壁由兩片殼組成，兩者由側帶連合。矽藻分為兩類：(1) 圓心矽藻—殼面呈圓形，紋理為輻射形對稱，例如圓篩藻屬；(2) 羽紋矽藻—細胞壁較長，兩側對稱，例如擬菱形藻屬。矽藻一般根據其形狀和矽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。矽藻多分佈於淡水及海洋環境，此外亦可在泥土中生長。圖 1 顯示矽藻的形態。

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.

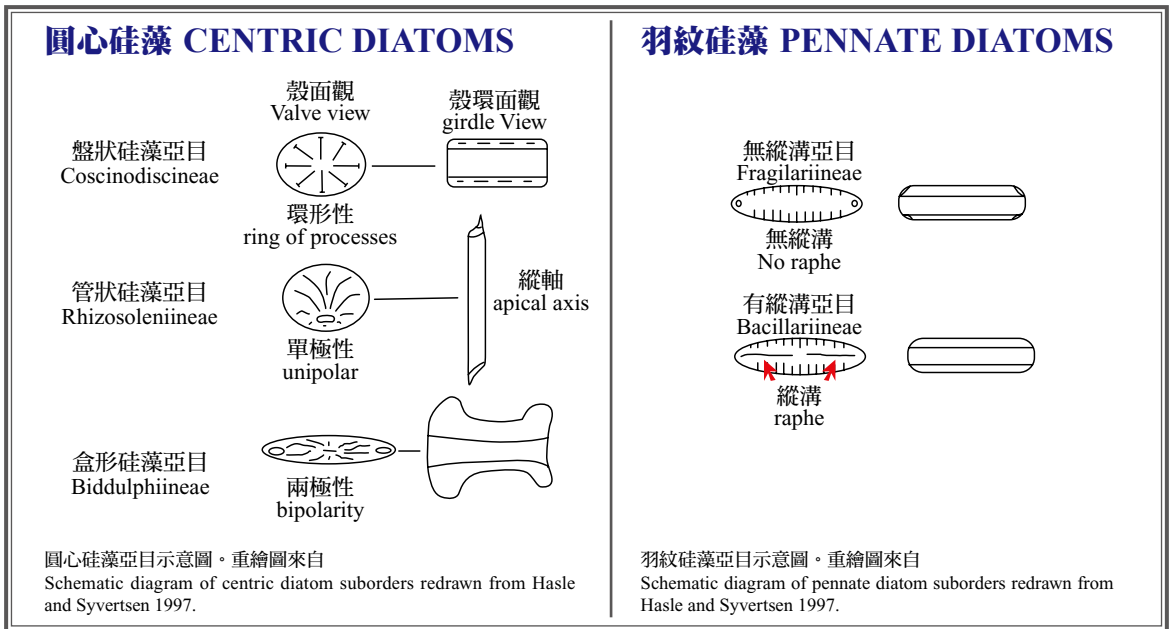


圖 1. 圓心、羽紋硅藻的形態
Figure 1. The morphology of centric and pennate diatoms

甲藻 (甲藻綱) 是微小的單細胞生物，可自由游動，長有兩根鞭毛。橫鞭毛嵌藏於環繞細胞橫溝的槽狀結構內，提供前進推動力和旋轉力；縱鞭毛在後方拖曳，推進動力有限，主要作方向舵。大部份甲藻均呈圓型，有些品種可相連成鏈狀。甲藻的長度或直徑介乎 5 至 2000 微米不等，多數品種分佈於海洋，但亦可以在淡水湖、河流及沼澤 / 濕地生長。甲藻一般分為：(1) 具有殼片甲藻 (長有殼片或細胞甲片) 和 (2) 不具殼片甲藻 (沒有殼片)。圖 2 顯示甲藻的形態及細胞結構。

- (1) 具有殼片甲藻：許多甲藻的細胞壁由很多纖維素質甲片組成，稱為殼片。主要根據殼片的數目、排列方式、形狀及結構分類，例如亞歷山大藻屬。
- (2) 不具殼片甲藻：細胞壁平滑富彈性，主要根據形狀及結構分類，例如凱倫藻屬。

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 cellulosic 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.

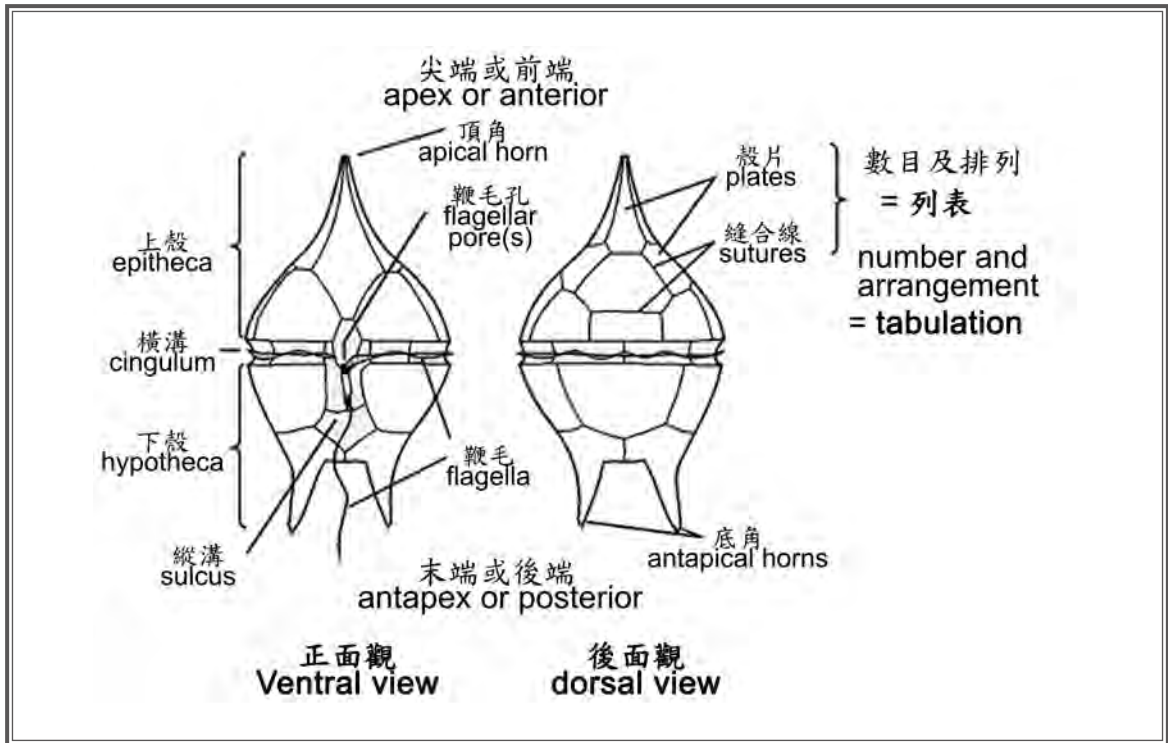


圖 2 甲藻的形態及細胞結構 (依照 Evitt, 1985 修改)

Figure 2. The morphology and cellular structure of dinoflagellate (Modified after Evitt, 1985)

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痺性貝類中毒、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鏈造成生物積聚，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.

香港紅潮 / 有害藻華

紅潮及有害藻華是一種自然現象，海洋中微小的單細胞藻類迅速大量繁殖及 / 或集結，可能令水體變成粉紅、紅、褐、紅褐、深綠或其他顏色。紅潮的成因結合了多項自然因素（如光照度、水溫、鹽份、養份、微量元素、水流及藻類細胞的能動性等）及助長藻類繁殖的人為因素（例如有機物或營養物的排放），這些因素會促進藻類迅速生長，形成紅潮或藻華，至於紅潮或藻華會否持續則視乎以上因素的轉變。

漁農自然護理署（漁護署）自 1975 年開始記錄紅潮的發生個案。由 1975 年至 2012 年，本港水域共錄得 867 宗紅潮個案，除 1988 年高峰期外，本港平均每年有 20 至 30 宗紅潮個案（圖 3）。

全球目前約有 330 種可導致紅潮的水生生物，截至 2012 年，曾在香港引發紅潮的藻類品種共 76 種，當中 19 種屬於有害藻華，有些品種曾對海洋生物造成危害。例如，指溝凱倫藻曾在 1998 年引發紅潮並造成大量魚類死亡（漁護署 1999 及楊 2000）。除了上述 19 種有害藻類，漁護署的定期浮游植物監察計劃亦於本港海域發現共 31 種其他可能有毒的藻類。

本冊子旨在提供簡易指引，以助鑑別本港水域的有毒和可能有毒的海洋微藻類。每種有記錄的微藻均附有照片、分類說明及潛在毒性、分佈及出現時間 / 季節等資料。

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.

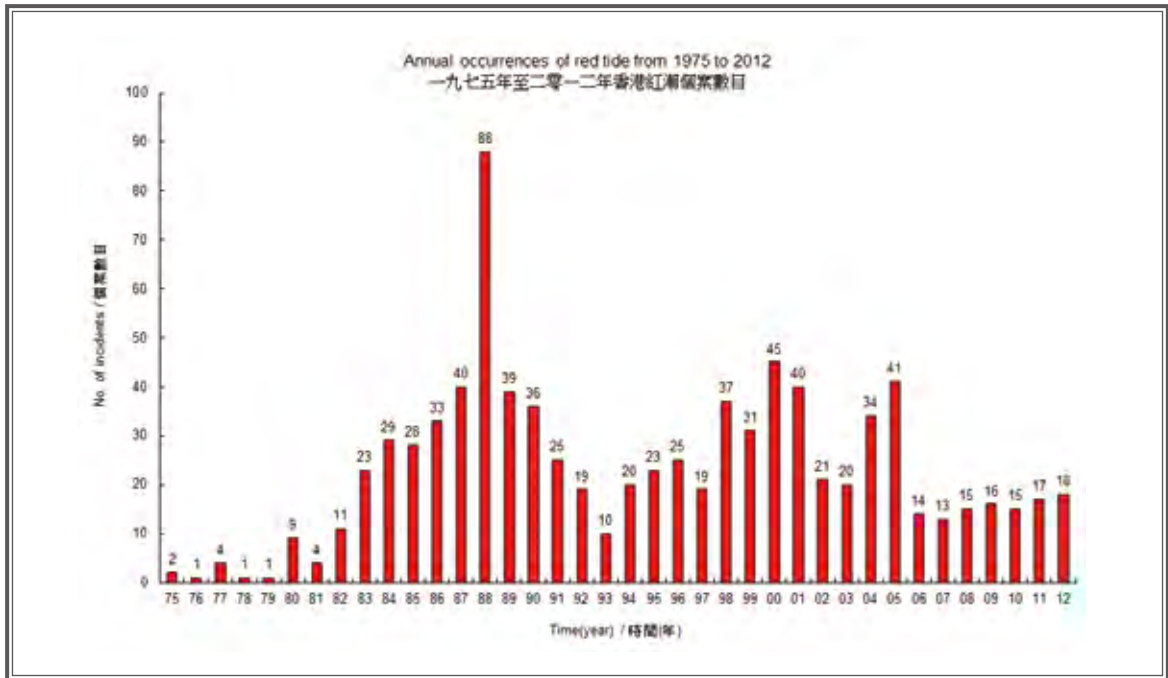


圖3 1975至2012年香港紅潮個案宗數

Figure 3. The number of red tide incidents in Hong Kong from 1975 to 2012.

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）、衛生署、康樂及文化事務署（康文署）、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/hkredtide/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 biotoxins 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.

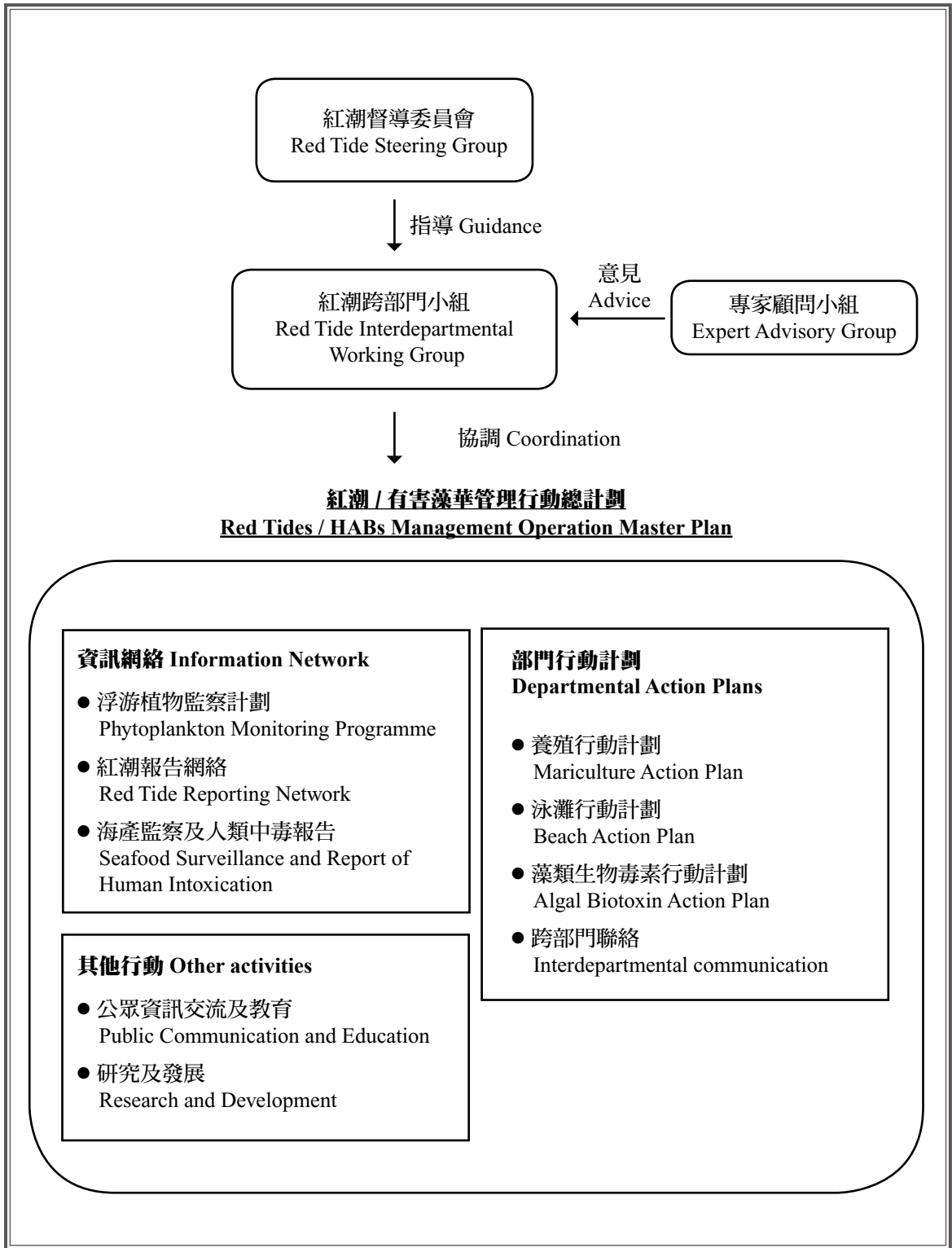


圖 4 紅潮 / 有害藻華管理框架
Figure 4. Red tide/HAB management framework

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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 calyptras 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.

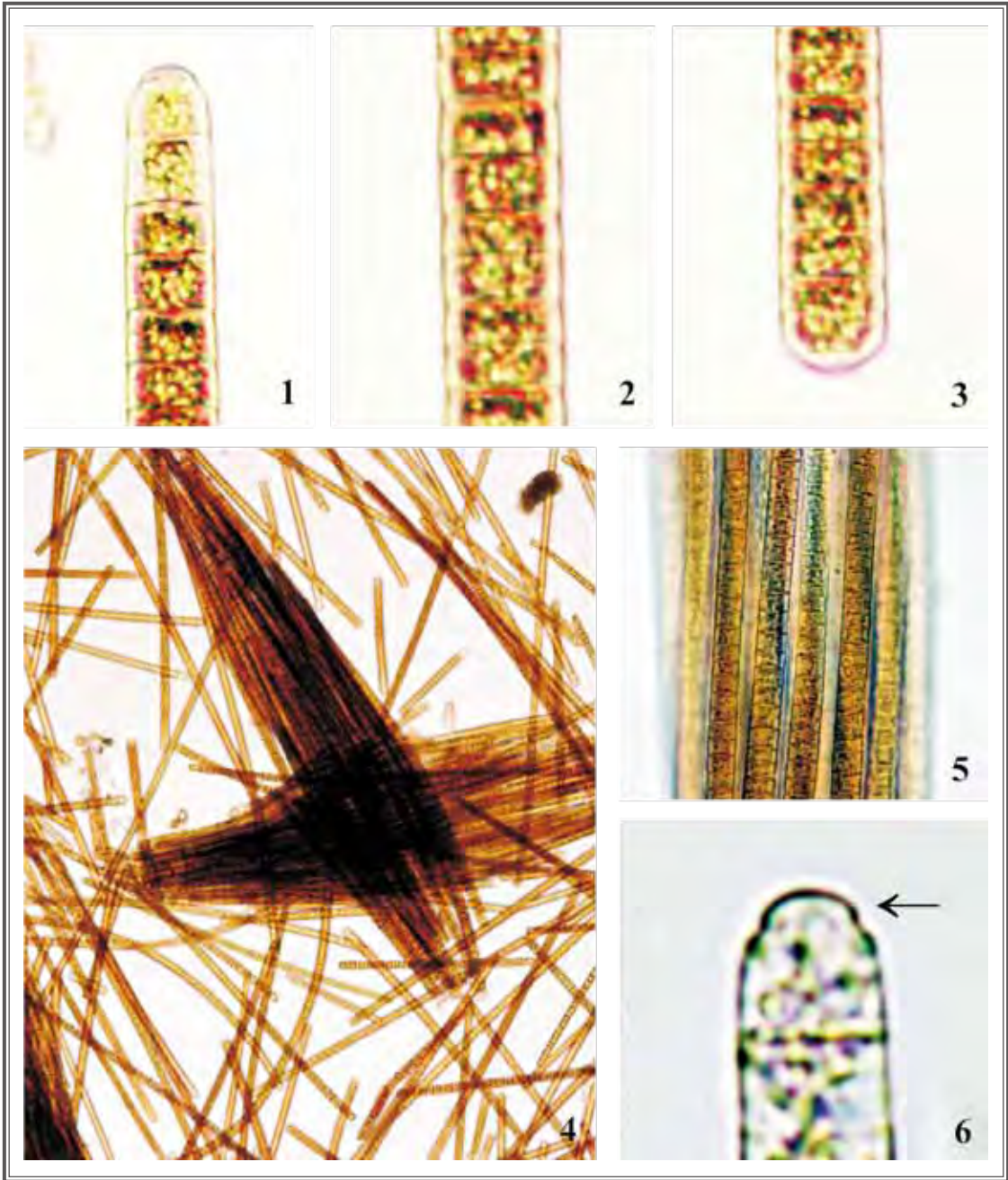
Regional distribution: *T. erythraeum* is widely distributed in tropical waters and known to cause red tides in Vietnam, Thailand, Japan, East China Sea and South China Sea including Hong Kong.

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.

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CYANOPHYCEAE



紅海束毛藻。圖 1-3：從藻絲可見每個細胞一般寬度大於長度。圖 4-5：藻絲體直，並行排列成束狀。圖 6：頂細胞呈半球形、錐形或凸面，藻絲末端有帽狀體（箭咀）。

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 winded 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 calyptas 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.

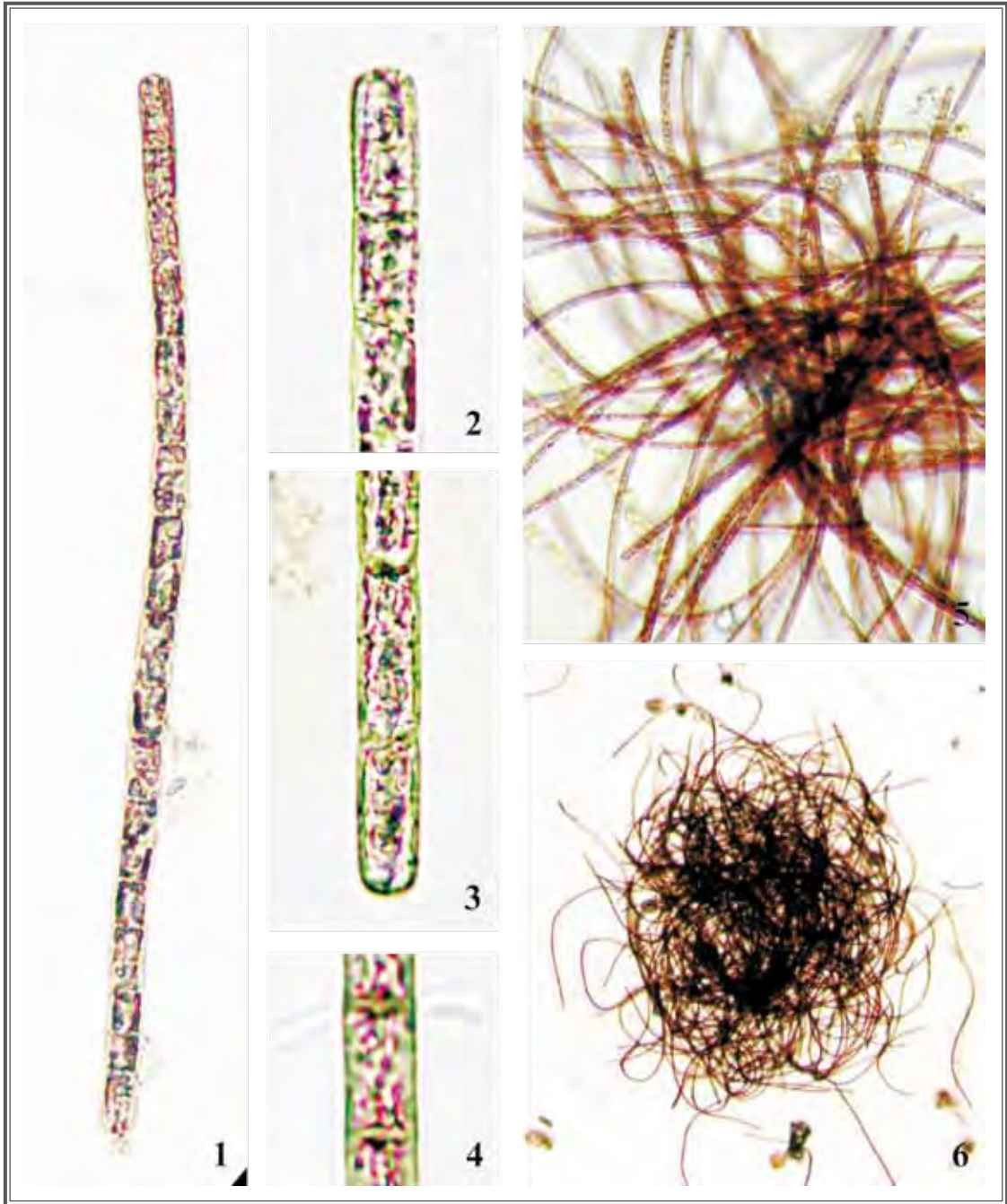
Regional distribution: *T. thiebautii* is widely distributed in tropical water and known to cause red tide in Japan, Vietnam, East China Sea and South China Sea including Hong Kong.

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:

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鐵氏束毛藻。圖 1：藻絲微曲或深度彎曲。圖 2-3：藻絲頂細胞呈圓形或扁平，藻絲末端沒有帽狀體。圖 4：從藻絲可見細胞通常長而窄，長度可比寬度大兩倍。圖 5-6：藻絲可形成輻射形排列、球形或繩索狀的群落，最大範圍可達 3 毫米。

Trichodesmium thiebautii. Figure 1: Trichomes slightly flexuous or well curled. Figures 2-3: Apical cells of trichomes are round or flatted without calyptas. Figure 4: Trichomes showing the individual cells ususally 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 : 矽藻門 Bacillariophyta

綱 Class : 矽藻綱 Bacillariophyceae

目 Order : 矽藻目 Bacillariales

科 Family : 矽藻科 Bacillariaceae

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

描述 : 靚紋擬菱形藻的殼面觀呈畢直長線形，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。香港培植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.

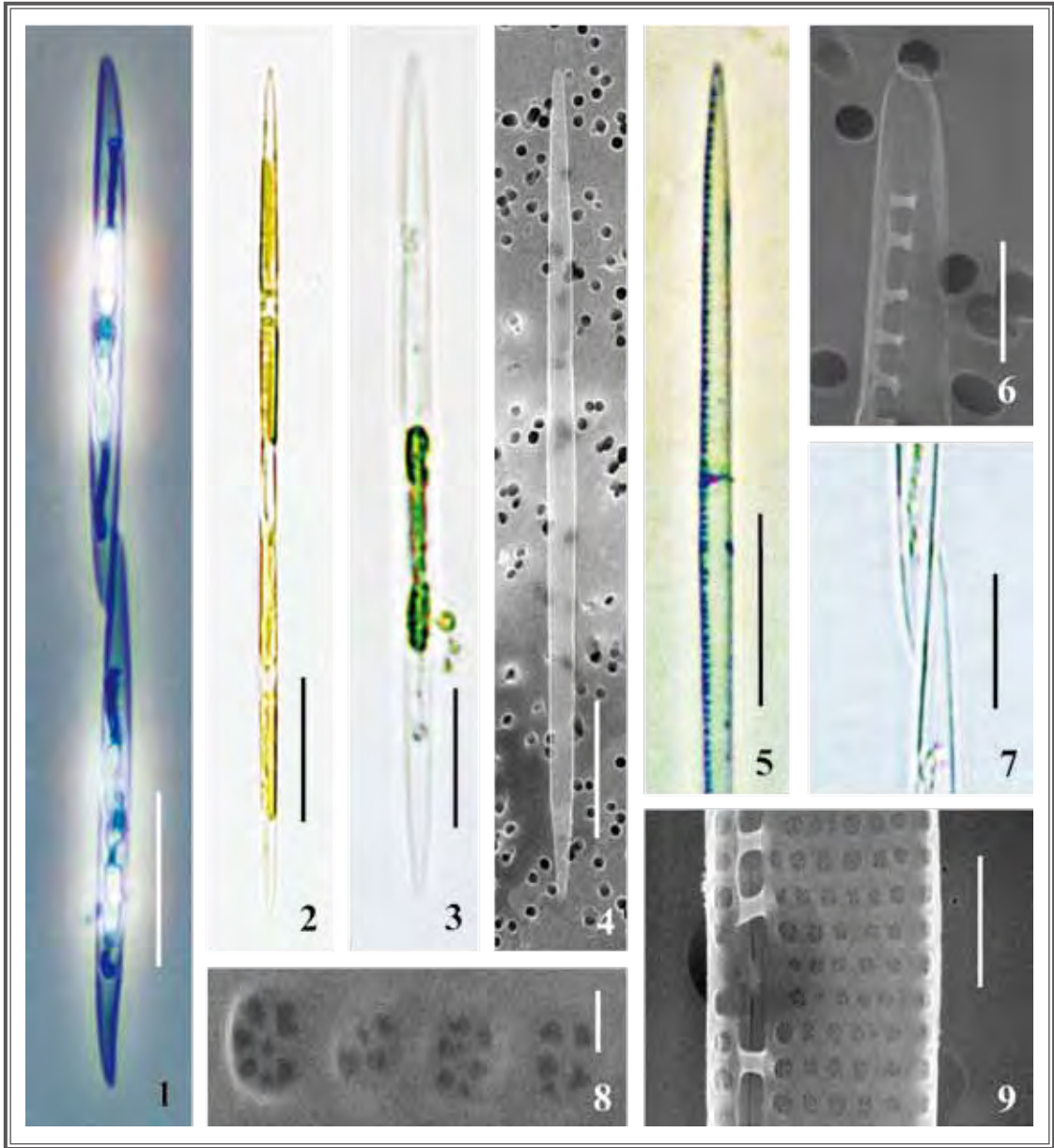
Toxicology: *P. calliantha* is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). However local cell cultures did not find to produce domoic acid.

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.

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觀紋擬菱形藻培植藻株。圖 1：細胞串成鏈狀、殼環面相位差活細胞圖片。圖 2：細胞串成鏈狀、殼面觀活細胞。圖 3：以魯哥氏液固定的細胞殼面。圖 4：掃描電鏡殼面觀。圖 5：酸洗細胞壁，殼面可見船骨點及中央間隙（掃描電鏡觀）。圖 6：殼面頂尖（掃描電鏡觀）。圖 7：交疊細胞（殼環面觀）。圖 8：高倍放大圖片，顯示孔紋的細胞膜。圖 9：殼面中央部份，顯示大中央間隙及一排孔紋（掃描電鏡觀）。圖 1-2：比例尺 = 20 微米；圖 3-5 及 7：比例尺 = 10 微米；圖 6：比例尺 = 1 微米；圖 8：比例尺 = 100 納米；圖 9：比例尺 = 1 微米。

Cultured cells of *Pseudo-nitzschia calliantha*. Figure 1: Live cells in chain, girde 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, girde. 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 : 矽藻門 Bacillariophyta

綱 Class : 矽藻綱 Bacillariophyceae

目 Order : 矽藻目 Bacillariales

科 Family : 矽藻科 Bacillariaceae

異名 Synonyms : *Nitzschia actydropbila* 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。香港培植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.

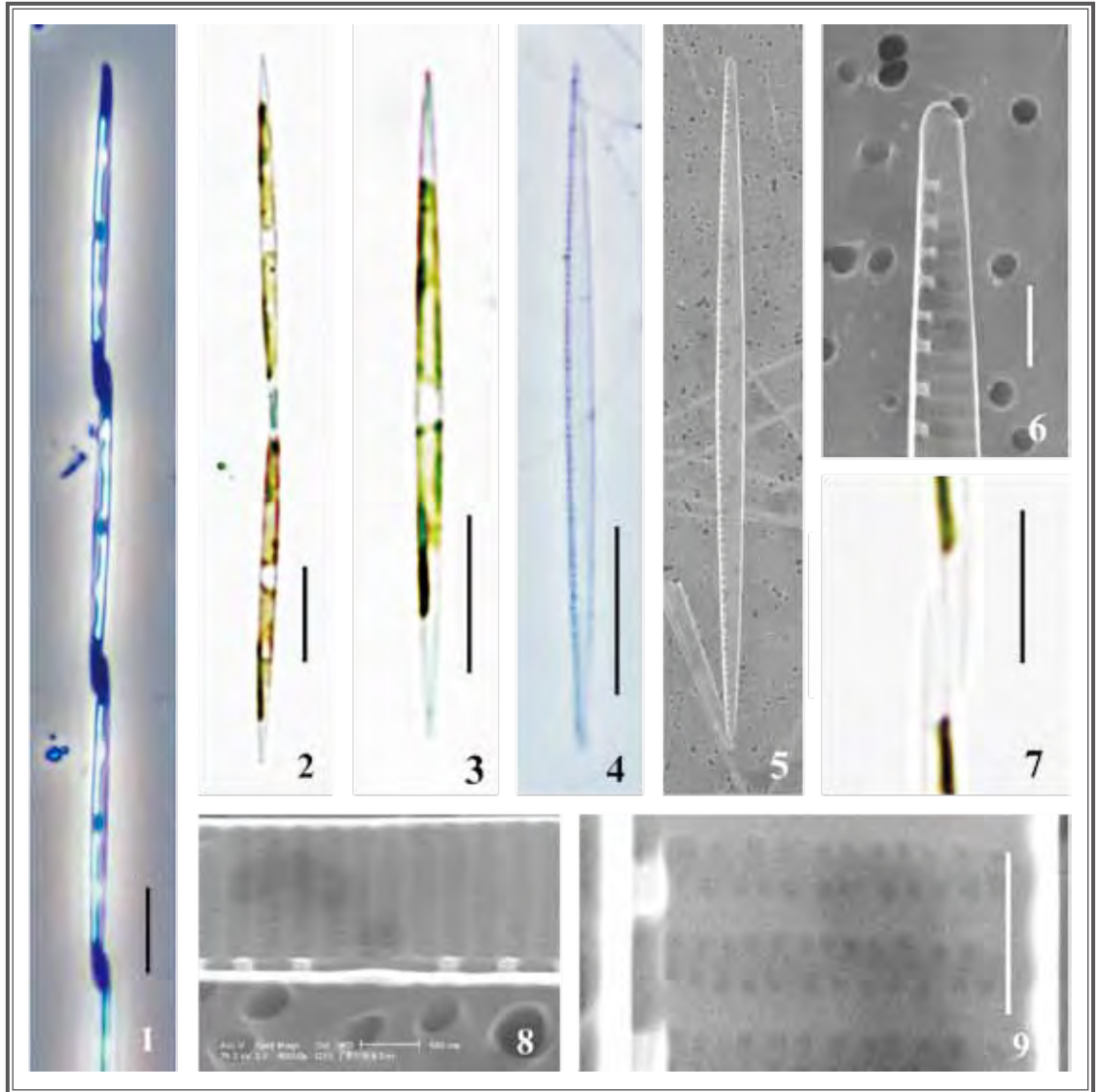
Toxicology: *P. delicatissima* is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). However local cell cultures did not find to produce domoic acid.

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.

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柔弱擬菱形藻培植藻株。圖 1：串連面、殼環面相位差活細胞圖片。圖 2：串連面、殼面觀活細胞。圖 3：活單細胞，兩端尖（殼面觀）。圖 4：酸洗細胞壁，殼面可見船骨點。圖 5：殼面（掃描電鏡觀）。圖 6：殼面頂端（掃描電鏡觀）。圖 7：交疊細胞（殼環面觀）。圖 8：殼面中央部份，顯示大中央間隙。圖 9：殼面中央部份，可見兩排孔紋（掃描電鏡觀）。圖 1-5：比例尺 = 10 微米；圖 6：比例尺 = 1 微米；圖 7：比例尺 = 5 微米；圖 9：比例尺 = 500 納米。

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 : 矽藻門 Bacillariophyta

綱 Class : 矽藻綱 Bacillariophyceae

目 Order : 矽藻目 Bacillariales

科 Family : 矽藻科 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。香港培植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 tuncated 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.

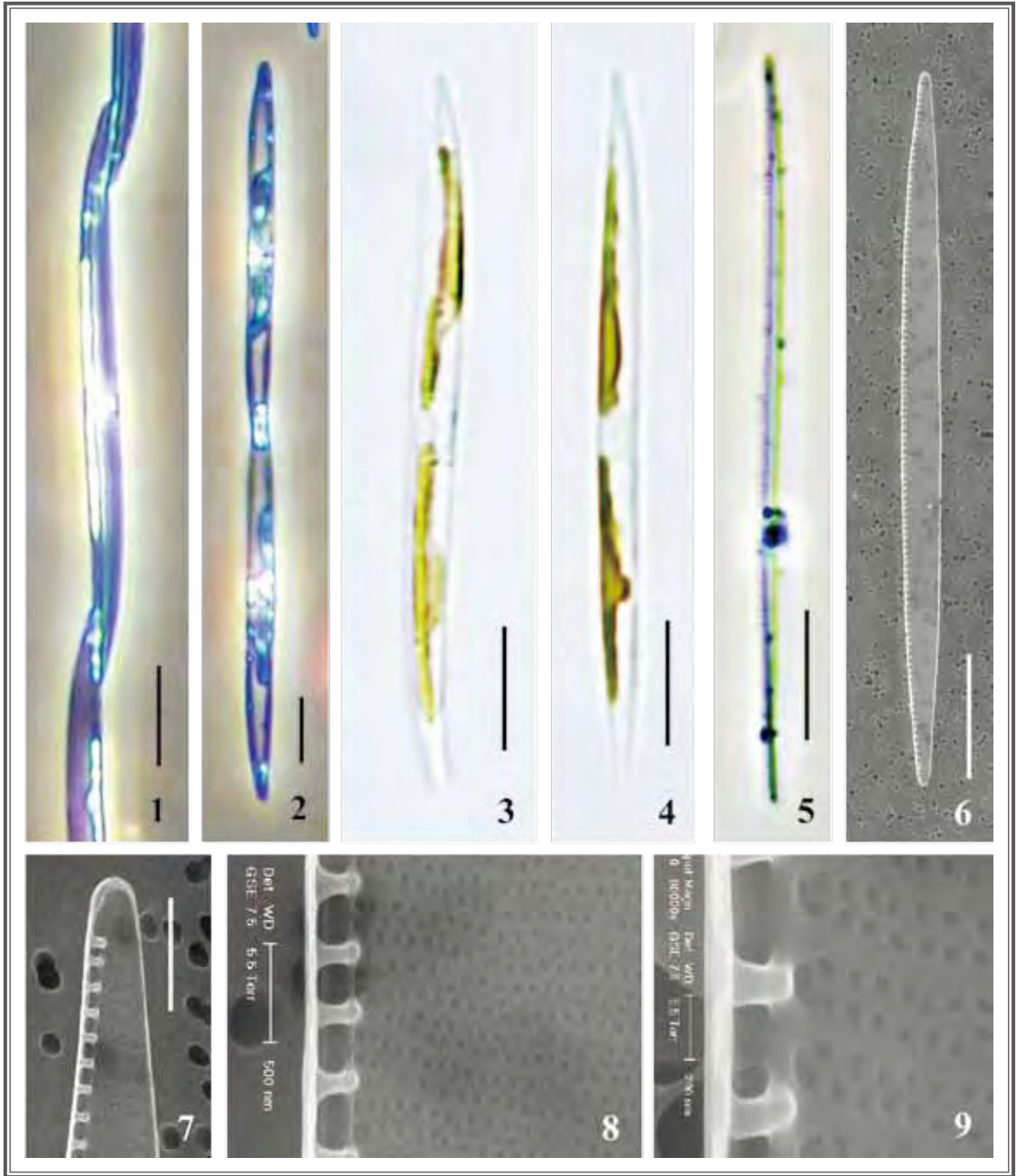
Toxicology: *P. multistriata* is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). Local cell cultures did not find to produce domoic acid.

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.

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- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 23-29,41-43. Denmark.
- Quijano-Scheggia, S., Garces, E, Van Lenning, K., Sampedro, N. and Camp, J. Sarno, D. and Dahlmann, J. 2005. First detection of diatom *Pseudo-nitzschia brasiliiana* (non toxic) and its relative *P. multistriata* (presumably toxic) in the NW Mediterranean Sea. pp. 5. *Harmful Algae News* 29. IOC of UNESCO. Spain.
- Sarno, D. and Dahlmann, J. 2000. Production of domoic acid in another species of *Pseudo-nitzschia*: *P. multistriata* in the Gulf of Naples (Mediterranean Sea). pp. 5. *Harmful Algae News*, 21. IOC of UNESCO. Mediterranean Sea.

BACILLARIOPHYCEAE



多紋擬菱形藻培植藻株。圖 1：串連面、殼環面相位差活細胞圖片。圖 2：串連面、殼面相位差活細胞圖片。圖 3：單細胞（殼環面觀）。圖 4：單細胞（殼面觀）。圖 5：殼環帶。圖 6：殼面（掃描電鏡觀）。圖 7：細胞頂端（掃描電鏡觀）。圖 8-9：殼面中央部份，顯示 2 至 3 排孔紋（掃描電鏡觀）。圖 1-6：比例尺 = 10 微米；圖 7：比例尺 = 2 微米。

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 : 矽藻門 Bacillariophyta

綱 Class : 矽藻綱 Bacillariophyceae

目 Order : 矽藻目 Bacillariales

科 Family : 矽藻科 Bacillariaceae

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

描述: 殼面觀的假柔弱擬菱形藻細胞畢直，中央收窄至接近兩端位置，兩端於殼面及殼環面觀均尖小。縱軸為 50 – 140 微米，橫軸為 1.3 – 3.4 微米，有中央間隙。細胞交疊位置佔總長度六分之一。每 10 微米肋紋間及船骨點數目分別為 29 – 46 及 14 – 26。另有一排孔紋，孔紋膜分為兩大部份，每 1 微米孔紋數目為 4 – 6。

毒性: 假柔弱擬菱形藻可產生引致失憶性貝類中毒的軟骨藻酸。本地培植的藻株每個細胞可產生 0.0035 微微克的軟骨藻酸。

地區分佈: 假柔弱擬菱形藻分佈於溫帶沿岸水域，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 1988 年及 1996 年在吐露港及南部水域引發 4 次紅潮，但沒有造成魚類死亡。

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.

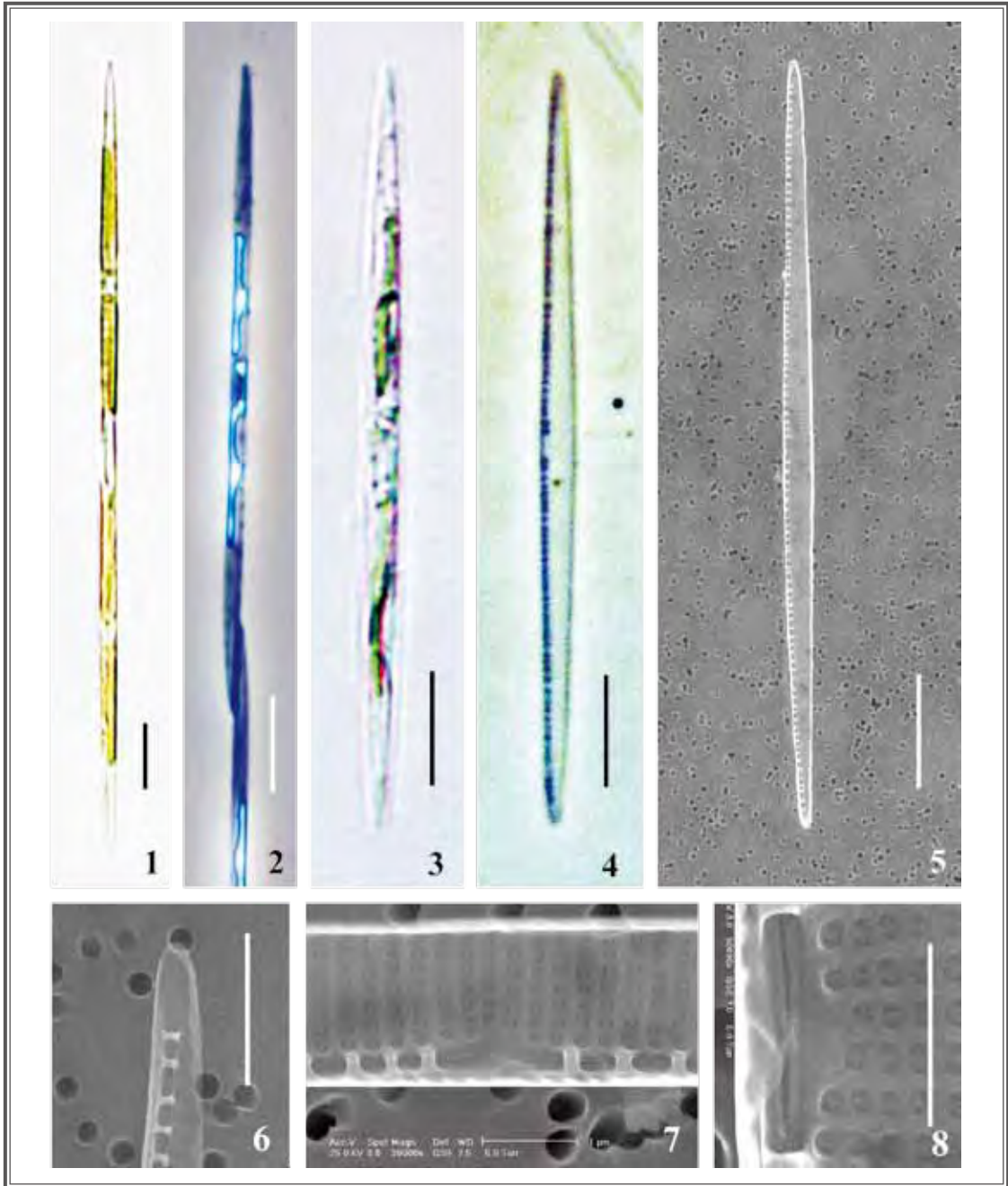
Toxicology: *P. pseudodelicatissima* is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). Local cell cultures found to produce 0.0035 pg of domoic acid per cell.

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:

- Hallegraeff, G. M. 1994. Species of the diatom genus *Pseudo-nitzschia* in Australian waters. *Botanica Marina*, 37:397-411.
- Hasle, G. R. 1965. *Nitzschia* and *Fragilariopsis* species studied in the light and electron microscopes II. The group *Pseudo-nitzschia*. Det Norske Videnskaps-Akademi I Oslo, I. Mat. Naturv Klasse, Ny Serie, No. 18: 1-45.
- Lundholm, N., Moestrup, O., Hasle, G. R. and Hoef-Emden, K. 2003. A study of the *P. pseudodelicatissima* / *cuspidata* complex (Bacillariophyceae) : what is *P. pseudodelicatissima*? *Journal of Phycology*, 39:797-813.
- Skov, J., Lundholm, N., Moestrup, O. and Larsen, J. 1999. *Potentially Toxic Phytoplankton: 4*. The diatom genus *Pseudo-nitzschia* (Diatomophyceae / Bacillariophyceae). ICES Identification Leaflets for Plankton.

BACILLARIOPHYCEAE



假柔弱擬菱形藻培植藻株。圖 1：串連面、殼面觀活細胞。圖 2：串連面、殼環面相位差活細胞圖片。圖 3：活細胞（殼面觀）。圖 4：酸洗細胞壁，殼面可見龍骨點及中央間隙。圖 5：殼面（掃描電鏡觀）。圖 6：殼面頂端（掃描電鏡觀）。圖 7：殼面中央部份，顯示大中央間隙、一排孔紋（掃描電鏡觀）。圖 8：高倍放大圖片，顯示大中央間隙及孔紋膜分為兩大部份。圖 1-5：比例尺 = 10 微米；圖 6：比例尺 = 2 微米；圖 7-8：比例尺 = 1 微米。

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 : 矽藻門 Bacillariophyta

綱 Class : 矽藻綱 Bacillariophyceae

目 Order : 矽藻目 Bacillariales

科 Family : 矽藻科 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。香港培植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 .

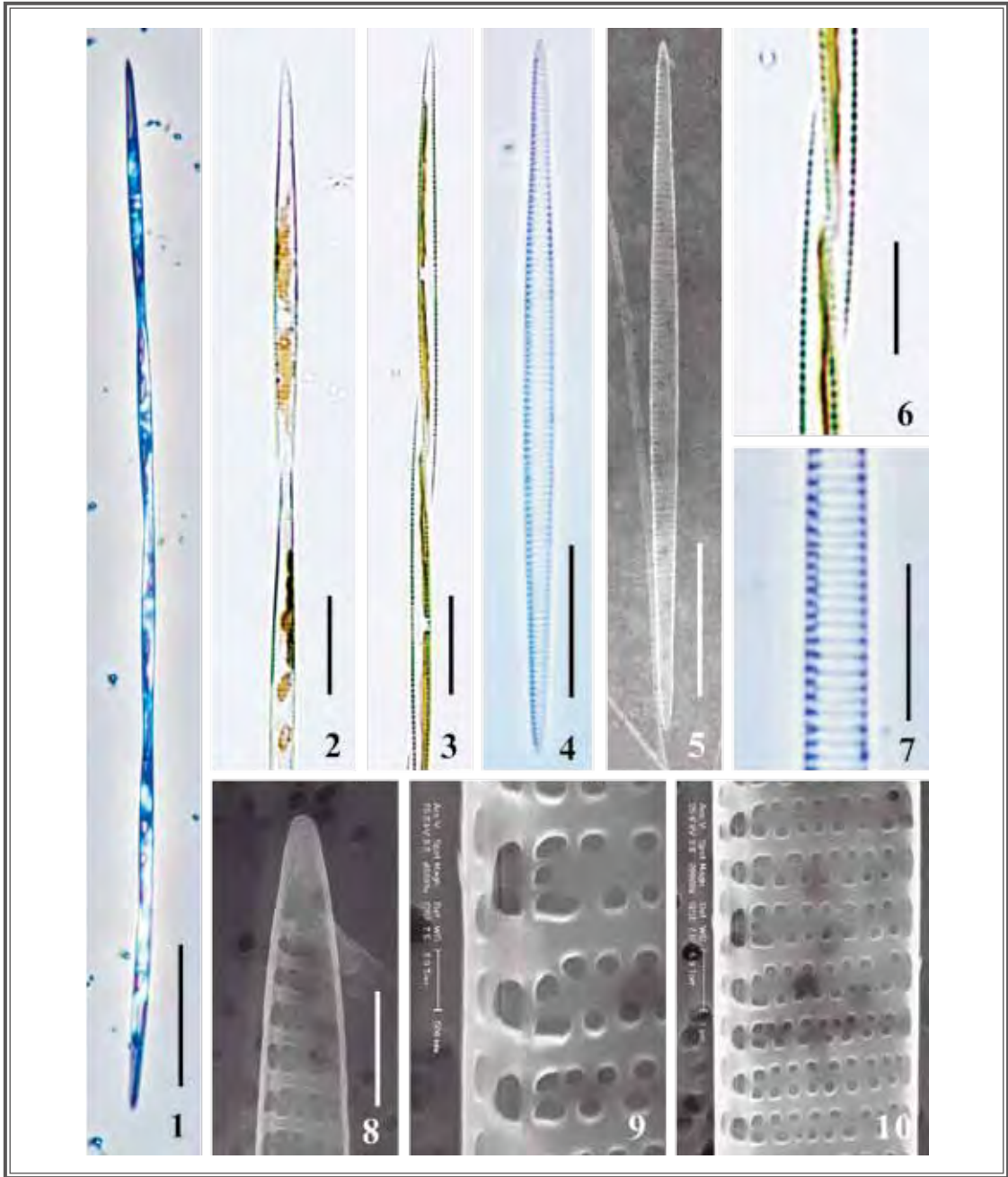
Toxicology: *P. pungens* is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). Local cell cultures did not find to produce domoic acid.

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:

- Hallegraeff, G. M. 1994. Species of the diatom genus *Pseudo-nitzschia* in Australian waters. *Botanica Marina*, 37:397-411.
- Hasle, G. R. 1965. *Nitzschia* and *Fragilariopsis* species studied in the light and electron microscopes II. The group *Pseudo-nitzschia*. Det Norske Videnskaps-Akademi I Oslo, I. Mat. Naturv Klasse, Ny Serie, No. 18: 1-45.
- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters*. *Opera Botanica* 140. Council for Nordic Publications in Botany. pp. 23-29,43-44. Denmark.
- Skov, J., Lundholm, N., Moestrup, O. and Larsen, J. 1999. *Potentially Toxic Phytoplankton: 4. The diatom genus Pseudo-nitzschia* (Diatomophyceae / Bacillariophyceae). ICES Identification Leaflets for Plankton.

BACILLARIOPHYCEAE



尖刺擬菱形藻培植藻株。圖 1：串連面、殼面觀及相位差細胞。圖 2：串連面、殼面觀活細胞。圖 3：串連面、殼面觀活細胞。圖 4：酸洗細胞壁，殼面可見船骨點及肋紋間。圖 5：殼面 (掃描電鏡觀)。圖 6：細胞交疊 (殼環面觀)。圖 7：殼面中央部份。圖 8：殼面頂端 (掃描電鏡觀)。圖 9：殼面中央部份，顯示沒有中央間隙 (掃描電鏡觀)。圖 10：殼面中央部份，可見兩排孔紋 (掃描電鏡觀)。圖 1：比例尺 = 50 微米；圖 2-5：比例尺 = 20 微米；圖 6-7：比例尺 = 10 微米；圖 8：比例尺 = 2 微米；圖 9-10：比例尺 = 500 納米。

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

門 Phylum : 褐胞藻門 Ochrophyta

綱 Class : 矽鞭藻綱 Dictyochophyceae

目 Order : 矽鞭藻目 Dictyochales

科 Family : 矽鞭藻科 Dictyochaceae

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

描述 : 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。細胞周邊分佈着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（嗜鐵性）。

毒性 : 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 : 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.

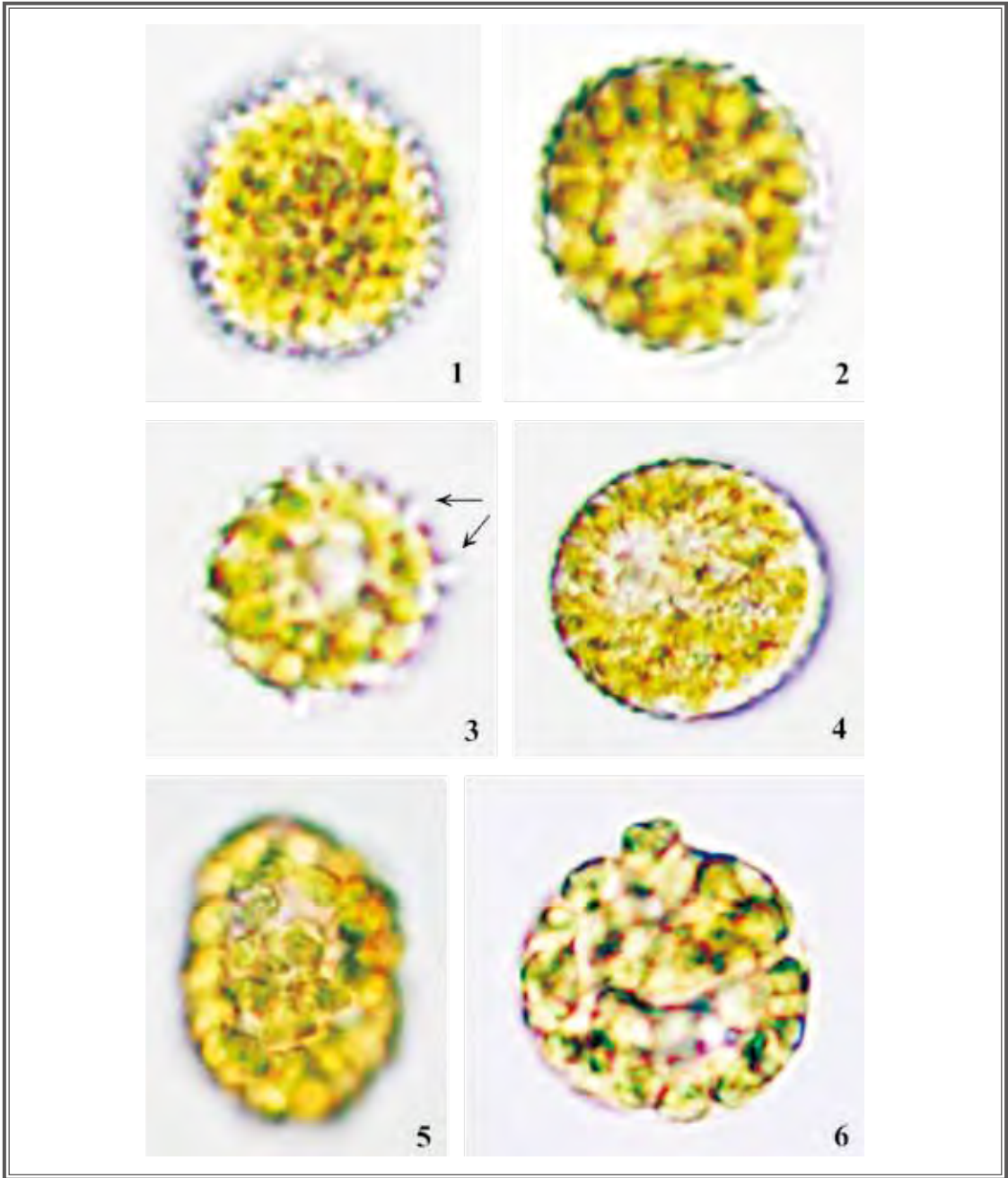
Toxicology: *P. verruculosa* is a suspected toxic species that causes fish kill according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

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:

- Fukuyo, Y., Takano, H., Chihara, M. and Matsuoka, K. 1990. *Red Tide Organisms in Japan-An Illustrated Taxonomic Guide*. pp. 342-343. Uchida Rokakuho, Co., Ltd. Tokyo, Japan.
- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 519. UNESCO publishing.
- Hosoi-Tanabe S., Honda D., Fukuya S., Otake I., Inagaki Y. & Sako, Y. 2007. Proposal of *Pseudochattonella verruculosa* gen. nov., comb. nov. (Dictyochophyceae), for a former raphidophycean alga *Chattonella verruculosa*, based on 18S rDNA phylogeny and ultrastructural characteristics. *Phycological Research*, 55: 185-192.

DICTYOPHYCEAE



疣突擬褐胞藻。圖 1-4：活體細胞可見無數細小的盤狀黃褐色葉綠體；細胞周邊分佈着多個有子彈狀包體的大黏液泡；光學顯微鏡下可見疣突（箭咀）。圖 5-6：以魯哥氏液固定的不同形狀細胞。

Pseudochattonella verruculosa. Figures 1-4: Live cells showing numerous small and disc-shaped 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

門 Phylum : 褐胞藻門 Ochrophyta
綱 Class : 矽鞭藻綱 Dictyochophyceae
目 Order : 矽鞭藻目 Dictyochales
科 Family : 矽鞭藻科 Dictyochaceae

異名 Synonym : *Chattonella globosa* 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，大量淡褐或金褐色橢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.

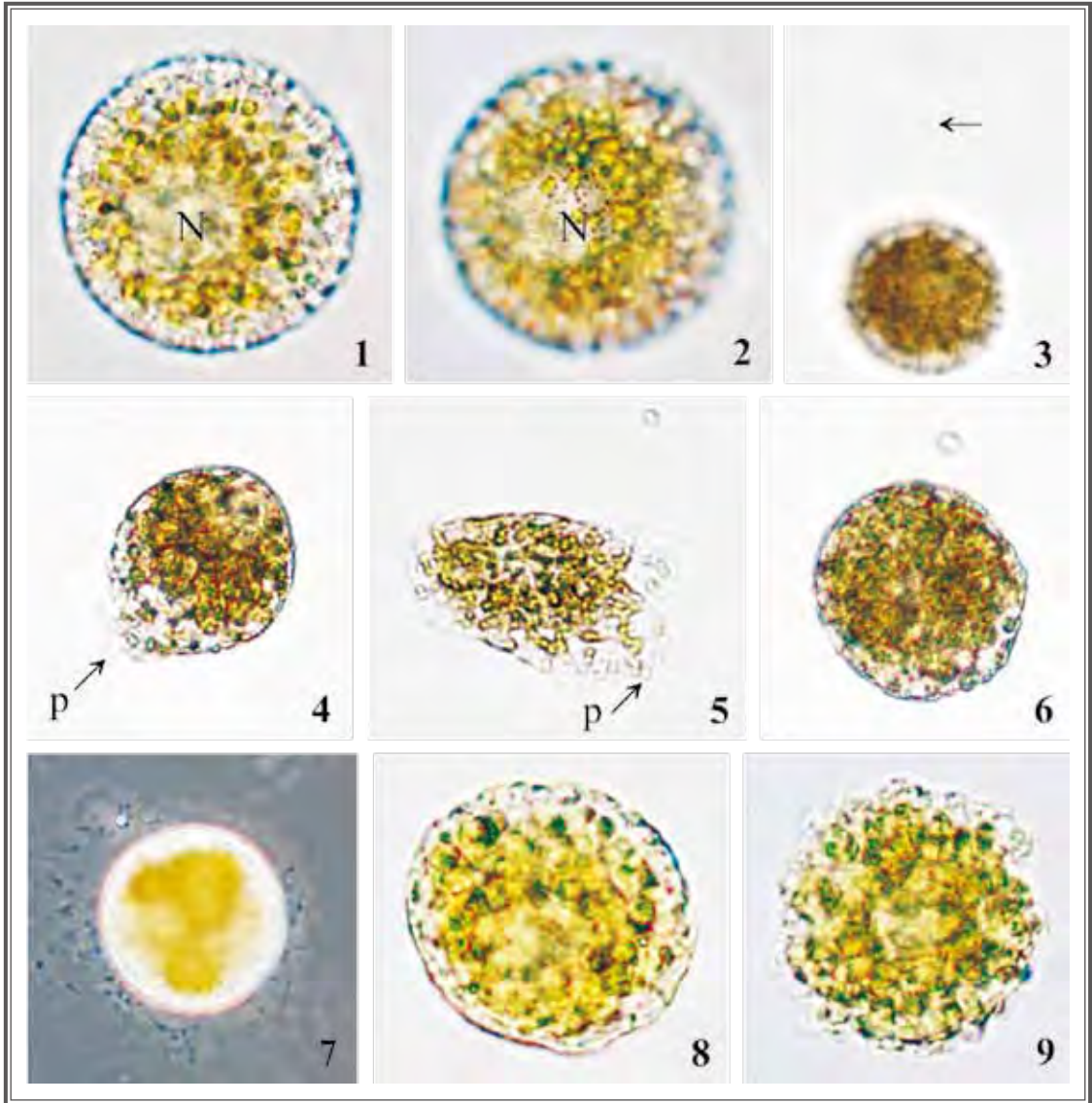
Toxicology: *V. globosus* is toxic species that causes respiratory damage in fish according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

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.

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- Fukuyo, Y., Takano, H., Chihara, M. and Matsuoka, K. 1990. *Red Tide Organisms in Japan-An Illustrated Taxonomic Guide*. pp. 334-335. Uchida Rokakuho, Co., Ltd. Tokyo, Japan.
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- Chang, F. H., McVeagh, M., Gall, Mark and Smith, P. 2012. *Chattonella globosa* is a member of Dictyochophyceae: reassignment to *Vicicitus* gen. nov., based on molecular phylogeny, pigment composition, morphology and life history. *Phycologia*, 51(4):403-420.

DICTYOCOPHYCEAE



Vicicitus globosus。圖 1-2：活細胞，顯示呈球狀，細胞核 (N) 位於細胞的上至中心位置；並有無數細小的橢球形淡褐色或金褐色葉綠體；細胞周邊有多個大黏液泡，內有指甲狀包體；使細胞表面呈疣狀。圖 3：拖曳鞭毛游動的活細胞（箭咀）；鞭毛膨大區（膨脹部分）清晰可見。圖 4-6：在拍攝時段內（約 1 分鐘），變形細胞在數十秒內由游動球狀演變突出的假足及至回復球狀（圖 6）。圖 7：強光照射下黏液泡釋出黏液。圖 8-9：以魯哥氏液固定的細胞。

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 globular form (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.

擬鏈狀亞歷山大藻

Alexandrium acatenella (Whedon & Kofoid) Balech 1985

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 : *Gonyaulax acatenella* Whedon & Kofoid 1936, *Protogonyaulax acatenella* (Whedon & Kofoid) Taylor 1979, *Gessnerium acatenellum* (Loeblich III & Loeblich) Taylor 1979

描述 : 擬鏈狀亞歷山大藻是單細胞的小至中型藻，體長為 35 – 51 微米，寬 26 – 44 微米。正面觀細胞長度大於寬度，輪廓稍呈稜角，上殼片比下殼片長，表面有明顯圓孔紋，底部有兩根短刺，沒有頂角。第一片頂甲片直接與頂孔甲 (Po) 相連接，正面有一小腹孔，頂孔甲 (Po) 大致呈橢圓形，正面漸窄。橢圓細胞核呈 C 形而有橫溝。

毒性 : 擬鏈狀亞歷山大藻可產生麻痺性貝殼毒素。香港的藻株疑有毒性，但尚未能確定。

地區分佈 : 擬鏈狀亞歷山大藻很少出現在亞洲海域。這種藻頗為罕見，不曾引致紅潮，只有 2003 年在香港東部海域錄得。

Description: *Alexandrium acatenella* occurs as 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.

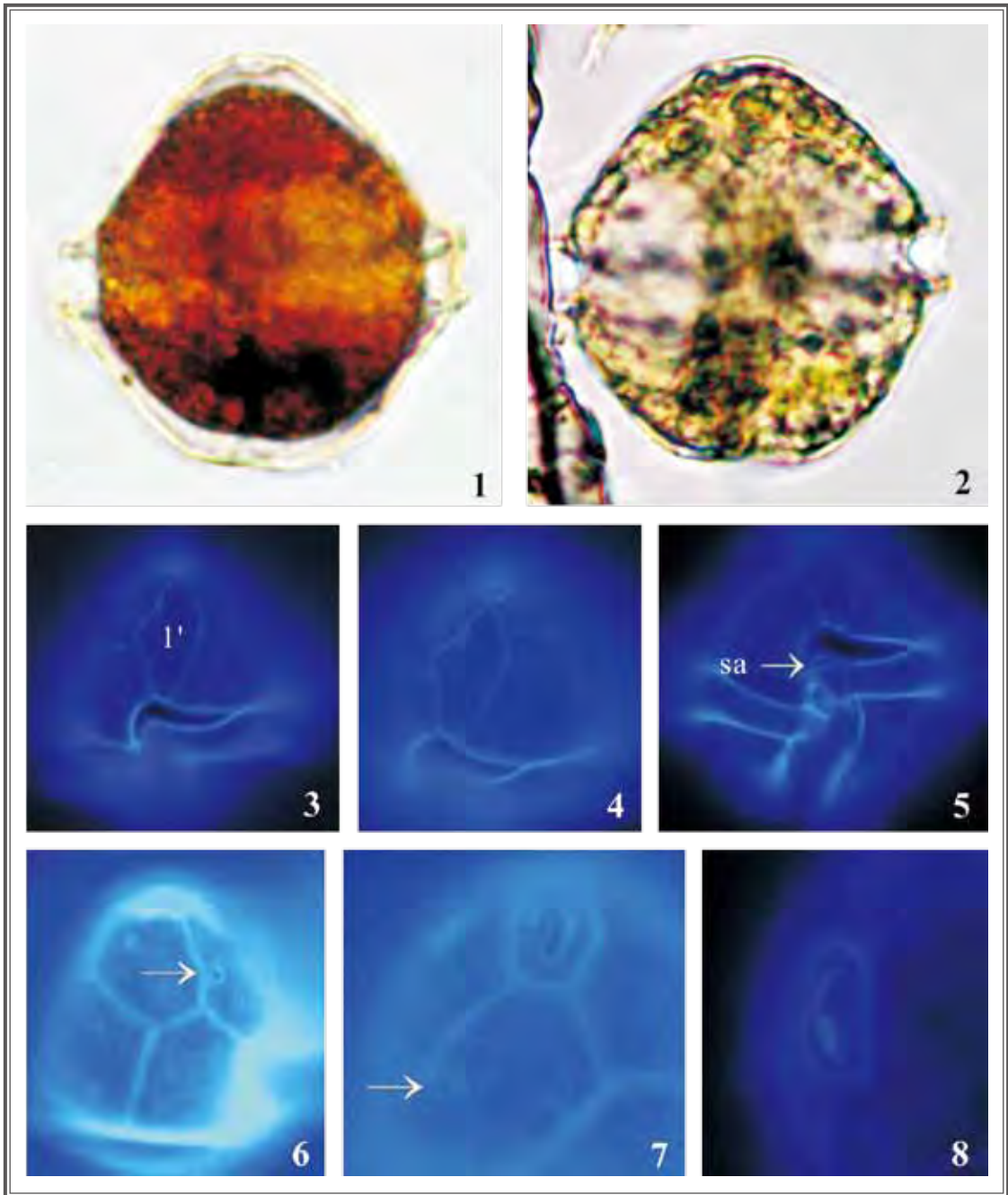
Toxicology: *A. acatenella* is capable of producing Paralytic Shellfish Poisoning (PSP) toxins. Toxicity of the Hong Kong strain is uncertain.

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.

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- Balech, E. 1995. *The Genus Alexandrium Halim (Dinoflagellata)*. pp. 44-45. A Sherkin Island Marine Station, Ireland.
- Carmelo, R. T. 1997. *Identifying Marine Phytoplankton*. pp. 488-490. Academic Press. USA.
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- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 74-83. Denmark.

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擬鏈狀亞歷山大藻。圖 1-2：魯哥氏碘液固定細胞正面觀，顯示上殼片略長於下殼片。圖 3-4：第 1 片甲片正面有孔和刺絲泡。圖 5：前縱溝甲片 (sa) 有皺襞 (箭咀)。圖 6-7：不同細胞的正面觀，顯示第一片甲片及腹孔 (vp) 的不同位置 (箭咀)。圖 8：頂孔甲 (Po) 沒有前黏附孔 (aap)。

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).

鏈狀亞歷山大藻

Alexandrium catenella (Whedon & Kofoid) Balech 1985

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 : *Gonyaulax catenella* Whedon & Kofoid 1936, *Protogonyaulax catenella* (Whedon & Kofoid) Taylor 1979, *Gessnerium catenellum* (Loeblich III & Loeblich) Taylor 1979

描述 : 鏈狀亞歷山大藻的藻體為單細胞，較常由 2、4 或 8 個細胞串連成短鏈狀，細胞為圓形，長 20 – 48 微米，寬 18 – 56 微米，頂部偏圓，末端稍凹。細胞寬長度大於長度及細胞表面有淺圓孔紋，頂孔甲 (Po) 大致呈三角形，相連孔較大。第一片頂甲片與頂孔甲相連接，沒有腹孔。頂孔甲內是獨特的魚鉤形殼頂孔。串連成鏈狀時，前後黏附孔均清晰可見。細胞核呈 U 形。

毒性 : 鏈狀亞歷山大藻可製造麻痺性貝類毒素，香港的藻株已證實有毒性。麻痺性貝類毒素 (C1 – C4 毒素、蛤科毒素及膝溝藻毒素) 是透過污染貝類傳播，對人類和其他哺乳類均構成影響，並可能危害魚類。

地區分佈 : 鏈狀亞歷山大藻廣泛分佈於溫帶沿海水域，曾經在澳洲、日本、中國東海水域及中國南海水域包括香港形成紅潮。這種藻曾在澳洲及日本引起麻痺性貝類中毒事件。

鏈狀亞歷山大藻在 1989 及 2011 年曾在香港東南及東北部水域引發 2 次紅潮，但並沒有造成魚類死亡。於 1990 – 1992 年、1996 年、2000 – 2004 年本港周圍水域均有發現這種藻，但出現率低，在 2005 年至今出現頻率較高。

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.

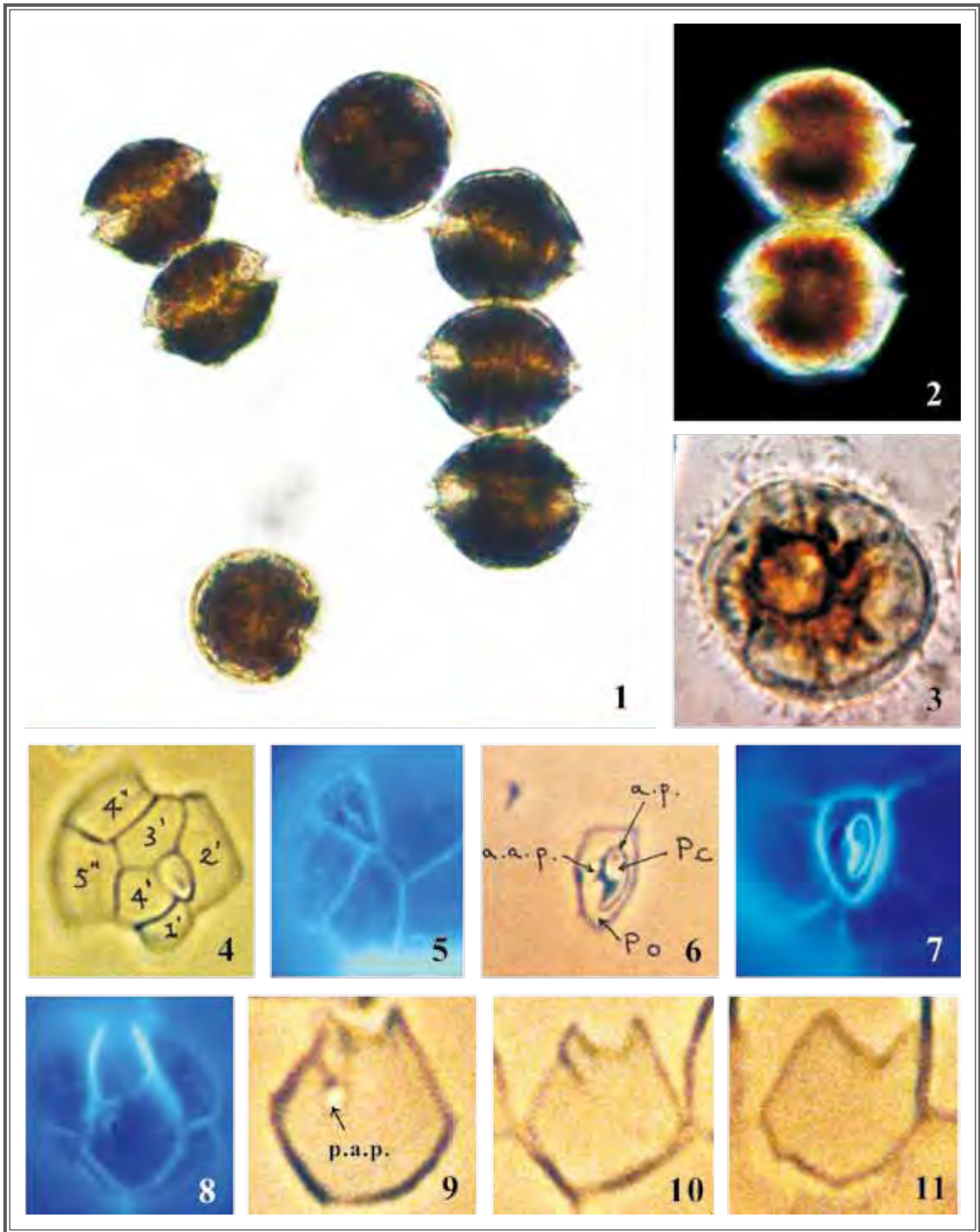
Regional distribution: *A. catenella* is widely distributed in cold temperate coastal waters and caused red tides in Australia, Japan, East China Sea, South China Sea including Hong Kong and resulted in Paralytic Shellfish Poisoning in Australia and Japan.

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.

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- Balech, E. 1995. *The Genus Alexandrium Halim (Dinoflagellata)*. pp. 48-50. A Sherkin Island Marine Station, Ireland.
- Faust, M. A. and Gulledge, R. A. 2002. *Identification Harmful Marine Dinoflagellates*, United States National Herbarium 42:11-12, 98.
- Fukuyo, Y., Takano, H., Chihara, M. and Matsuoka, K. 1990. *Red Tide Organisms in Japan-An Illustrated Taxonomic Guide*. pp. 86-87. Uchida Rokakuho, Co., Ltd. Tokyo, Japan.
- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 404-405. UNESCO publishing.

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鏈狀亞歷山大藻。圖 1-2：魯哥氏碘液固定細胞。圖 3：包囊。圖 4-5：頂觀顯示第 1 片甲片沒有腹孔。圖 6-7：頂孔甲 (PO) 有前黏附孔 (app)。圖 8-9：後縱溝甲片有後黏附孔 (pap)。圖 10-11：後縱溝甲片沒有後黏附孔 (pap)。

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 (aap). 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).

豐迪亞歷山大藻

Alexandrium fundyense Balech 1985

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

描述 : 豐迪亞歷山大藻是小至中型藻，大致呈球形，長度稍大於寬度，介乎 27 至 50 微米，細胞一般單個或成對排列，偶有四個排列。成對細胞可能有前黏附孔 (aap) 及後黏附孔 (pap)，殼片薄而平滑，第一片頂甲片或可與頂孔甲 (Po) 相連接，沒有腹孔，第四片甲片有明顯斑紋。頂孔甲內有大魚鉤形殼頂孔及圓形小前黏附孔。

毒性 : 豐迪亞歷山大藻可產生麻痺性貝類毒素，香港的藻株疑有毒性，但尚未能確定。

地區分佈 : 豐迪亞歷山大藻很少出現在亞洲海域及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 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 4th plate. Po houses a large fishhook shaped foramen and a small round aap.

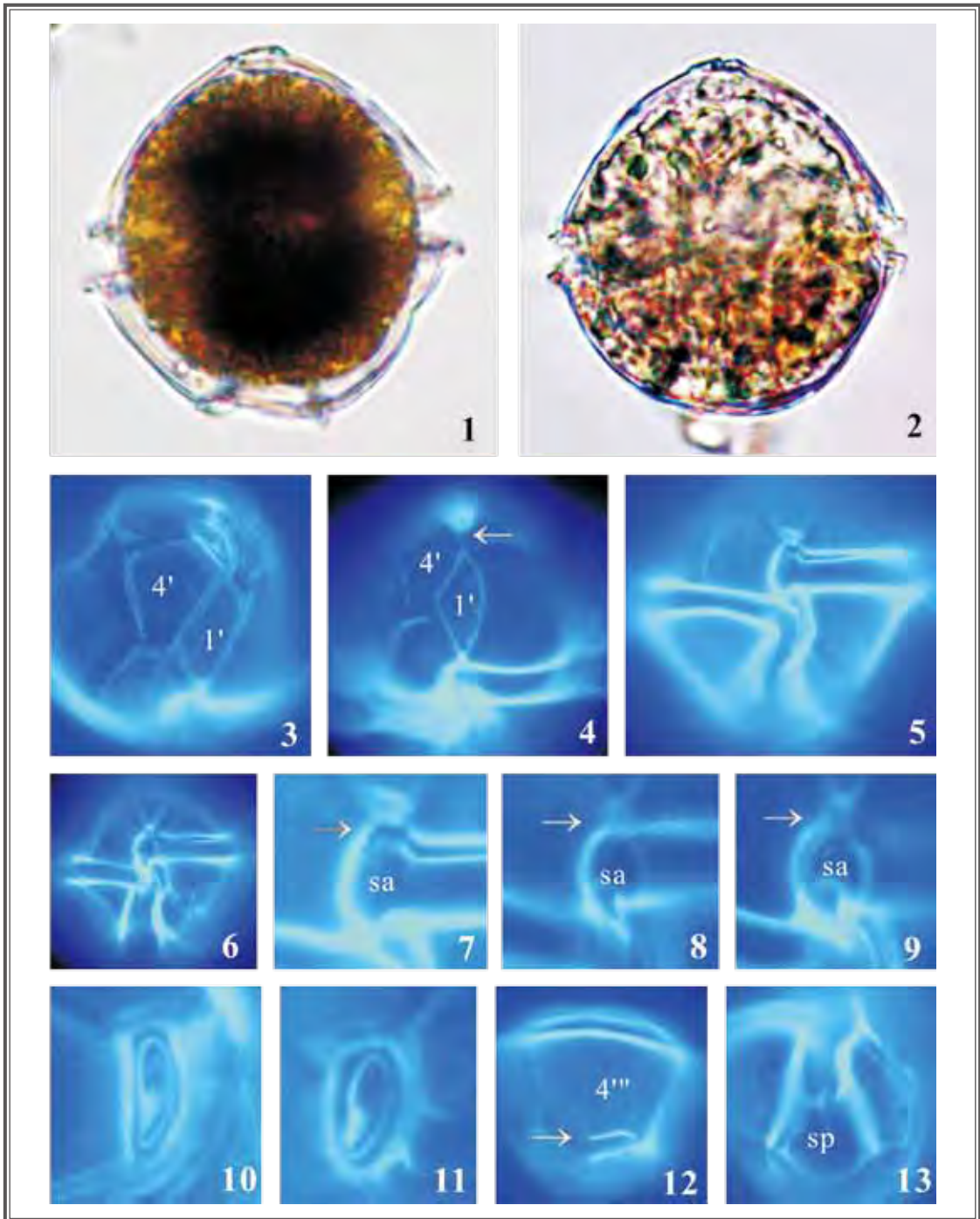
Toxicology: *A. fundyense* is capable of producing paralytic shellfish poisoning (PSP) toxins. Toxicity of the Hong Kong strain is uncertain.

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.

參考文獻 References:

- Balech, E. 1995. *The Genus Alexandrium Halim (Dinoflagellata)*. pp. 43. A Sherkin Island Marine Station, Ireland.
Carmelo, R. T. 1997. *Identifying Marine Phytoplankton*. pp. 494. Academic Press. USA.
La Du, J., Erdner, D., Dyhrman, S. and Anderson, D. 2002. Molecular Approaches to Understanding Population Dynamics of the Toxic Dinoflagellate *Alexandrium fundyense*. *The Biological Bulletin*, 203:244-245.

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豐迪亞歷山大藻。圖 1-2：不同細胞正面觀。圖 3-4：第一與第四片甲片之間沒有腹孔，第一片甲片可觸及或不觸及頂孔甲 (Po) (箭咀)。圖 5-6：正面觀。圖 7：前縱溝甲 (sa) 前段穿透第一片甲片 (箭咀)。圖 8-9：前縱溝甲 (sa) 前段不穿透第一片甲片 (箭咀)。圖 10-11：頂孔甲。圖 12：第四片甲片可見明顯斑紋 (箭咀)。圖 13：後縱溝甲 (sp)。

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).

廣野亞歷山大藻

Alexandrium hiranoi Kita & Fukuyo 1988

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

描述 : 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殼環帶寬度。

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，不會在香港引致紅潮。

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.

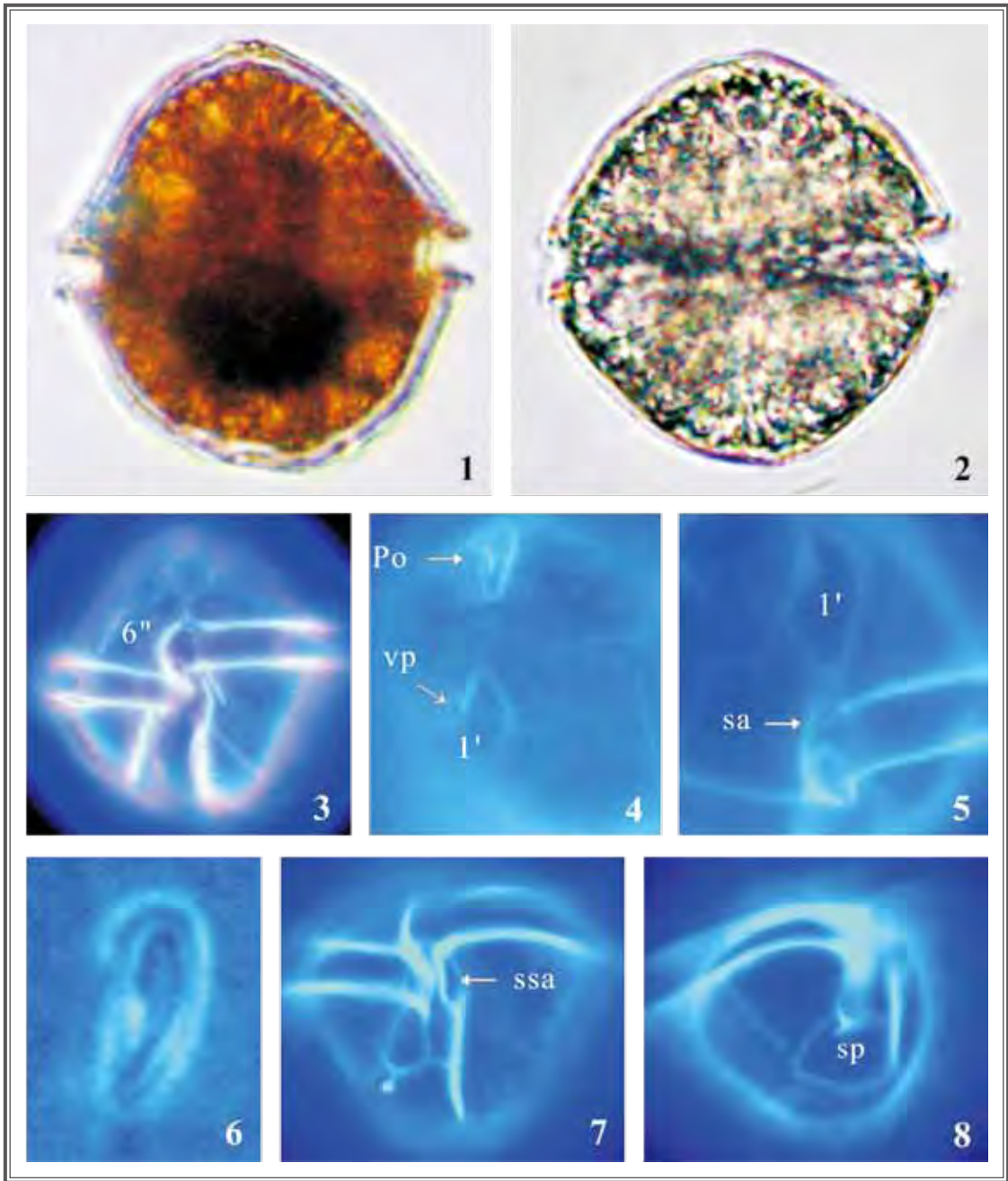
參考文獻 References:

Balech, E. 1995. *The Genus Alexandrium Halim (Dinoflagellata)*. pp. 82. A Sherkin Island Marine Station, Ireland.

Carmelo, R. T. 1997. *Identifying Marine Phytoplankton*. pp. 494. Academic Press. USA.

Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 405-406. UNESCO publishing.

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廣野亞歷山大藻。圖 1-2：以魯哥氏碘液固定的細胞。圖 3：正面觀，顯示第六片甲片長度大於寬度。圖 4：正面觀。圖 4：前正面觀，顯示頂孔甲 (Po) 不直接觸及第一片甲片。圖 5：前縱溝甲 (sa) 有前翼片 (箭咀)。圖 6：頂孔甲 (Po)。圖 7：左前側片 (ssa) 窄長 (箭咀)。圖 8：後縱溝甲 (sp)。

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

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 : *Pyrodinium minutum* (Halim) Taylor 1976, *Alexandrium ibericum* Balech 1985, *A. lusitanicum* Balech 1985, *A. angustitabulatum* F.J.R. Taylor in Balech 1995

描述 : 微小亞歷山大藻藻體細小，呈球形或橢圓形，底端略扁平，直徑介乎 15 – 30 微米。細胞單個，很少成對排列，上殼片比下殼片大，呈半橢圓錐形，兩側凸出。頂孔甲 (Po) 呈橢圓或大致三角形，後側尖小，有寬大的逗號形狀殼頂孔。頂孔甲與第一片頂甲片相連接，有小腹孔。獨特的第六片前橫溝甲 (6^{''}) 形狀狹長。

毒性 : 微小亞歷山大藻可製造麻痺性貝類毒素 (膝溝藻毒素)，這類毒素對人類、其他哺乳類及鳥類構成影響，並可能危害魚類。香港藻株已證實有毒性。

地區分佈 : 微小亞歷山大藻廣泛分佈於世界沿海水域，曾經在澳洲、紐西蘭及台灣形成紅潮及引起麻痺性貝類中毒事件。這種藻甚少在香港水域出現，不曾引致紅潮，於香港東北部及南部海域有記錄，細胞濃度低。

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.

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.

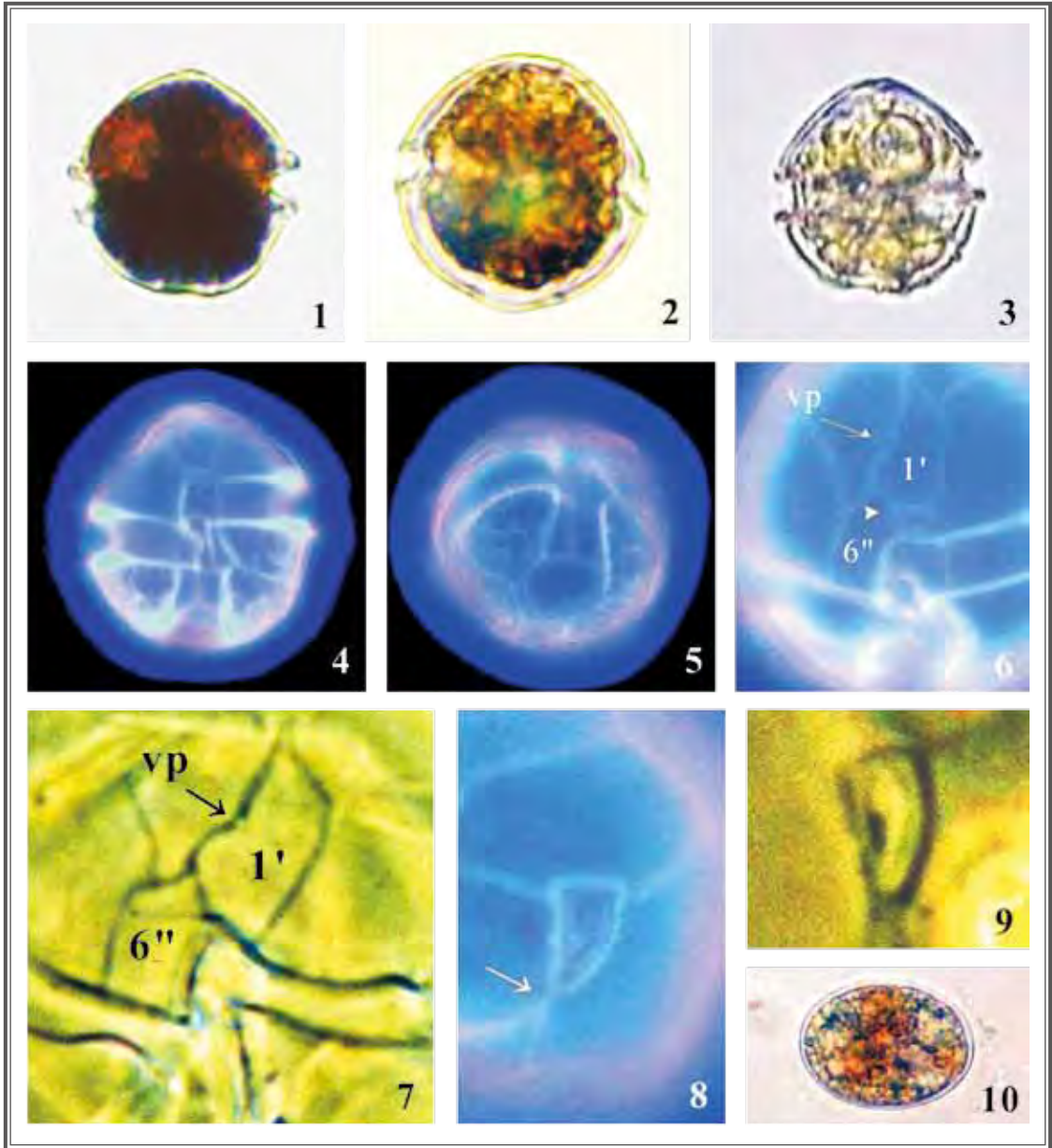
Regional distribution: *A. minutum* is widely distributed in coastal waters worldwide. It caused red tides in Australia, New Zealand and Taiwan and led to paralytic shellfish poisoning events.

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.

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- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 406. UNESCO publishing.
- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 99-101. Denmark.

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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 aeration. 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.

奧斯亞歷山大藻

Alexandrium ostenfeldii (Paulsen) Balech & Tangen 1985

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 : *Goniodoma ostenfeldii* Paulsen 1904, *Goniaulax ostenfeldii* (Paulsen) Paulsen 1949, *Triadinium ostenfeldii* (Paulsen) Dodge 1976, *Gessnerium ostenfeldii* (Paulsen) Loeblich III & Loeblich 1979, *Pyrodinium phoneus* Woloszynska & Conrad 1939, *Gonyaulax globosa* (Braarud) Balech 1971, *Protogonyaulax globosa* (Braarud) Taylor 1979, *Gonyaulax trygvei* Parke 1976, *Heteraulacus ostenfeldii* (Paulsen) Loeblich III 1970, *Goniaulax tamarensis* var. *globosa* Braarud 1945

描述 : 奧斯亞歷山大藻是獨特的非鏈狀藻，細胞圓大而平滑，大小介乎 30 至 56 微米，有記錄最大樣本為 71 微米。殼片頗薄，佈滿不均勻的小孔。第一片頂甲片窄長，呈不對稱形狀，有特大腹孔。頂孔甲 (Po) 相對偏大，有寬大逗號形狀殼頂孔。

毒性 : 奧斯亞歷山大藻可產生麻痺性貝類毒素及神經毒素 (螺旋藻毒)。香港的藻株疑有毒性，但尚未確定。

地區分佈 : 奧斯亞歷山大藻很少出現在亞洲海域，不曾在香港水域導致紅潮。這種藻極少出現，過去在香港南部、西部及東北部海域錄得低濃度。

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.

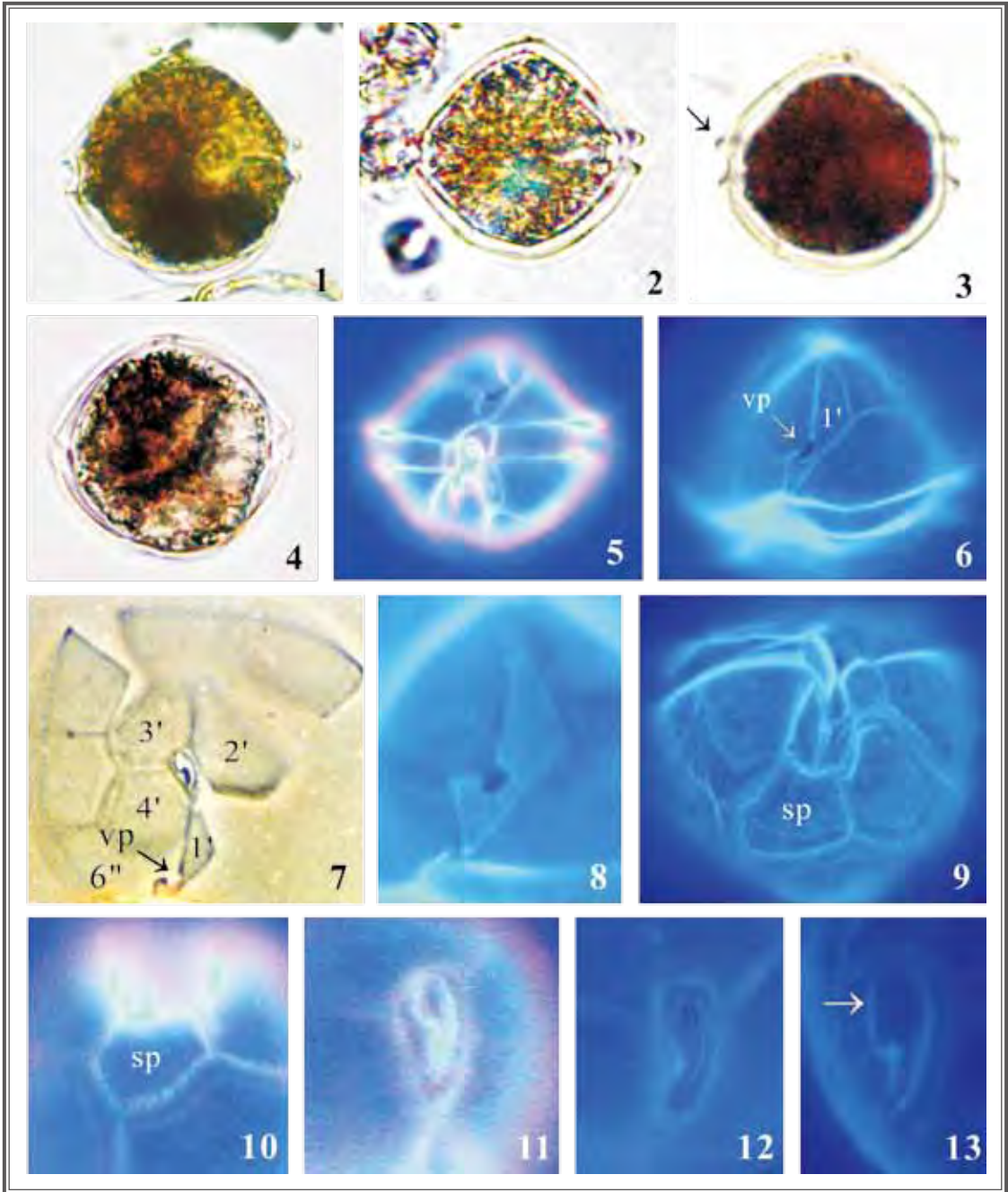
Toxicology: *A. ostenfeldii* is capable of producing paralytic shellfish poisoning (PSP) toxins and a neurotoxin, spirolide. Toxicity of the Hong Kong strain is uncertain.

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:

- Carmelo, R. T. 1997. *Identifying Marine Phytoplankton*. pp. 499. Academic Press. USA.
- Cembella, A. D., Lewis, N. I. and Quilliam, M. A. 2000. The marine dinoflagellate *Alexandrium ostenfeldii* (Dinophyceae) as the causative organism of spirolide shellfish toxins. *Phycologia*, 39(1):67-74.
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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殼頂孔（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

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** : *Goniodoma pseudogoniaulax* Biecheler 1952

描述 : 擬漆亞歷山大藻是中至大型非鏈狀藻，細胞寬度比長度大，上殼片比下殼片稍短，長 34 – 60 微米，寬 39 – 69.5 微米。殼片薄而平滑，佈滿微細小孔。第一片頂甲不觸及頂孔甲 (Po) 而呈五角形，第四片甲片邊緣有闊大腹孔。頂孔甲 (Po) 呈橢圓形，有寬大逗號形狀殼頂孔及多個不規則小孔。

毒性 : 擬漆亞歷山大藻可產生麻痺性貝類毒素及獨有的 Goniodomin A (GA) 藻毒素，據外國文獻調查顯示有抑制真菌作用。香港的藻株疑有毒性，但尚未能確定。

地區分佈 : 擬漆亞歷山大藻於越南及日本水域有記錄。這種藻常見於香港海域，但細胞濃度低，不曾在香港水域引致紅潮。

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.

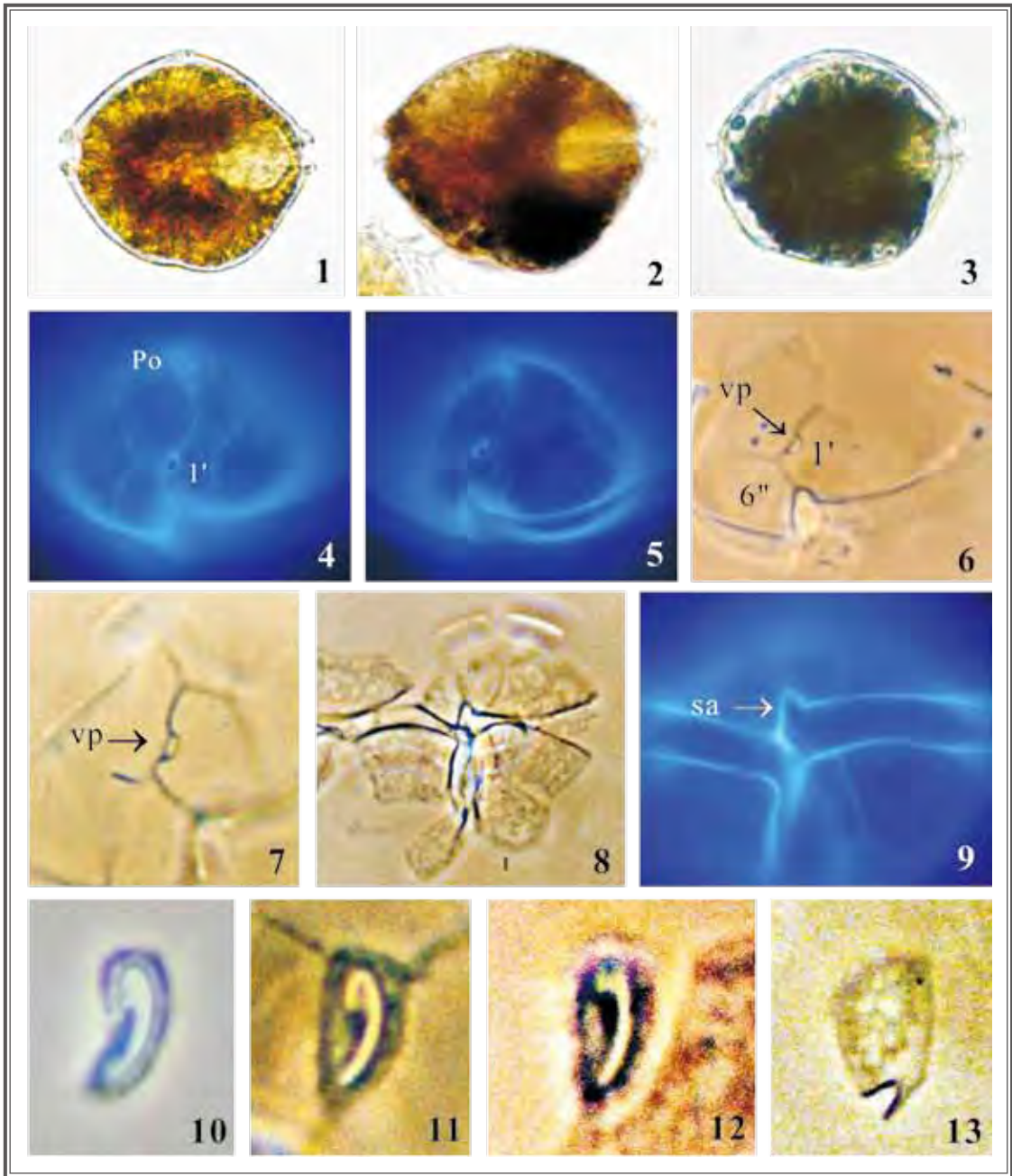
Toxicology: *A. pseudogonyaulax* is capable of producing paralytic shellfish poisoning (PSP) toxins and unique phycotoxin, Goniodomin A (GA) which has an antifungal effect according to overseas findings. Toxicity of the Hong Kong strain is uncertain.

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.

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擬漆亞歷山大藻。圖 1-3：不同細胞正面觀。圖 4-5：前正面觀，顯示第一片甲片不觸及頂孔甲 (Po)。圖 6-7：第一片甲片呈五角形，有關大圓形腹孔 (vp)(箭咀)。圖 8：網狀殼甲。圖 9：前縱溝甲 (sa) 前段突出，伸至上殼片 (箭咀)。圖 10-12：不同形狀的頂孔甲。圖 13：後縱溝甲。

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

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 : *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 : 塔馬亞歷山大藻是小至中型藻，藻體近球形，長度稍大於寬度，長 22 – 51 微米，寬 17 – 50 微米。細胞單個或成對排列，亦偶有四個排列。成對細胞可能有前連接孔 (aap) 及後連接孔 (pap)，殼片薄而平滑，第一片頂甲片有小腹孔，與頂孔甲 (Po) 相連接。頂孔甲內有寬大魚鉤形殼頂孔及小圓形前連接孔。

毒性 : 塔馬亞歷山大藻可產生麻痺性貝類毒素，香港藻株已證實有毒性。麻痺性貝類毒素 (膝溝藻毒素、新蛤科毒素及蛤科毒素) 是透過污染貝類傳播，對人類或其他哺乳類構成影響，並可能危害魚類。

地區分佈 : 塔馬亞歷山大藻分佈於溫帶水域，曾經在日本、菲律賓、澳洲、馬來西亞、中國東海水域及中國南海水域包括香港形成紅潮。塔馬亞歷山大藻常見於香港海域，但濃度低。曾於 1991 年及 1993 年在東南部海域造成 2 次紅潮，但沒有導致魚類死亡。

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.

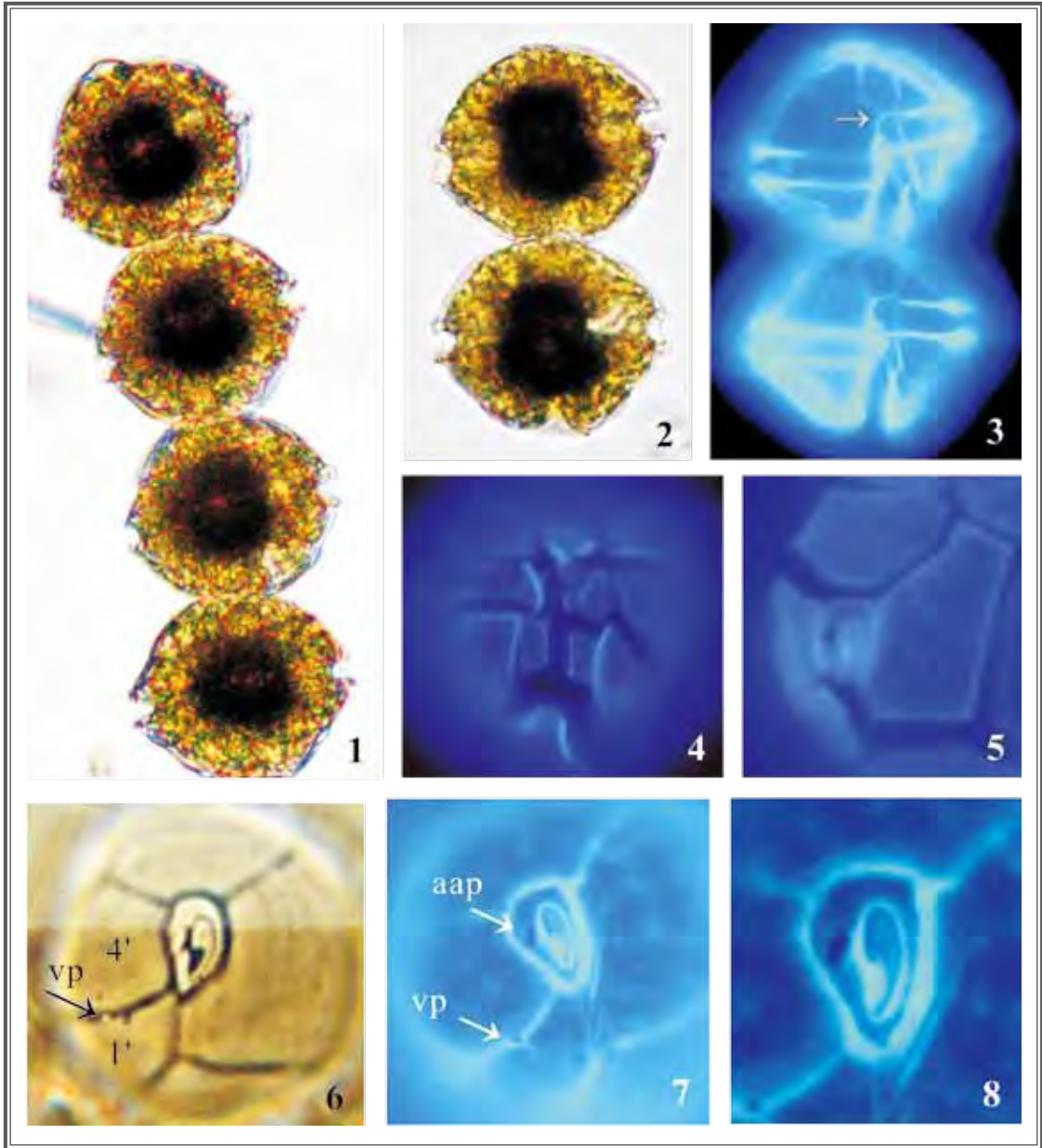
Toxicology: *A. tamarense* is a paralytic shellfish poisoning (PSP) producer and toxicity of the Hong Kong strain is confirmed. The PSP toxins (gonyautoxins, neosaxitoxin and saxitoxin), transmitted via contaminated shellfish, can affect humans or other mammals and possibly fish.

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.

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塔馬亞歷山大藻。圖 1-2：以魯哥氏液固定的鏈狀細胞。圖 3：前縱溝甲 (sa) 有皺襞 (箭咀)。圖 4：正面觀顯示縱溝甲。圖 5-8：頂面觀顯示頂孔甲有前黏附孔 (aap)，第一片甲片有腹面孔 (vp)。

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鏈狀藻，一般由 8 個或以上細胞串連成鏈狀，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 (s.a.) has a pre-cingular part. The round posterior attachment pore is present in the center of the posterior sulcal plate (sp).

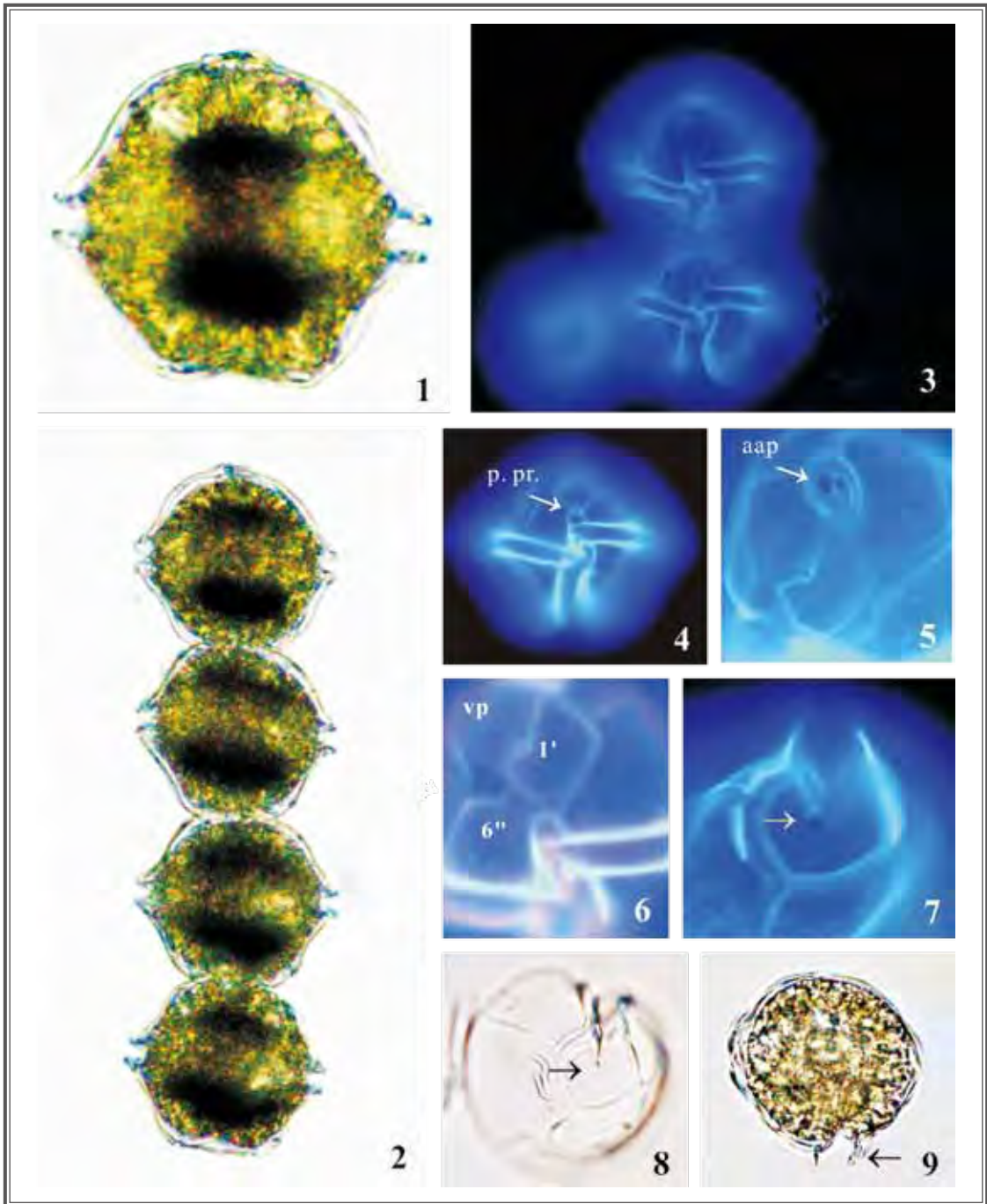
Toxicology: *A. tamiyavanichii* is capable of producing potent paralytic shellfish poisoning (PSP) toxins (gonyautoxins and saxitoxin) according to overseas findings. Toxicity of the Hong Kong strain is uncertain.

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.

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泰咪亞歷山大藻。圖 1：以魯哥氏液固定的細胞正面觀。圖 2-3：串連成鏈狀的細胞。圖 4：前縱溝甲 (sa) 有前側帶 (p.pr)。圖 5：頂孔甲 (Po) 有大前連接孔 (aap)。圖 6：第一片甲片有腹面孔 (vp)。圖 7-8：後縱溝甲 (sp) 有後連接孔 (pap)。圖 9：前正面觀顯示縱溝翼片發育良好 (箭咀)。

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).

強壯前溝藻

Amphidinium carterae Hulburt 1957

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

描述：強壯前溝藻的細胞背正面觀大致橢圓，細胞長 12 – 18 微米，寬 8 – 10 微米。上錐部細小，呈新月或舌形，向左偏斜呈下行旋渦狀，橫溝上下位移約 2 – 3 個殼環帶寬度。葉綠體廣泛分佈於細胞周邊，中心有大澱粉核。新月形細胞核位於下錐部。

毒性：據外國文獻記載強壯前溝藻可產生溶血毒素。香港的藻株疑有毒性，但尚未能確定。

地區分佈：強壯前溝藻分佈於溫帶及熱帶水域，這種藻甚少出現於香港水域，只 1993 及 1994 年在東北部及東部海域錄得細胞濃度低，不曾在香港引致紅潮。

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.

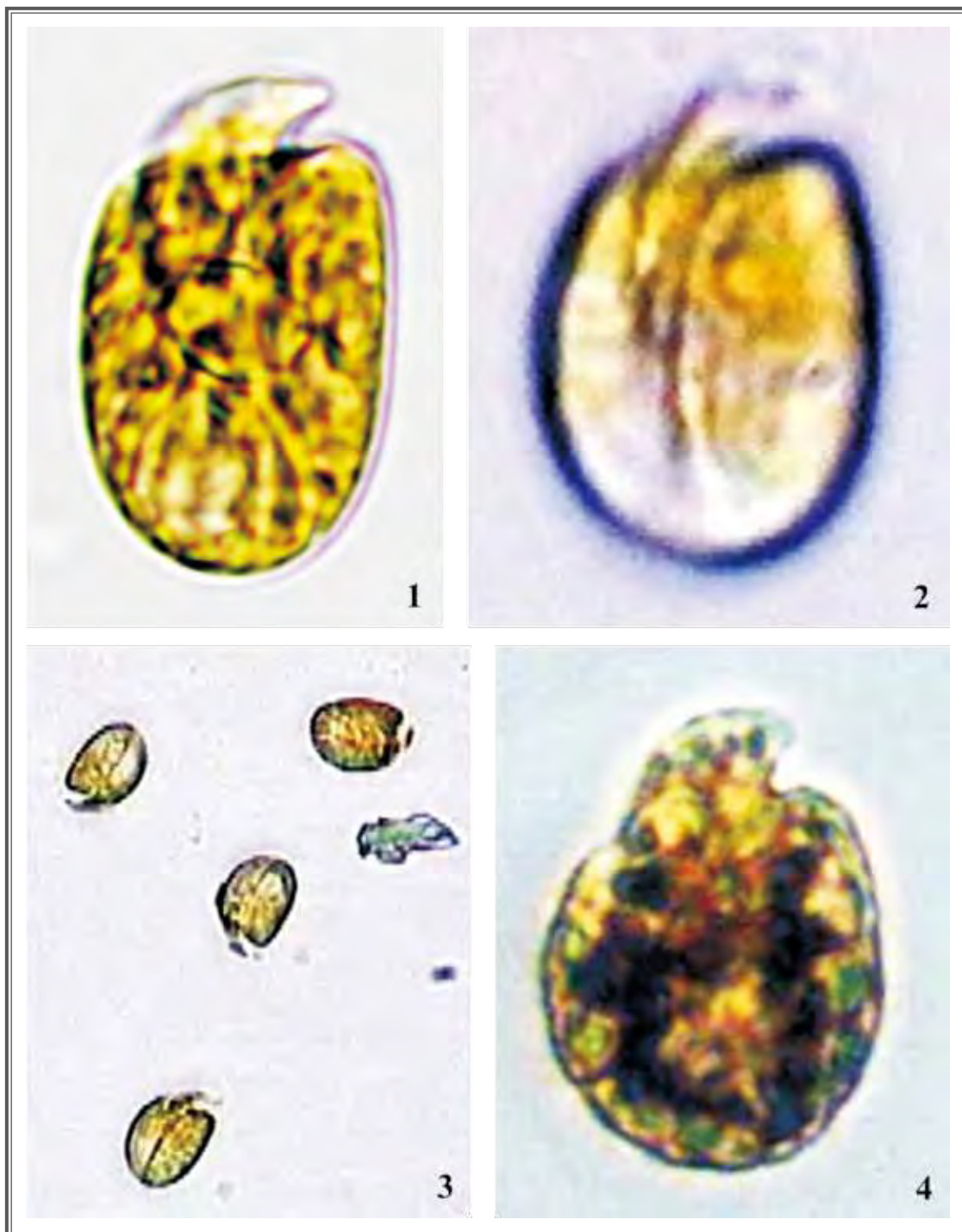
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強壯前溝藻。圖 1-3：活藻株顯示附加體細小而呈新月或舌形及向左偏斜。圖 4：以魯哥氏液固定的細胞正面觀。

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。這種藻串連成短鏈狀，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.

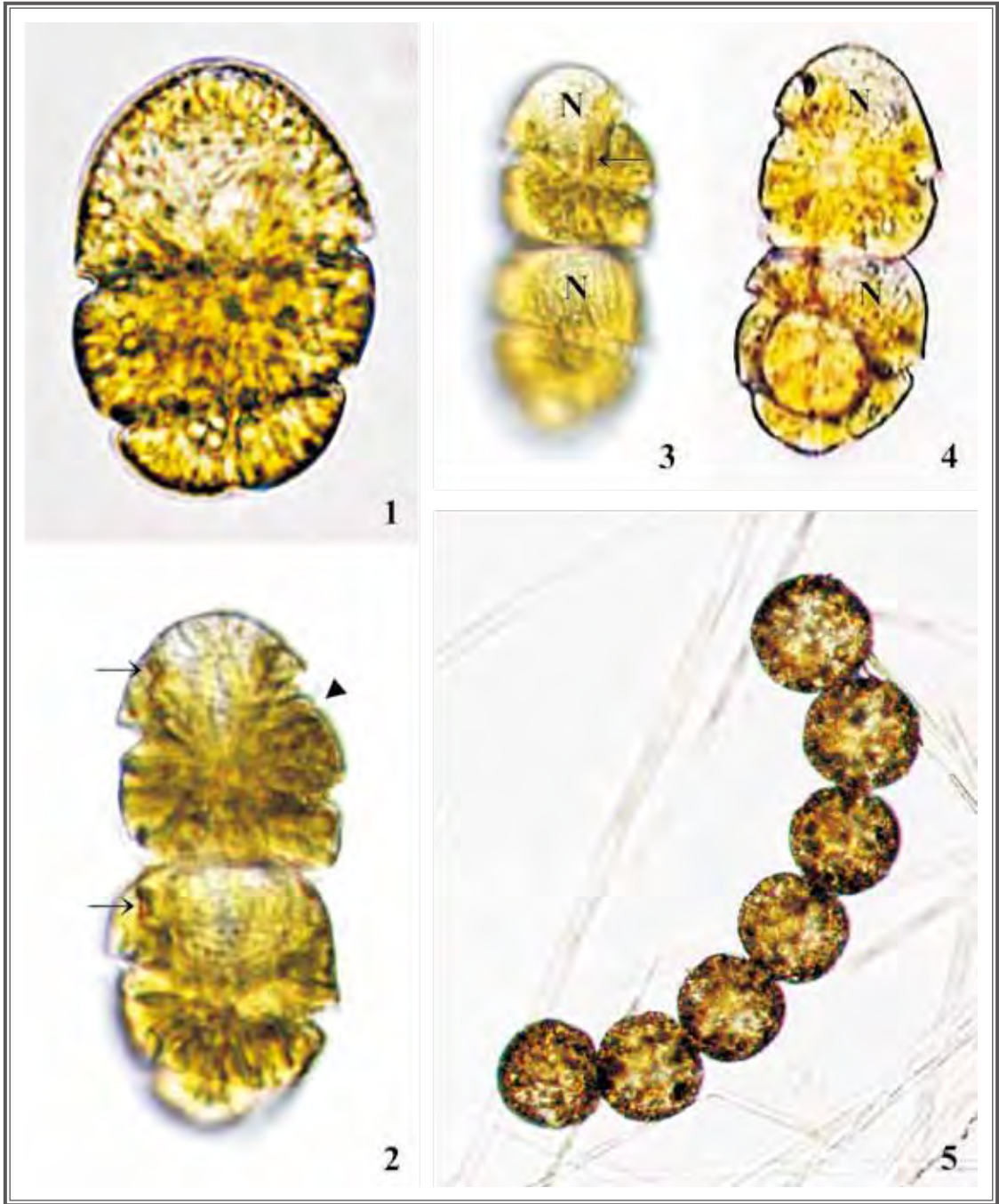
Toxicology: *C. polykrikoides* is a toxic species and it associated with fish kills according to overseas findings, but there is no fish kill record in Hong Kong.

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 a 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.

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多環旋溝藻。圖 1：單一活細胞後面觀。圖 2：後面觀，串連成鏈狀活細胞顯示縱溝位置 (箭頭) 及位於上殼的紅色眼點 (箭咀)。圖 3-4：細胞表面可見呈桿狀橢圓葉綠體 (箭咀) 及位於上殼的細胞核 (N)。圖 5：以魯哥氏液固定的細胞。

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

異名 Synonyms : *Dinophysis lachmannii* Paulsen 1949, *D. borealis* Paulsen 1949, *D. boehmii* Paulsen 1949, *D. paulsenii* Woloszynska 1928, *D. levanderi* Woloszynska 1928, *D. ellipsoides* Kofoid 1907, *D. cassubica* Woloszynska 1928, *D. skagii* Paulsen 1949, *D. baltica* (Paulsen) Woloszynska 1928

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。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 : 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 : 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.

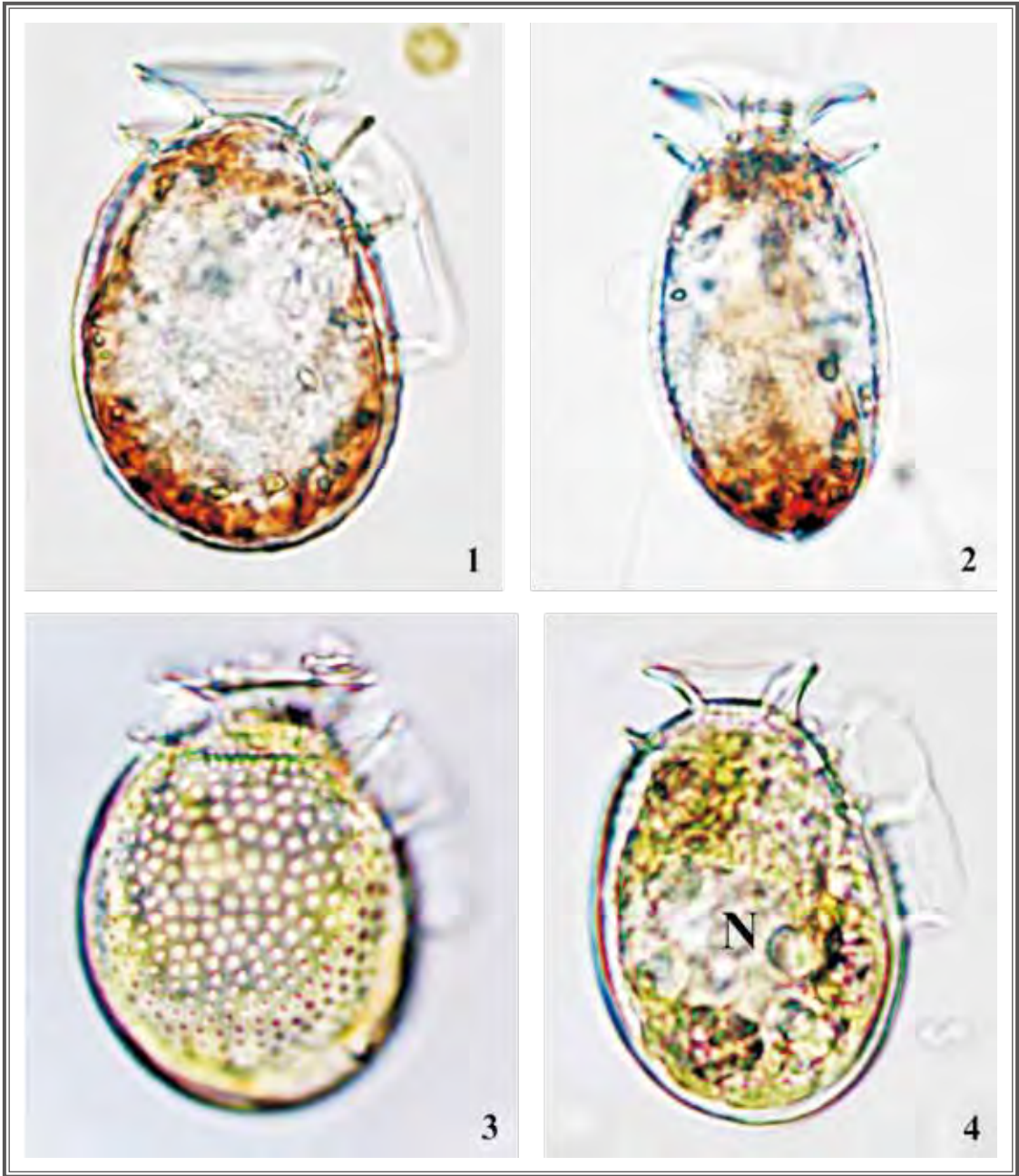
Toxicology: *D. acuminata* is capable of producing okadaic acid that causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

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:

- Carmelo, R. T. 1997. *Identifying Marine Phytoplankton*. pp. 428-429. Academic Press. USA.
- Faust, M. A. and Guedge, R. A. 2002. *Identification Harmful Marine Dinoflagellates*, United States National Herbarium 42:23-25,107.
- Fukuyo, Y., Takano, H., Chihara, M. and Matsuoka, K. 1990. *Red Tide Organisms in Japan-An Illustrated Taxonomic Guide*. pp. 34-35. Uchida Rokakuho, Co., Ltd. Tokyo, Japan.
- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 414. UNESCO publishing.

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漸尖鱗藻。圖 1：活細胞側面觀。圖 2：活細胞後面觀。圖 3-4：以魯哥氏液固定的細胞顯示殼甲佈滿顯著的環形網及可見大型中置細胞核 (N)。

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).

具尾鱗藻

Dinophysis caudata Saville-Kent 1881

門 Phylum : 甲藻門 Dinophyta

綱 Class : 甲藻綱 Dinophyceae

目 Order : 鱗藻目 Dinophysiales

科 Family : 鱗藻科 Dinophysiaceae

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

描述 : 具尾鱗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。橫溝狹窄，有兩片翼片：前橫溝翼片 (ACL) 及後橫溝翼片 (PCL)，另有多根肋支撐。兩片橫溝翼片均向前外突，而前橫溝翼片形成闊且深的漏斗形結構，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: 具尾鱗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 : 具尾鱗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.

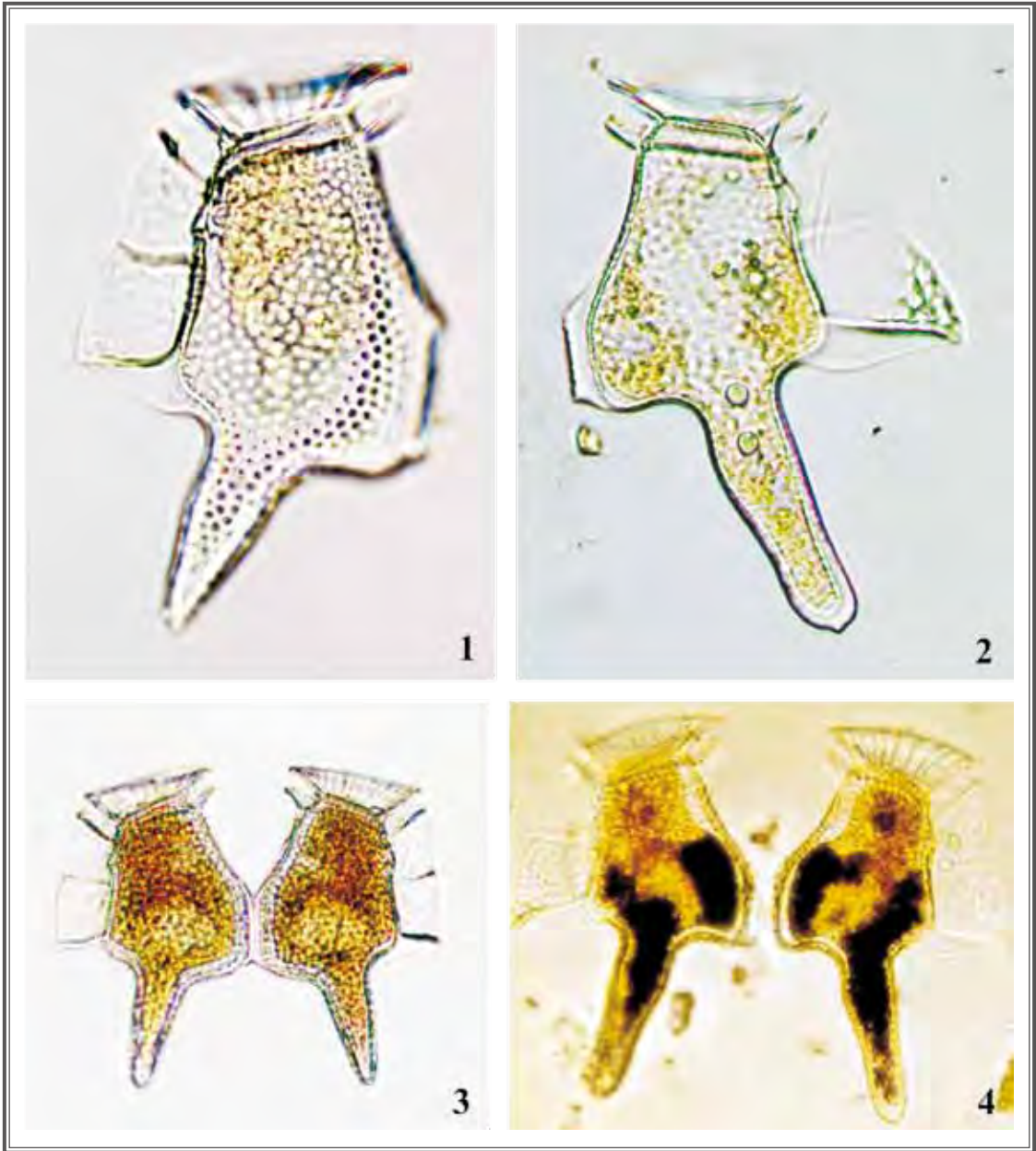
Toxicology: *D. caudata* is capable of producing okadaic acid that which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

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:

- Faust, M. A. and Gulledge, R. A. 2002. *Identification Harmful Marine Dinoflagellates*, United States National Herbarium 42:26-28, 109.
- Fukuyo, Y., Takano, H., Chihara, M. and Matsuoka, K. 1990. *Red Tide Organisms in Japan-An Illustrated Taxonomic Guide*. pp. 36-37. Uchida Rokakuho, Co., Ltd. Tokyo, Japan.
- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 415. UNESCO publishing.
- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 65-67. Denmark.

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具尾鱗藻。圖 1-2：細胞側面觀呈長而不規則卵形狀，下殼片有長腹突體。殼甲佈滿網紋，各有小孔。圖 3-4：成對細胞。

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

倒卵形鱗藻

Dinophysis fortii Pavillard 1923

門 Phylum : 甲藻門 Dinophyta

綱 Class : 甲藻綱 Dinophyceae

目 Order : 鱗藻目 Dinophysiales

科 Family : 鱗藻科 Dinophysiaceae

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

描述 : 鱗藻屬的藻體兩側扁平，上殼片細小呈帽狀，下殼片較大。倒卵形鱗藻細胞屬大型藻，長 60 – 80 微米，側面觀呈長卵形，細胞底部形狀寬闊及偏圓。殼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 : 倒卵形鱗藻可產生的鱗藻毒素 (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 : 倒卵形鱗藻分佈於溫帶水域，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.

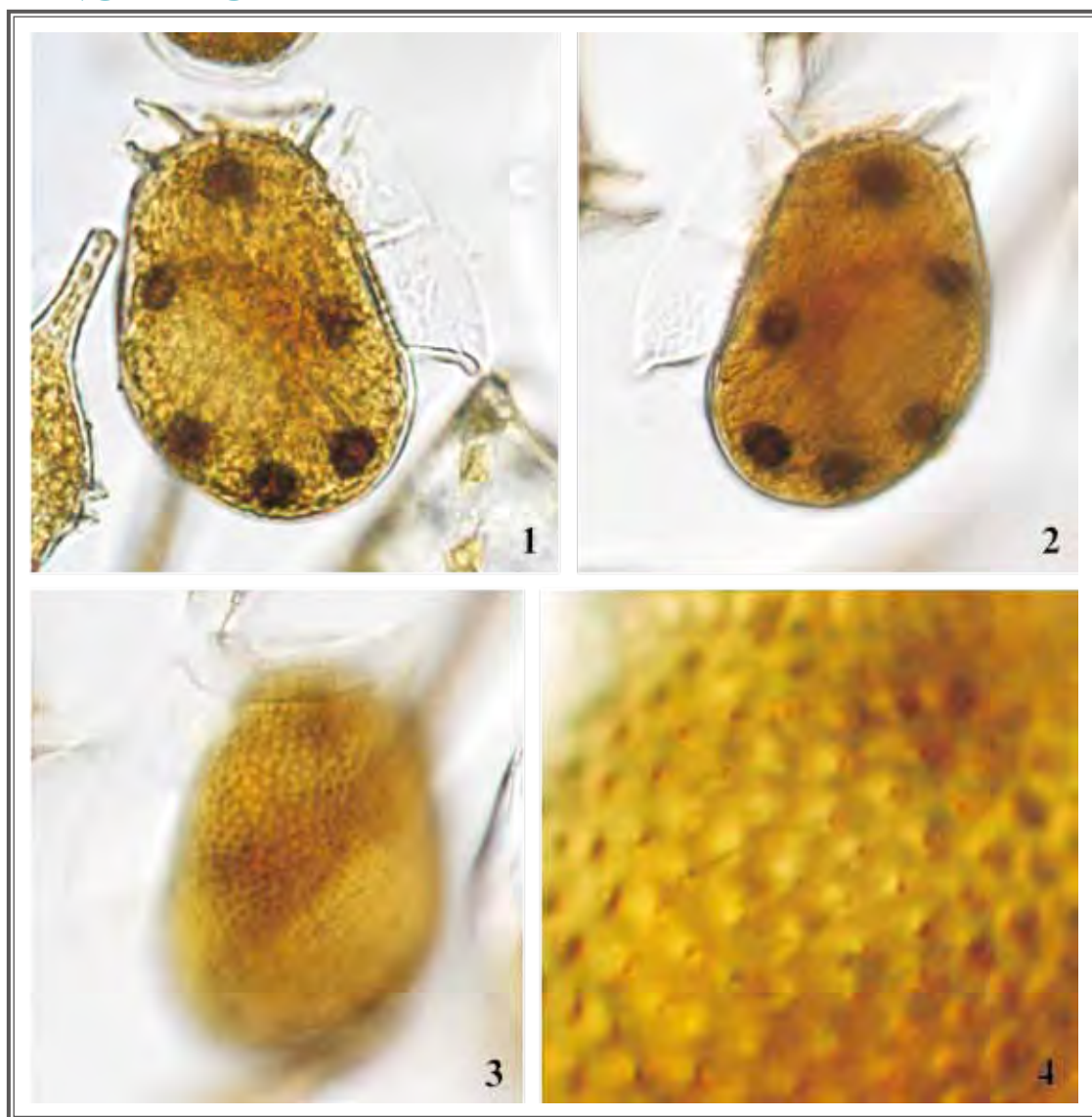
Toxicology: *D. fortii* is capable of producing Dinophysistoxin-1 (DTX1), Pectenotoxin-2 (PTX2) and okadaic acid that which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

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:

- Faust, M. A. and Gullledge, R. A. 2002. *Identification Harmful Marine Dinoflagellates*, United States National Herbarium 42:28-29, 110.
- Fukuyo, Y., Takano, H., Chihara, M. and Matsuoka, K. 1990. *Red Tide Organisms in Japan-An Illustrated Taxonomic Guide*. pp. 38-39. Uchida Rokakuho, Co., Ltd. Tokyo, Japan.
- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 415. UNESCO publishing.

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倒卵形鱗藻。圖 1-2：細胞側面觀呈長卵形。圖 3-4：殼甲佈滿顯著的環形網紋，每個均有小孔。

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 .

矛形鱗藻

Dinophysis hastata Stein 1883

門 Phylum : 甲藻門 Dinophyta

綱 Class : 甲藻綱 Dinophyceae

目 Order : 鱗藻目 Dinophysiales

科 Family : 鱗藻科 Dinophysiaceae

異名 Synonym : *Phalacroma hastatum* Pavillard 1909

描述: 矛形鱗藻的細胞為中至大型，這呈卵形細胞的下殼片有明顯的底刺。細胞通常約 42 – 90 微米長，背腹寬 37 – 64 微米。殼甲佈滿清晰的環狀網紋，每個均有小孔。左縱溝翼片 (LSL) 伸展至接近下殼總長度三分之二位置，由三根向外輻射的肋支撐，當中第三根肋最長。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)，另有多根肋支撐。下殼片有四片大甲片，佔細胞大部份面積。細胞有大型中置細胞核，沒有葉綠體。

毒性: 矛形鱗藻疑是有毒性的品種，可能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: 矛形鱗藻分佈於熱帶及亞熱帶水域。這種藻不曾在香港及其他水域引致紅潮，極少在香港海域出現，只在東北部、東部及南部海域有記錄，但細胞濃度低。

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.

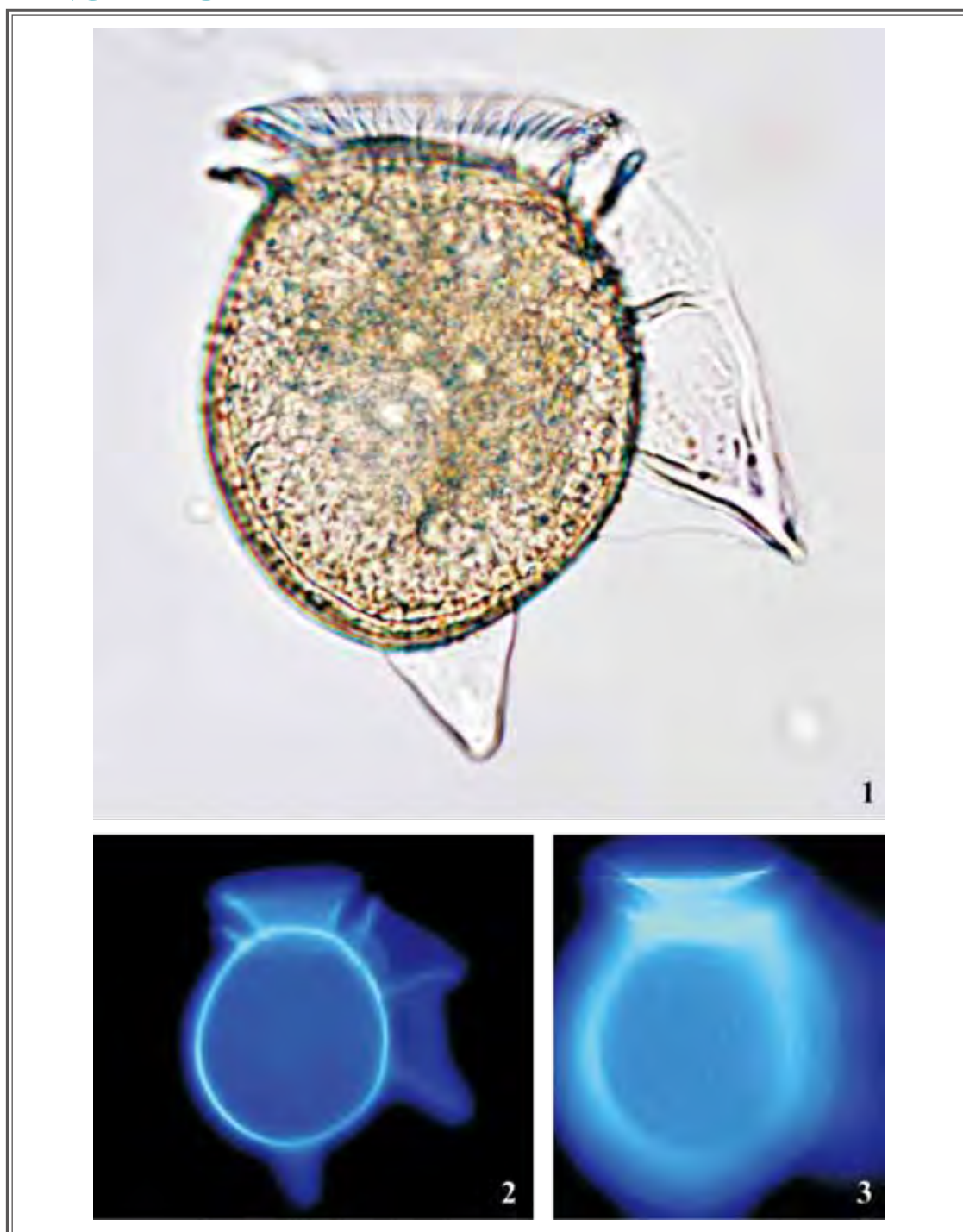
Toxicology: *D. hastata* is a suspected toxic species that might produce okadaic acid which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

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:

- Carmelo, R. T. 1997. *Identifying Marine Phytoplankton*. pp. 433. Academic Press. USA.
- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 67-68. Denmark.
- Larsen, J. and Moestrup, O. 1992. *ICES Identification Leaflets for Plankton No.180*. Potentially Toxic Phytoplankton 2. Genus *Dinophysis* (Dinophyceae). pp. 1-12.
- Norris, D. R., and Berner, L. D. 1970. Thecal morphology of selected species of *Dinophysis* (Dinoflagellata) from the Gulf of Mexico. *Contributions in Marine Science*. 15:145-192.3

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矛形鱗藻。圖 1-3：細胞側面觀呈圓卵形狀及下殼片的明顯底刺。

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

叉形鱗藻

Dinophysis miles Cleve 1900

門 Phylum : 甲藻門 Dinophyta

綱 Class : 甲藻綱 Dinophyceae

目 Order : 鱗藻目 Dinophysiales

科 Family : 鱗藻科 Dinophysiaceae

描述: 叉形鱗藻的細胞大而長，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。下殼片腹側呈波浪形，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: 叉形鱗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: 叉形鱗藻廣泛分佈於溫帶、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 antero-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.

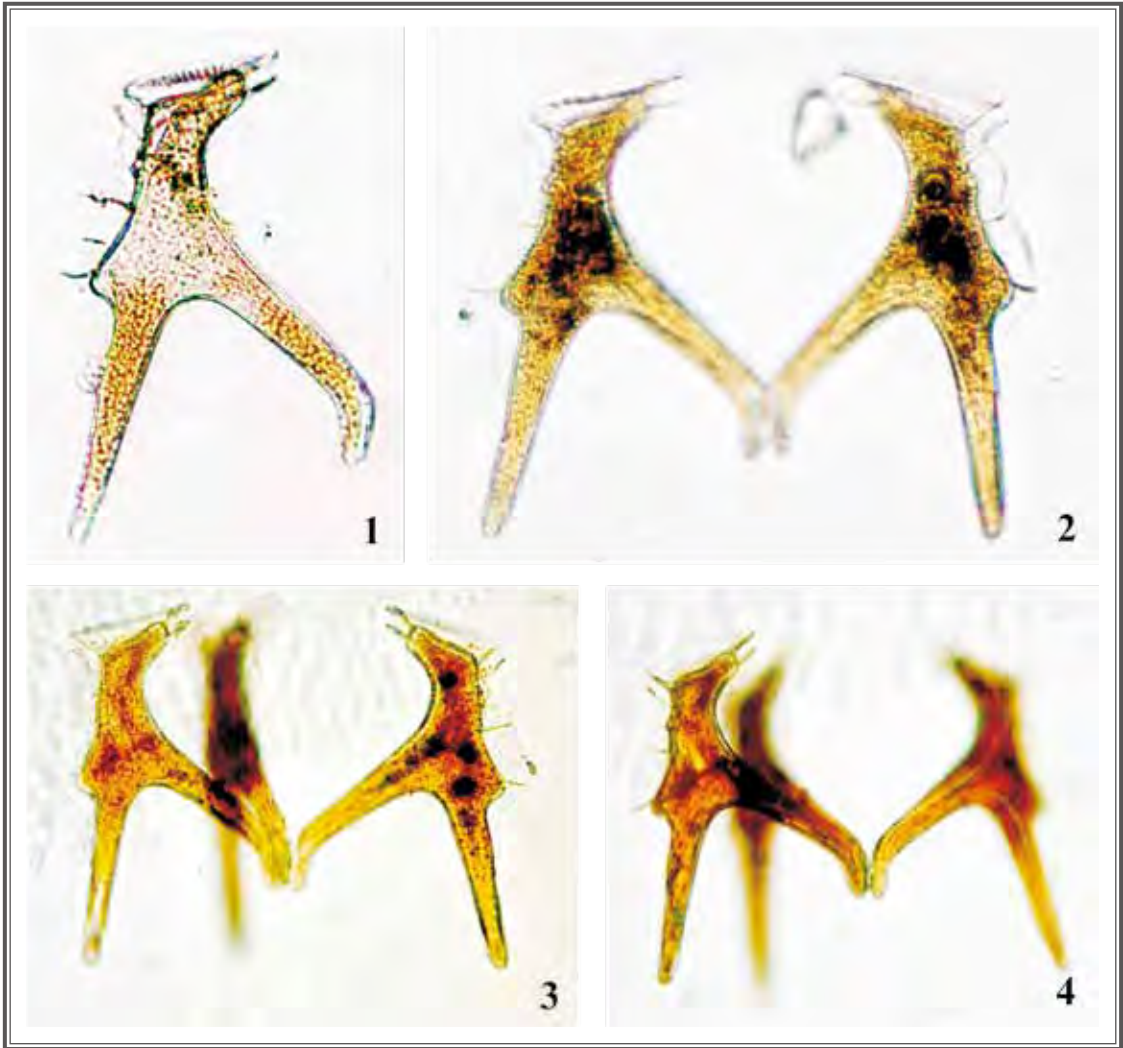
Toxicology: *D. miles* is capable of producing okadaic acid which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

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:

- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 415-416. UNESCO publishing.
- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 68-70. Denmark.

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叉形鱗藻。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 hypotheca with two fairly distinctive, long antapical and dorsal projections.

圓形鱗藻

Dinophysis rotundata Claparède & Lachmann 1859

門 Phylum : 甲藻門 Dinophyta

綱 Class : 甲藻綱 Dinophyceae

目 Order : 鱗藻目 Dinophysiales

科 Family : 鱗藻科 Dinophysiaceae

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

描述 : 圓形鱗藻的細胞屬中型，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) 常向後闊開，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。橫溝狹窄，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 : 圓形鱗藻可產生鱗藻毒素 (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 : 圓形鱗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.

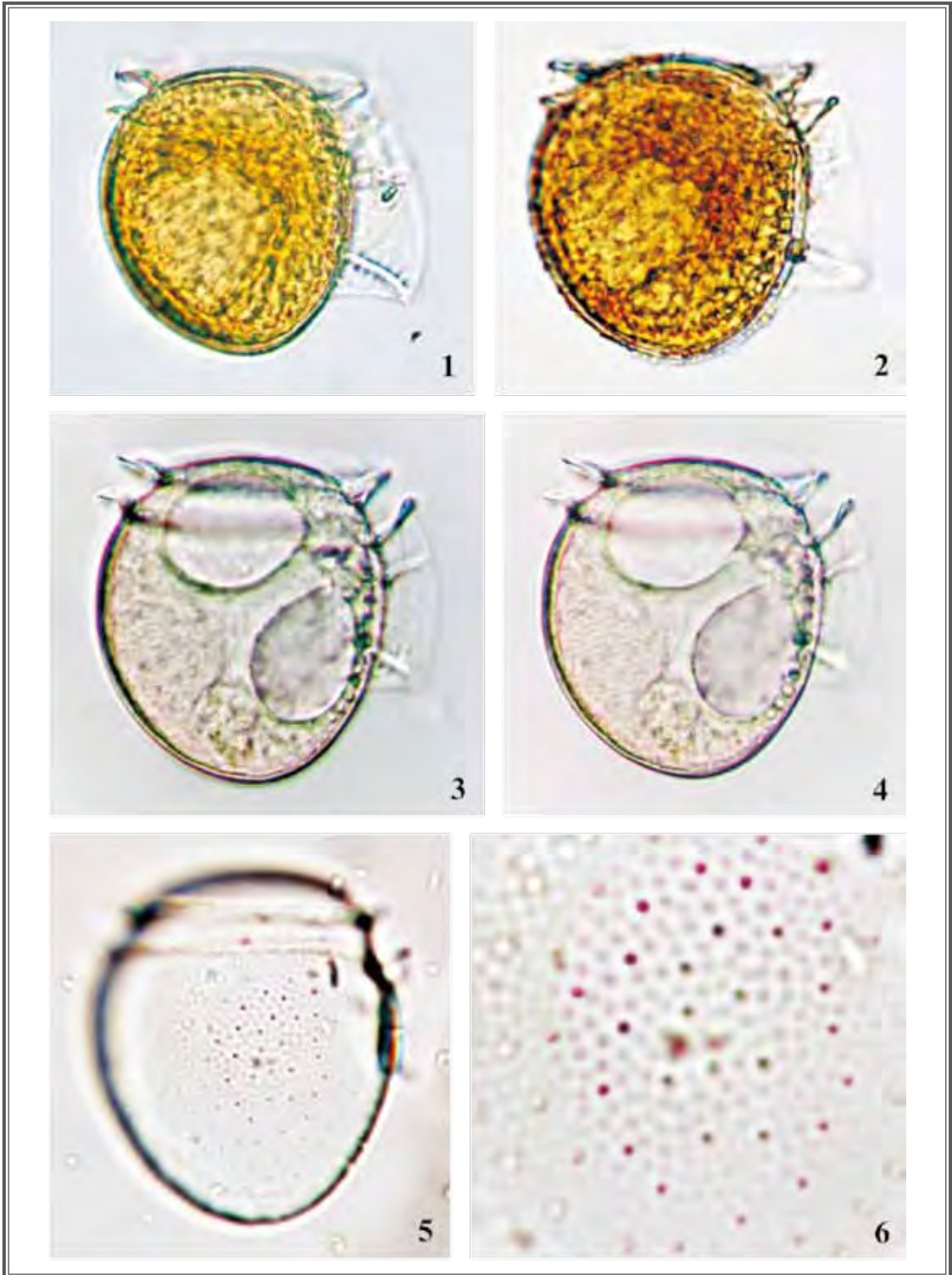
Toxicology: *D. rotundata* is capable of producing Dinophysistoxin-1 (DTX1) and okadaic acid which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

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:

- Faust, M. A. and Gulledge, R. A. 2002. *Identification Harmful Marine Dinoflagellates*, United States National Herbarium 42:32-33,113.
- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 416-418. UNESCO publishing.

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圓形鱗藻。圖 1-2：以魯哥氏液固定的細胞。圖 3-4：活細胞側面觀呈橢圓形狀。圖 5-6：殼甲頗厚，佈滿擬孔及零散小孔。

Dinophysis rotundata. Figures 1-2: Lugol fixed cells. Figures 3-4: Live cells in lateral view showing round-oval in shape. Figures 5-6: Thecal plate thick and covered with poroids and scattered pores.

帽狀禿頂藻

Phalacroma mitra Schütt 1895

門 Phylum : 甲藻門 Dinophyta

綱 Class : 甲藻綱 Dinophyceae

目 Order : 鱗藻目 Dinophysiales

科 Family : 鱗藻科 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，側面觀呈微凸出。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 : 帽狀禿頂藻可產生鱗藻毒素 (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 hypothecal 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.

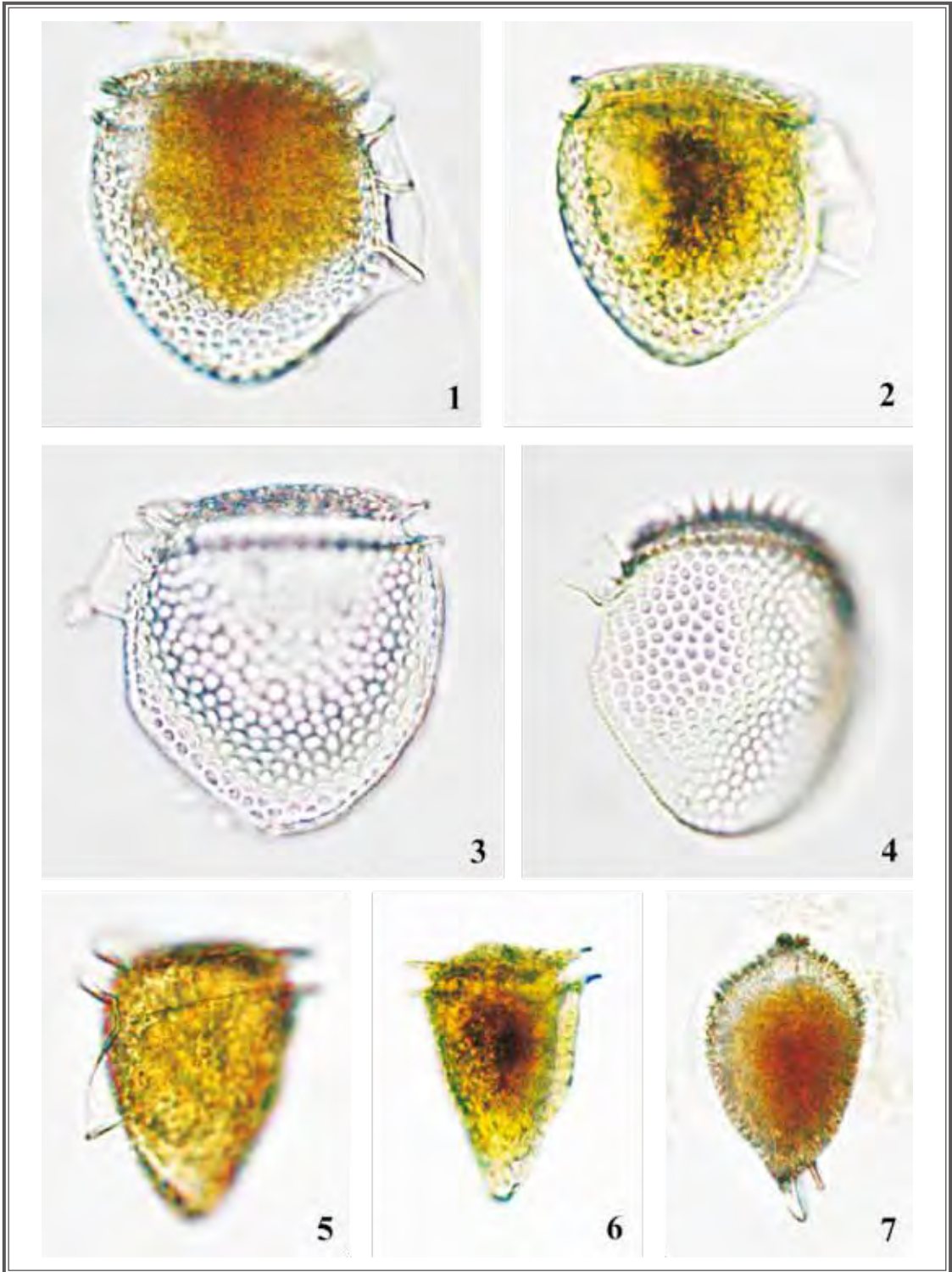
Toxicology: *P. mitra* is capable of producing Dinophysistoxin-1 (DTX1) and okadaic acid which causes diarrhetic shellfish poisoning (DSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

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:

- Faust, M. A. and Gulledege, R. A. 2002. *Identification Harmful Marine Dinoflagellates*, United States National Herbarium 42:29-30,111.
- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 416. UNESCO publishing.

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帽狀禿頂藻。圖 1-4: 細胞側面觀，闊大且呈楔形狀，殼甲頗厚及佈滿粗糙空隙孔。圖 5-6：正面觀。圖 7: 底面觀。

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.

鏈狀裸甲藻

Gymnodinium catenatum Graham 1943

門 Phylum： 甲藻門 Dinophyta

綱 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.

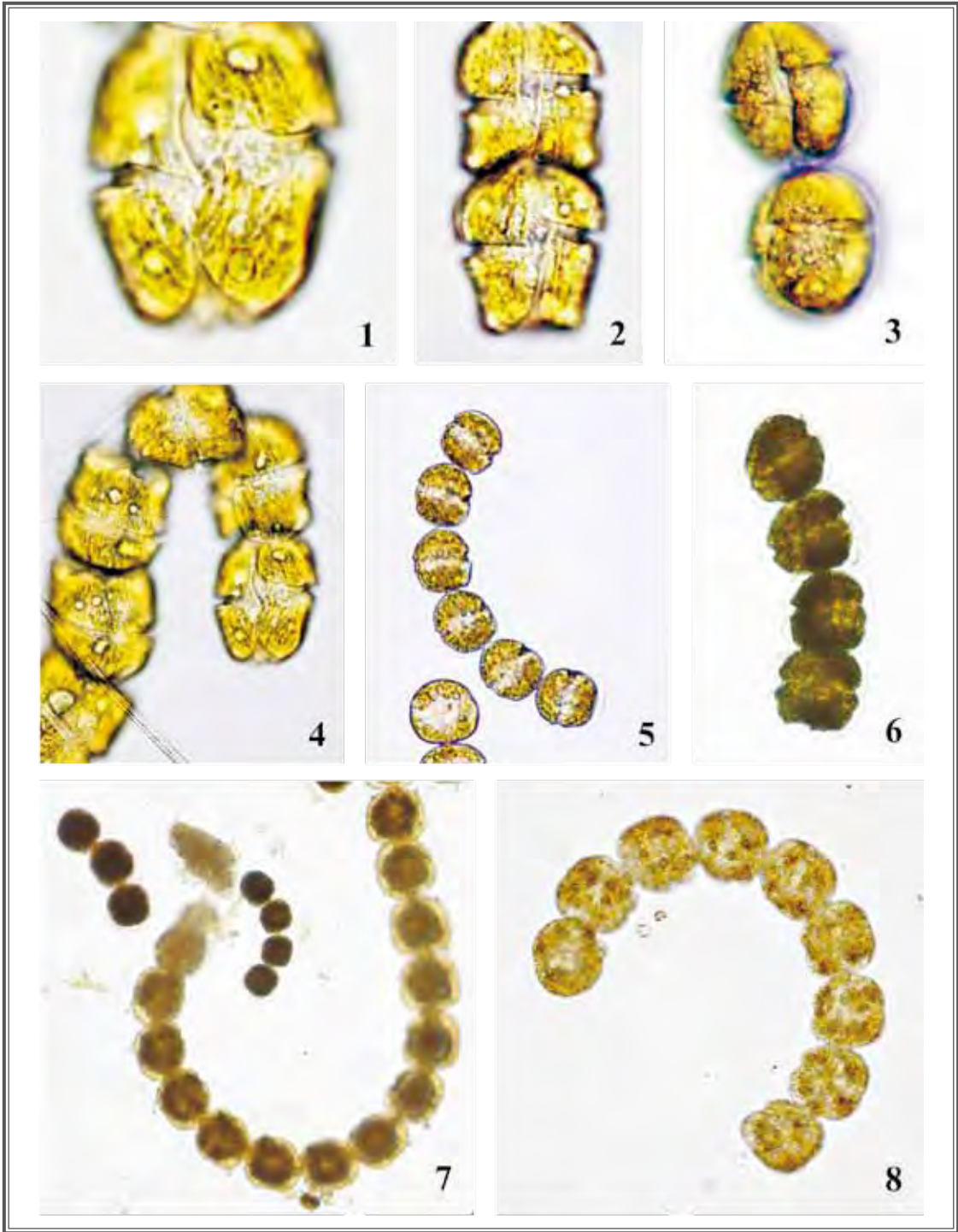
Toxicology: *G. catenatum* is capable of producing paralytic shellfish poisons (PSP) toxins and toxicity of the Hong Kong strain is confirmed. This species is the only unarmoured dinoflagellate known to produce PSP toxins.

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.

參考文獻 References:

- Carmelo, R. T. 1997. *Identifying Marine Phytoplankton*. pp. 447. Academic Press. USA.
- Faust, M. A. and Gulledege, R. A. 2002. *Identification Harmful Marine Dinoflagellates*, United States National Herbarium 42:39-40, 119.
- Fukuyo, Y., Takano, H., Chihara, M. and Matsuoka, K. 1990. *Red Tide Organisms in Japan-An Illustrated Taxonomic Guide*. pp. 46-47. Uchida Rokakuho, Co., Ltd. Tokyo, Japan.
- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 394-395. UNESCO publishing.
- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 122. Denmark.

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鏈狀裸甲藻。圖 1-2：單一或成對活細胞正面觀，呈長橢圓形狀。圖 3：活培養藻株，顯示細胞在惡劣環境下長出透明膜。圖 4：活鏈狀細胞正面觀。圖 5：長出透明膜的鏈狀活細胞。圖 6-8：以魯哥氏液固定的不同形狀細胞。

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.

圓鱗異囊藻

Heterocapsa circularisquama Horiguchi 1995

門 Phylum : 甲藻門 Dinophyta

綱 Class : 甲藻綱 Dinophyceae

目 Order : 多甲藻目 Peridinales

科 Family : 多甲藻科 Peridiniaceae

描述 : 圓鱗異囊藻是細小的單一具殼片甲藻，細胞呈梨狀，上殼片呈錐形，下殼片半球形。細胞長 20 – 29 微米，寬 14 – 20 微米。圓鱗異囊藻的名字來自藻體的鱗片，鱗片由環形底板和六根輻射脊組成。殼甲很薄。細胞密佈黃褐色的色素細胞和深殼環帶，縱溝相對較淺，頂部尖削。

毒性 : 圓鱗異囊藻可導致大量貝類死亡。香港的藻株疑有毒性，但尚未能確定。

地區分佈 : 圓鱗異囊藻曾經在日本、中國東海水域及中國南海水域包括香港形成紅潮。這種藻在日本造成大量貝類死亡。這種藻由 1983 至 2004 年在吐露港及東北部海域造成 16 次紅潮，但並未引致魚類死亡。圓鱗異囊藻常見於香港，細胞濃度低。

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.

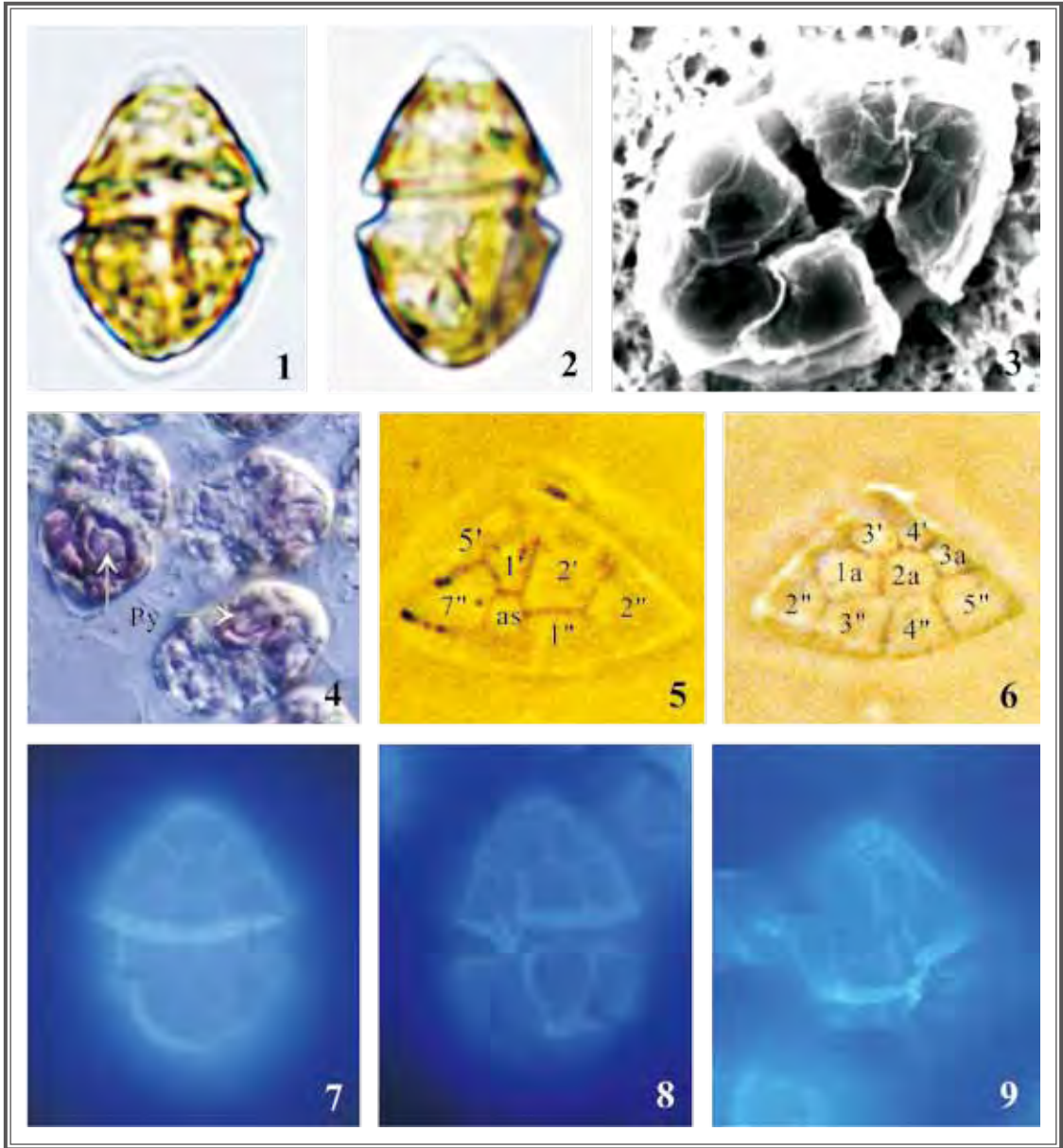
Toxicology: *H. circularisquama* is a toxic species which causes mass mortality of shellfish. Toxicity of the Hong Kong strain is uncertain.

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.

參考文獻 References:

- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 401. UNESCO publishing.
- Horiguchi, T. 1995. *Heterocapsa circularisquama* sp. Nov. (Peridinales, Dinophyceae): A new marine dinoflagellate causing mass mortality of bivalves in Japan. *Phycological Research*, 43:129-136.
- Kitaguchi, H., Hiragushi, N. Mitsutani, A., Yamaguchi, M. and Ishida, Y. 2001. Isolation of an algicidal marine bacterium with activity against the harmful dinoflagellate *Heterocapsa circularisquama* (Dinophyceae). *Phycologia*, 40(3):275-279.

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圓鱗異囊藻。圖 1：活細胞正面觀，可見頂部有細小的透明範圍。圖 2：活細胞後面觀。圖 3：掃描電子顯微鏡圖片。圖 4：細胞有大澱粉核。圖 5：上殼片正面觀，顯示殼甲排列方式 (as) 及前縱溝甲。圖 6：上殼片後面觀。圖 7-9：以螢光增白劑染白的殼甲。

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.

雙楔凱倫藻

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 : 雙楔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，位於下殼左方。葉綠體形狀可變異或呈盤狀，呈黃綠色。

毒性 : 雙楔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 : 雙楔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.

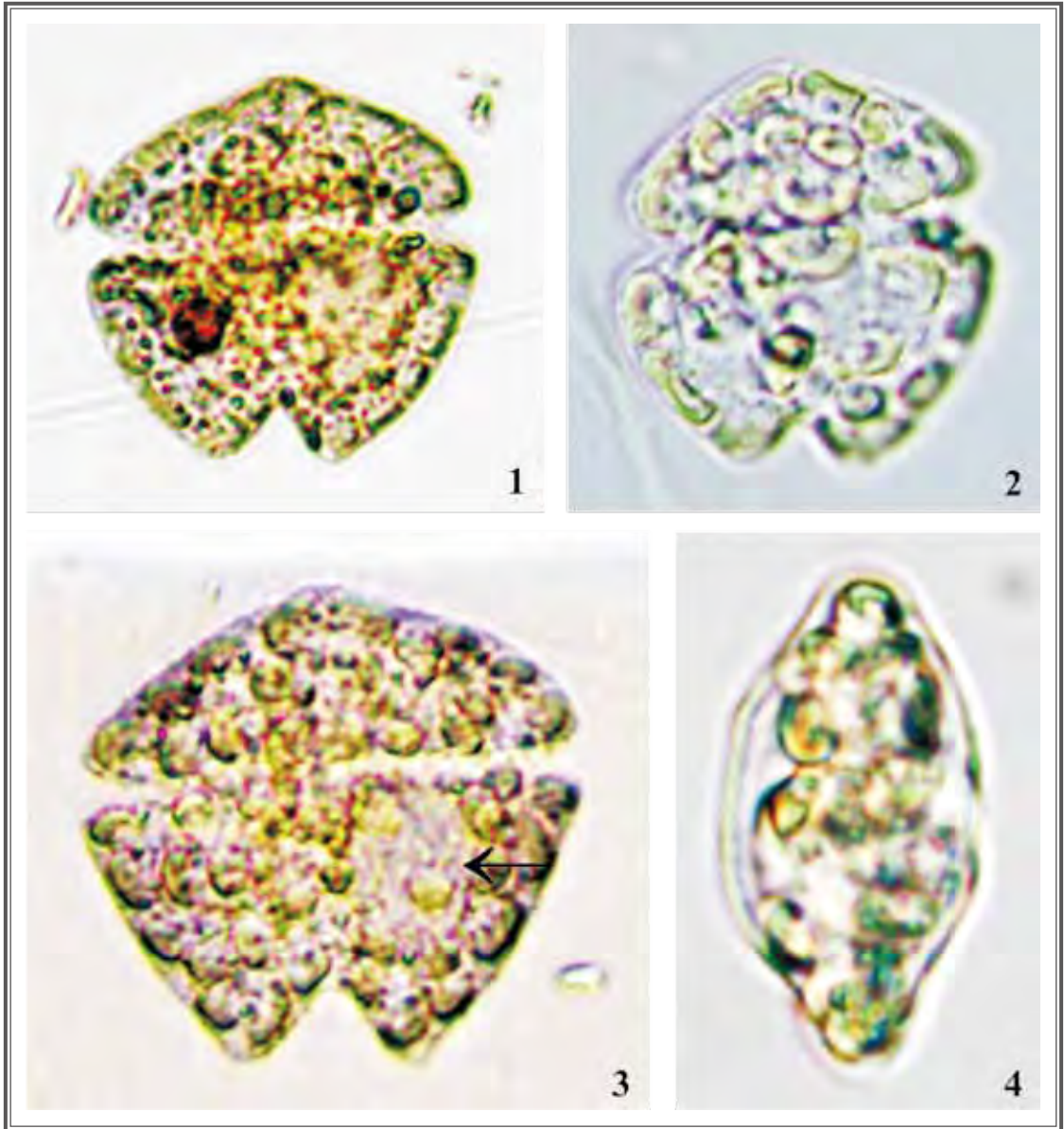
Toxicology: *K. bicuneiformis* is capable of producing neurotoxic brevetoxins that causes neurotoxic shellfish poisoning (NSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

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:

- Botes, L., Sym, S. D. and Pitcher, G. C. 2003. *Karenia cristata* sp. Nov. and *Karenia bicuneiformis* sp. Nov. (Gymnodiniales, Dinophyceae): two new *Karenia* species from the South African coast. *Phycologia*, 42(6):563-571.
- Haywood, A. J., Steidinger, K. A., Truby, E. W. 2004. Comparative morphology and molecular phylogenetic analysis of three new species of the genus *Karenia* (Dinophyceae) from New Zealand. *Journal of Phycology*, 40:165-179.

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雙楔凱倫藻。圖 1-3：細胞典型觀，呈 W 形下殼；葉綠體形狀可變異或呈盤狀；球形或近橢圓形細胞核位於左下殼（箭咀）。圖 4：側面觀，顯示背腹扁平形狀。

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 : 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 : 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 : 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 hypococone. Chloroplasts are elongated and yellowish green in color.

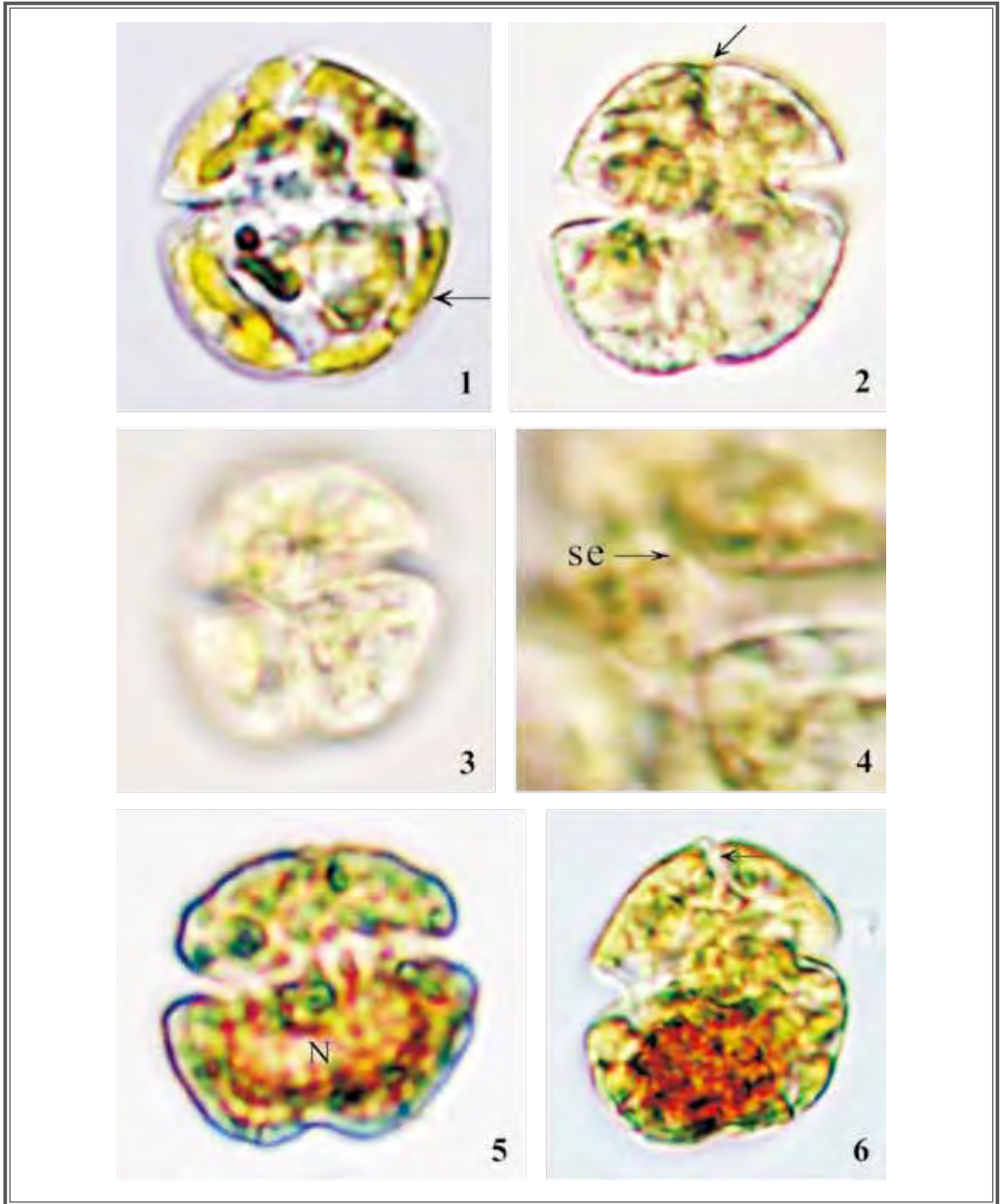
Toxicology: *K. brevisulcata* is a toxic species that causes fish kill according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

Regional distribution: *K. brevisulcata* caused red tide in New Zealand and led to mortality 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:

- Chang, F. H. 1999. *Gymnodinium brevisulcatum* sp. nov. (Gymnodiniales, Dinophyceae), a new species isolated from the 1998 summer toxic bloom in Wellington Harbour, New Zealand. *Phycologia*, 38: 377-384.
- Chang, F. H., Chiswell, S. M. and Uddstrom, M. J. 2001. Occurrence and distribution of *Karenia brevisulcata* (Dinophyceae) during the 1998 summer toxic outbreaks on the central east coast of New Zealand. *Phycologia*, 40: 215-222.
- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 396. UNESCO publishing.
- Haywood, A. J., Steidinger, K. A., Truby, E. W. 2004. Comparative morphology and molecular phylogenetic analysis of three new species of the genus *Karenia* (Dinophyceae) from New Zealand. *Journal of Phycology*, 40:165-179.

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短溝凱倫藻。圖 1：活細胞正面觀，可見長葉綠體（箭咀）。圖 2-4：以魯哥氏液固定的細胞正面觀，顯示頂部有小凹槽（箭咀）；橫溝上下位移，向右傾斜的縱溝延伸體 (se) 伸進上殼（箭咀）。圖 5-6：以魯哥氏液固定的細胞正面觀，顯示橫腎形細胞核 (N) 由下殼左瓣伸展至右瓣；獨特的短頂槽（箭咀）。

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).

指溝凱倫藻

Karenia digitata Yang, Takayama, Matsuoka & Hodgkiss 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：指溝凱倫藻是不具殼片甲藻，為細小的單一細胞，呈球狀或卵狀，背腹幾乎圓形但稍為扁平，細胞長 10–26.3 微米，寬 10–22.5 微米。上殼為半球形或大致錐形，下殼圓形或半球形，末端不凹陷。細胞有一線狀凹槽，位於縱溝軸右側。細胞核大，呈球形或卵形，位於下殼中央。葉綠體為黃綠色或黃褐色，形狀不規則。

毒性：指溝凱倫藻是有毒品種，1998 年在香港出現藻華期間，導致大量魚類死亡。香港的藻株已證實有毒。

地區分佈：指溝凱倫藻在日本及中國南海水域包括香港形成紅潮。這種藻在香港曾引發 2 次紅潮。第一次發生在 1998 年於吐露港、東北、東南部及南部海域，該紅潮導致大量魚類死亡。第二次發生在 2009 年，記錄於香港南部，沒有造成魚類死亡。這種藻在香港水域常有記錄，但細胞濃度俱低。

Description: *Karenia 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.

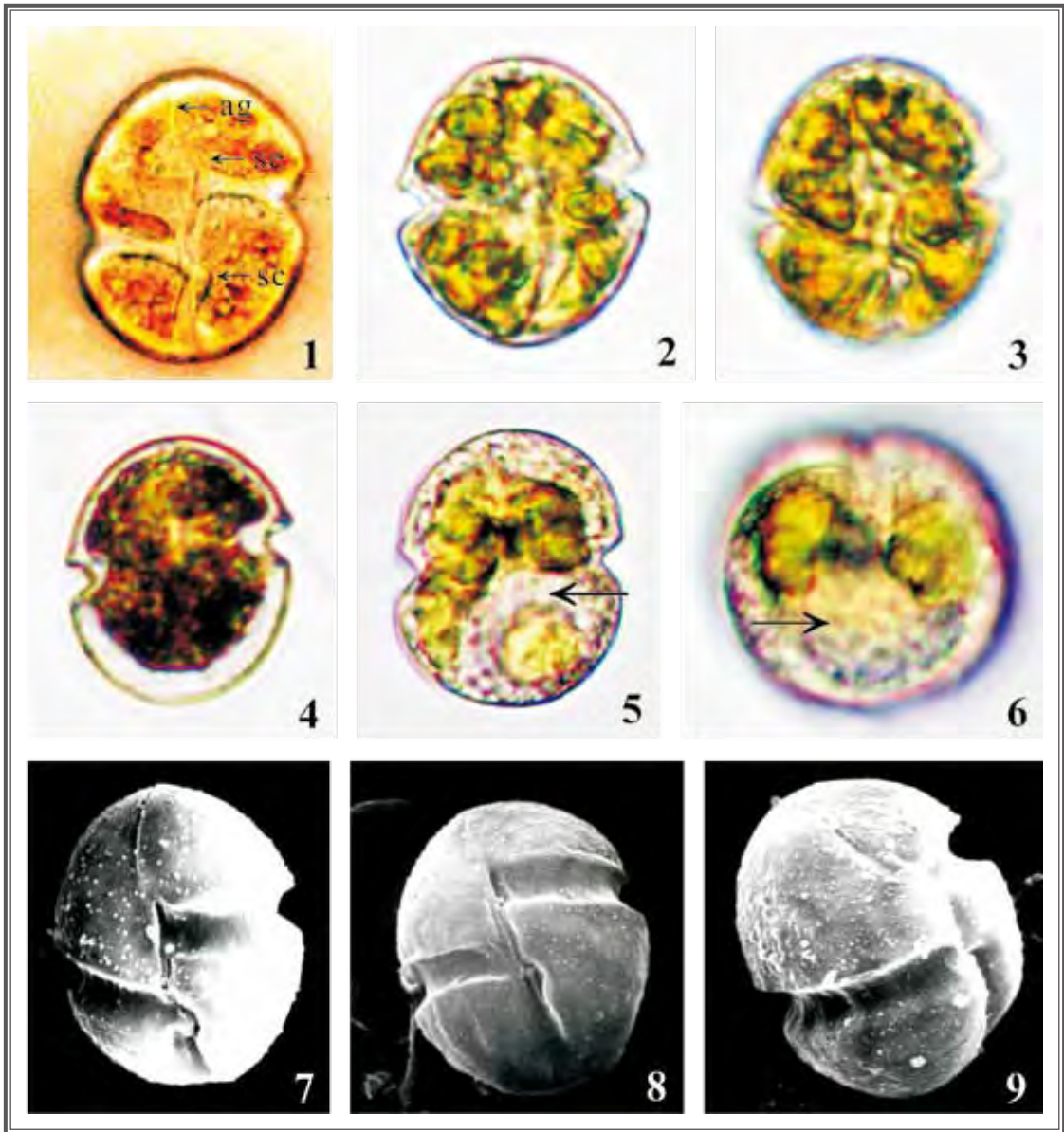
Toxicology: *K. digitata* is a toxic species that caused massive fish kill. The toxicity of the Hong Kong strain is confirmed.

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.

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指溝凱倫藻。圖 1：活細胞正面觀，可見上殼的頂槽 (ag) 及縱溝延伸體 (se)；下殼的縱溝彎曲度 (sc)。圖 2-5：以魯哥氏碘液固定的細胞正面觀，顯示細胞核位於下殼 (箭咀)。圖 6：以魯哥氏液固定的細胞底面觀，顯示細胞核 (箭咀)。圖 7-9：掃描電子顯微鏡圖片。

Karenia digitata. Figure 1: Live cell in ventral view; apical groove (ag); 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

異名 Synonyms : *Gymnodinium mikimotoi* Miyake & Kominami ex Oda 1935, *Gyrodinium nagasakiense* Takayama & Adachi 1984, *G. nagasakiense* Takayama & Adachi 1984

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，寬 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 : 米氏凱倫藻廣泛分佈於溫帶和熱帶水域，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.

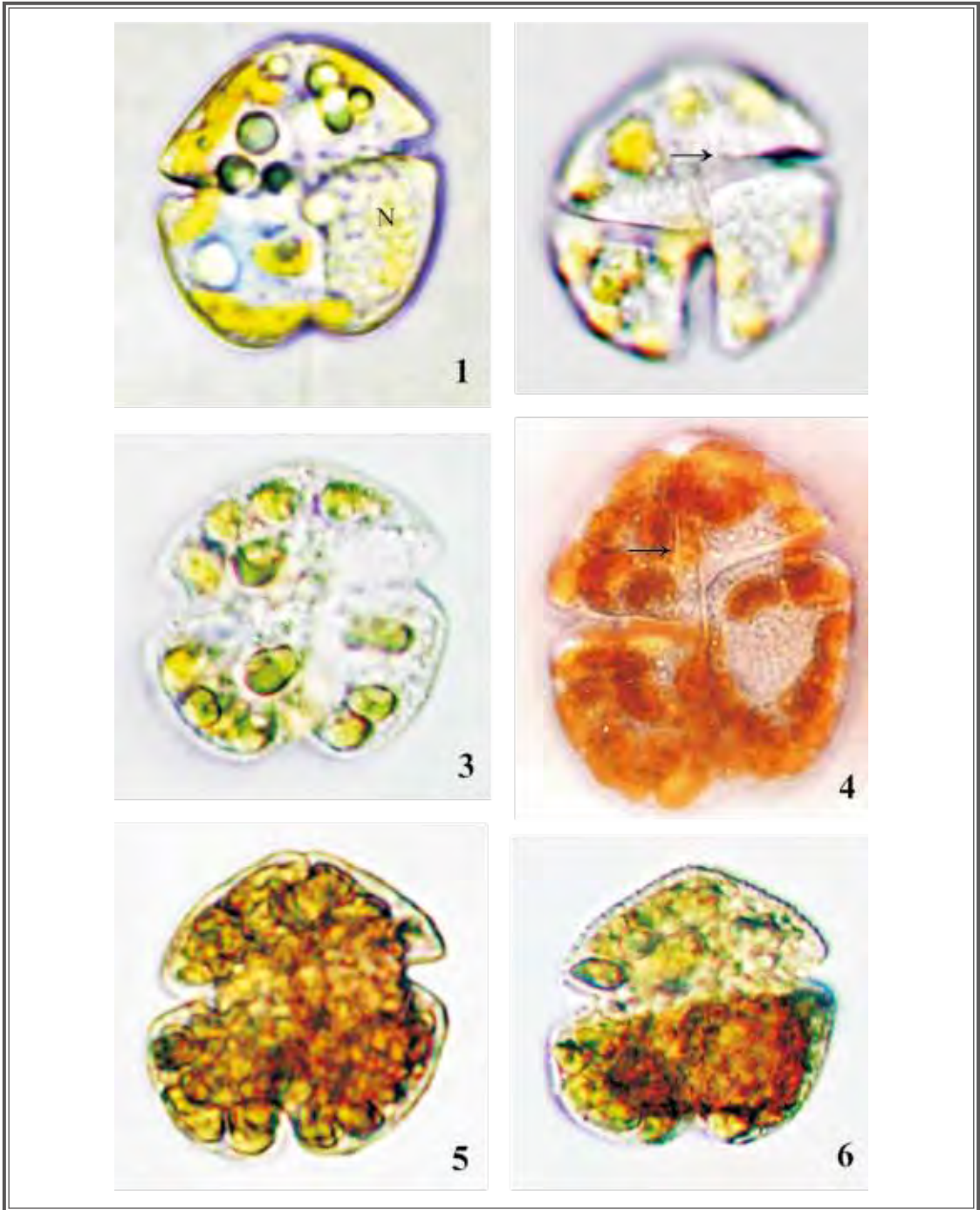
Regional distribution: *K. mikimotoi* is widely distributed in temperate and tropical waters and known to cause massive blooms in Japan, Korea, Australia, New Zealand, East China Sea, Bohai, South China Sea including Hong Kong. It is a dominant harmful red tide species in Japan and reported to cause 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 happened in 1980 to 1983.

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- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 123-124. Denmark.

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米氏凱倫藻。圖 1：活培植藻株。圖 2：活細胞正面觀，顯示短小的縱溝前延伸體（箭咀）。圖 3：球狀葉綠體（箭咀）含澱粉核。圖 4：活細胞正面觀，顯示頂槽（箭咀）伸展至上殼。圖 5：以魯哥氏液固定的細胞，顯示細胞核 (N) 位於細胞左側。圖 6：細胞核 (N) 位於下殼。

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 hypococone.

微疣凱倫藻

Karenia papilionacea Haywood & Steidinger 2004

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：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.

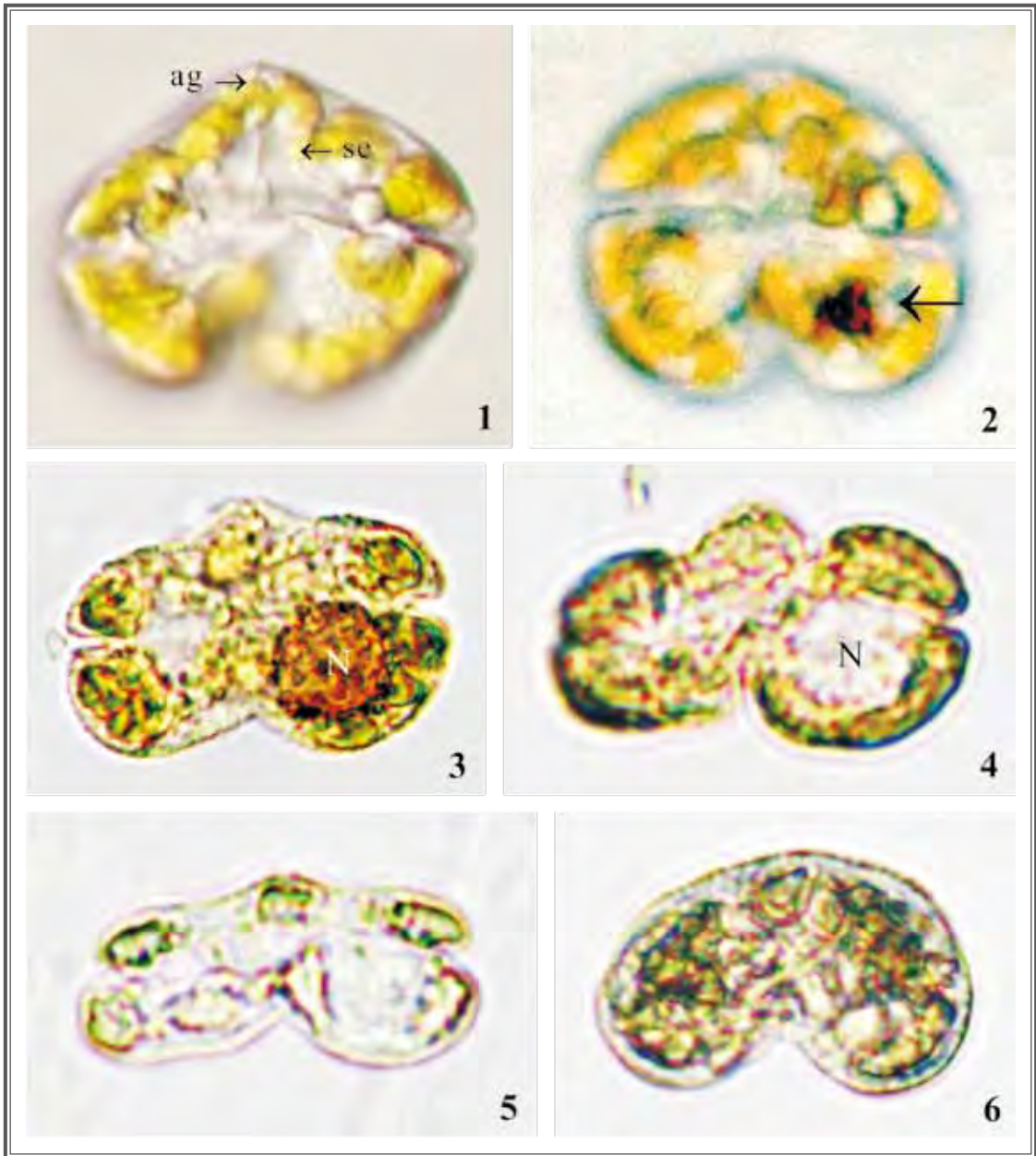
Toxicology: *K. papilionacea* is capable of producing neurotoxic brevetoxins that causes neurotoxic shellfish poisoning (NSP) in humans or other mammals. Toxicity of the Hong Kong strain is uncertain.

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.

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微疣凱倫藻。圖 1：活細胞正面觀，顯示葉綠體位於周邊，呈圓或腎形及黃綠色、頂槽 (ag)、縱溝延伸體 (se)。圖 2：活細胞後面觀，顯示下殼右側有紅色體 (箭咀)。圖 3-4：以魯哥氏液固定的細胞正面觀，顯示球形或近卵圓形的細胞核 (N) 位於下殼左方。圖 5：闊細胞正面觀。圖 6：細胞頂面觀。

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

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 Synonyms: *Woloszynskia micra* Leadbeater & Dodge 1966, *Gymnodinium veneficum* Ballantine 1956, *Karlodinium micrum* (Leadbeater & Dodge) 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 微米，寬 7 – 14 微米。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.

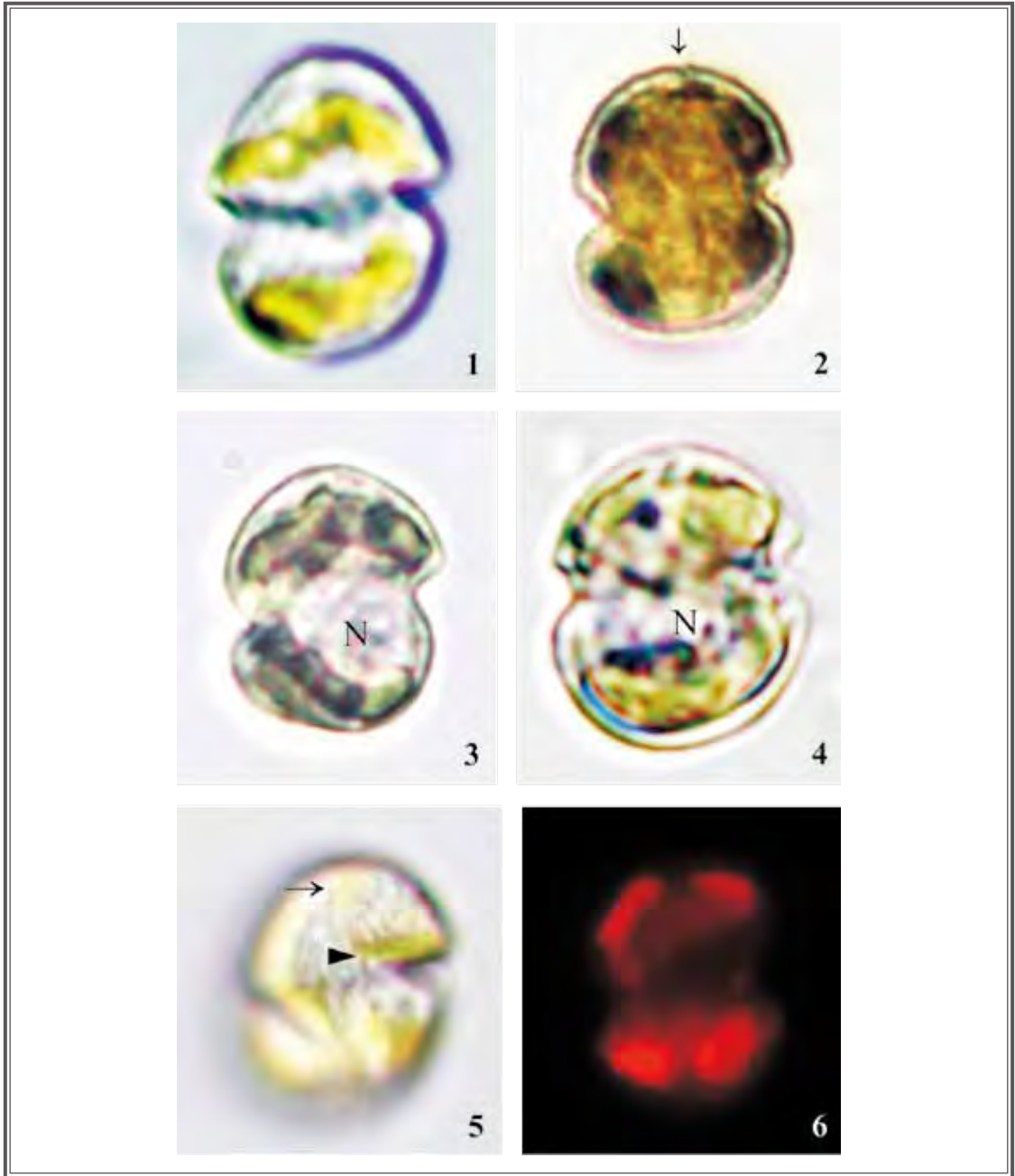
Toxicology: *K. veneficum* is capable of producing karlotoxins that cause mass mortality of fish. Toxicity of the Hong Kong strain is uncertain.

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.

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劇毒卡爾藻。圖 1：活細胞正面觀，可見四個金褐色葉綠體。圖 2：以魯哥氏液固定的細胞正面觀顯示細胞內的大葉綠體，細胞頂端由頂槽造成的凹陷位置（箭咀）。圖 3-4：細胞核 (N) 大而圓，位於細胞左下殼或中心位置。圖 5：細胞殼面可見頂槽（箭咀）及縱溝侵入體（箭頭）；橫溝坑紋深刻，上下位移達本身寬度三倍。圖 6：細胞顯示四個大而自發螢光葉綠體。

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稜角形或多面體形，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.

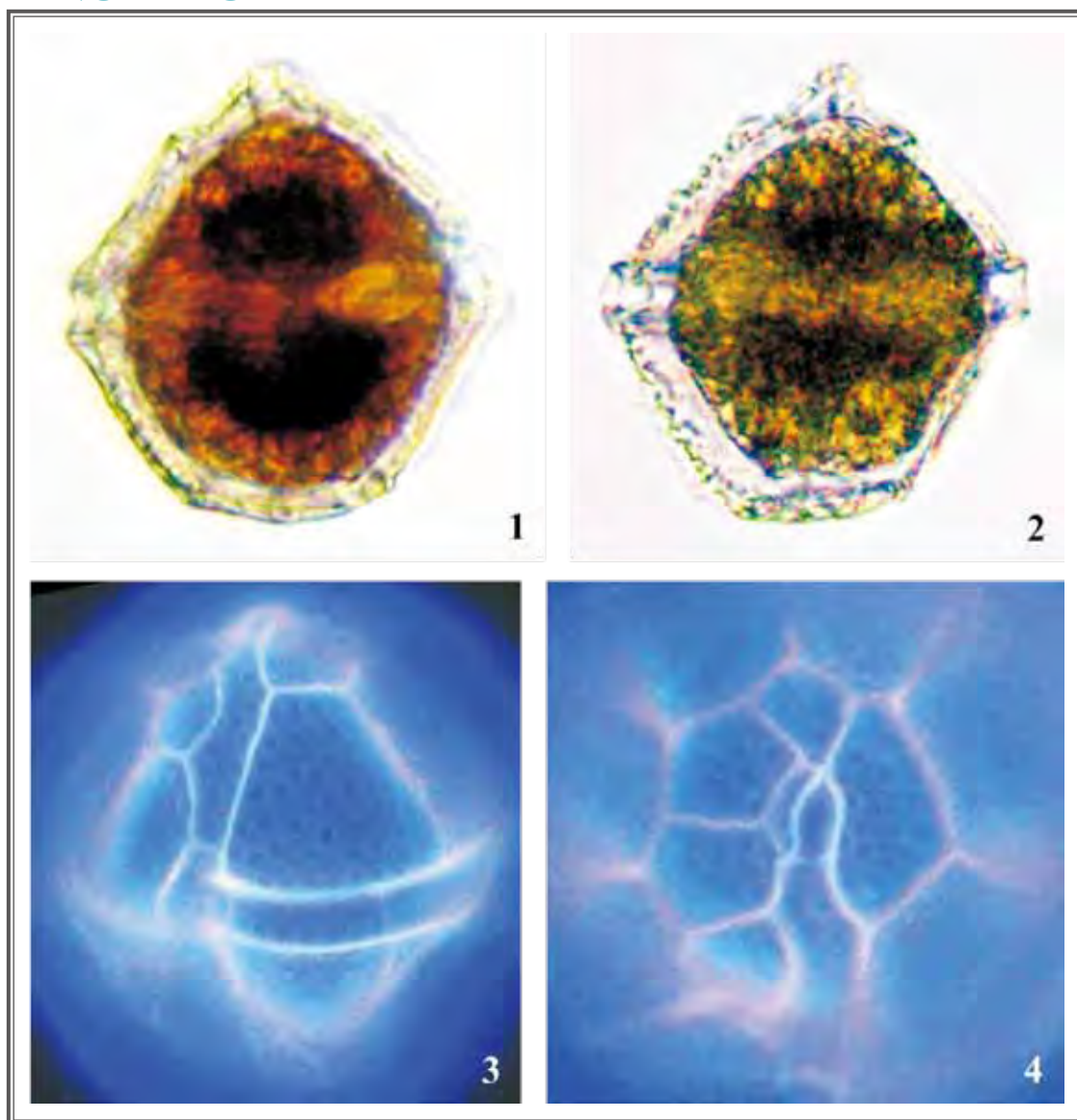
Toxicology: *L. polyedrum* is capable of producing yessotoxins (YTX) which might accumulate in bivalves and is toxic to mice according to overseas findings. The harmful effect of the Hong Kong strain is uncertain.

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.

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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

描述 : 牡蠣甲藻是具有殼片的底棲性甲藻，細胞呈扁豆形或大致卵圓形，漸向縱溝尖窄。背腹長度為 60 – 100 微米，橫徑為 45 – 80 微米。表甲平滑，佈滿大圓孔。第一片甲片大而呈六角形，位於中央。橫邊緣狹淺、平滑。腹甲 (Vp) 有腹孔 (Vo)，橫溝有毗連的彎曲硬甲片。縱溝細小而隱蔽。

毒性 : 牡蠣甲藻可產生 2 種神經毒素：Ostreotoxin – 1 及 Ostreotoxin – 3 毒素。香港的藻株疑有毒性，但尚未能確定。

地區分佈 : 牡蠣甲藻分佈於熱帶淺水區域，常黏附於大型海藻、珊瑚礁或沙粒上。這種藻不曾在香港水域導致紅潮，而且絕少出現，在東北部海域有記錄，細胞濃度低。

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.

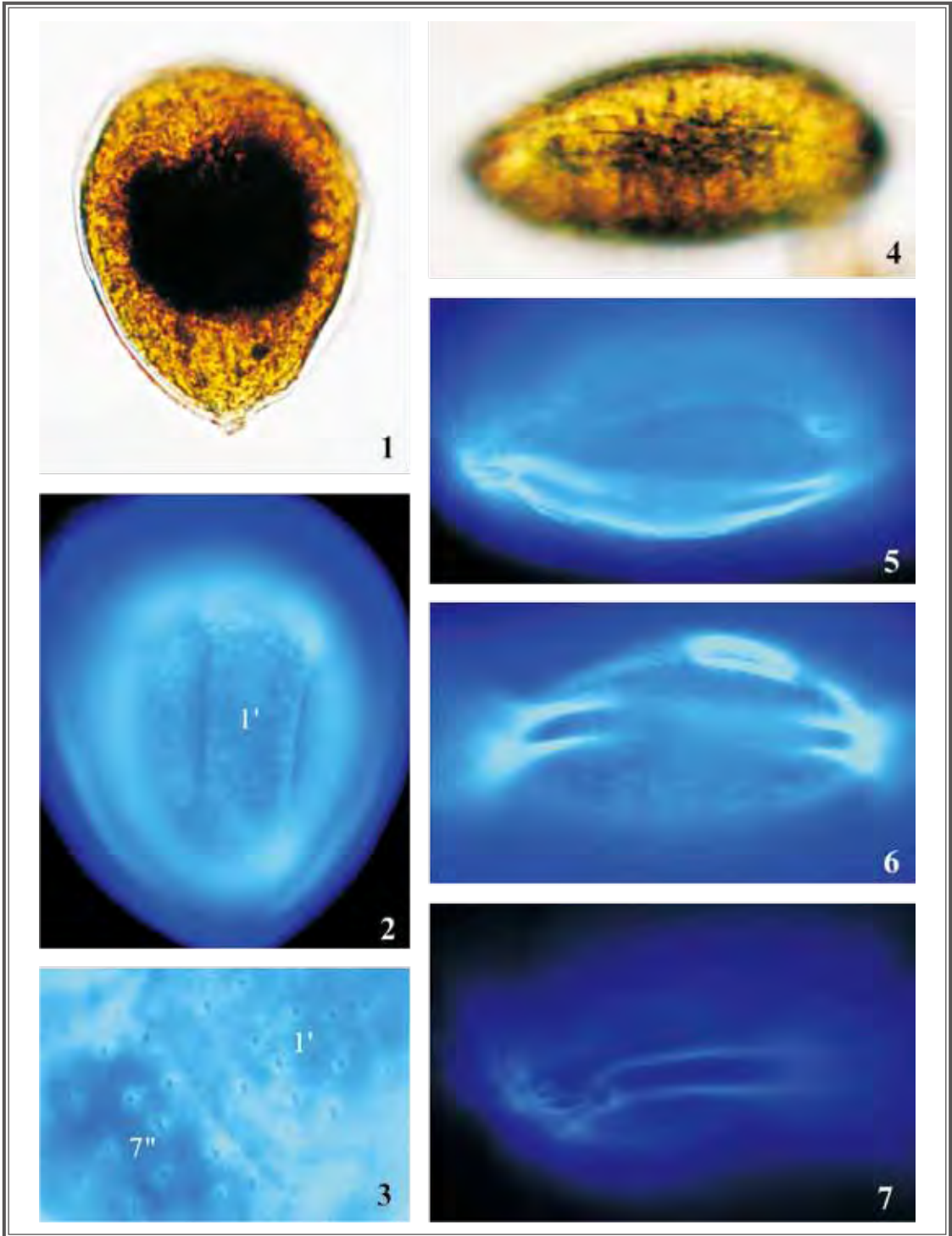
Toxicology: *O. lenticularis* is capable of producing 2 neurotoxins, Ostreotoxin – 1 and Ostreotoxin – 3. Toxicity of the Hong Kong strain is uncertain.

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.

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牡蠣甲藻。圖 1-2：頂面觀顯示細胞呈扁豆或大致卵圓形。圖 3：殼甲佈滿大孔（直徑約 0.4 微米）。圖 4-5：以魯哥氏液固定的細胞左側面觀。圖 6：後面觀。圖 7：正面觀。

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.

利瑪原甲藻

Prorocentrum lima (Ehrenberg) Stein 1878

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

異名 Synonyms : *Cryptomonas lima* Ehrenberg 1860, *Exuviaella marina* Cienkowski 1881, *Dinopyxis laevis* Stein 1883, *Exuviaella lima* (Ehrenberg) Butschii 1885, *E. laevis* (Stein) Schroder 1900, *E. cincta* Schiller 1933, *E. ostenfeldii* Schiller 1933, *E. caspica* Kiselev 1940

描述 : 利瑪原甲藻是具有殼片的底棲性甲藻，細胞呈長方或卵形，屬小至中型藻，殼面觀呈梨形，細胞長 30 – 50 微米，寬 20 – 30 微米。細胞中央有明顯的澱粉核，細胞核位於後側。殼面表面平滑，表面中央範圍以外有零散小孔分佈。圍鞭毛區位於右殼面，呈現淺小 V 形凹陷，右殼面由八片小甲及兩個孔組成（一個較大的鞭毛孔及一個較小的輔助孔）。

毒性 : 利瑪原甲藻可產生製造多種毒素，例如快速反應毒素 (FAT)、原甲藻大環內酯和下痢性貝類毒素 (DSP) 有關毒素，包括大田軟海綿酸 (OA)、鱈藻毒素 DTX-1、DTX-2 及 DTX-4。香港的藻株疑有毒性，但尚未能確定。

地區分佈 : 利瑪原甲藻廣泛分佈於溫帶和熱帶水域。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: *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).

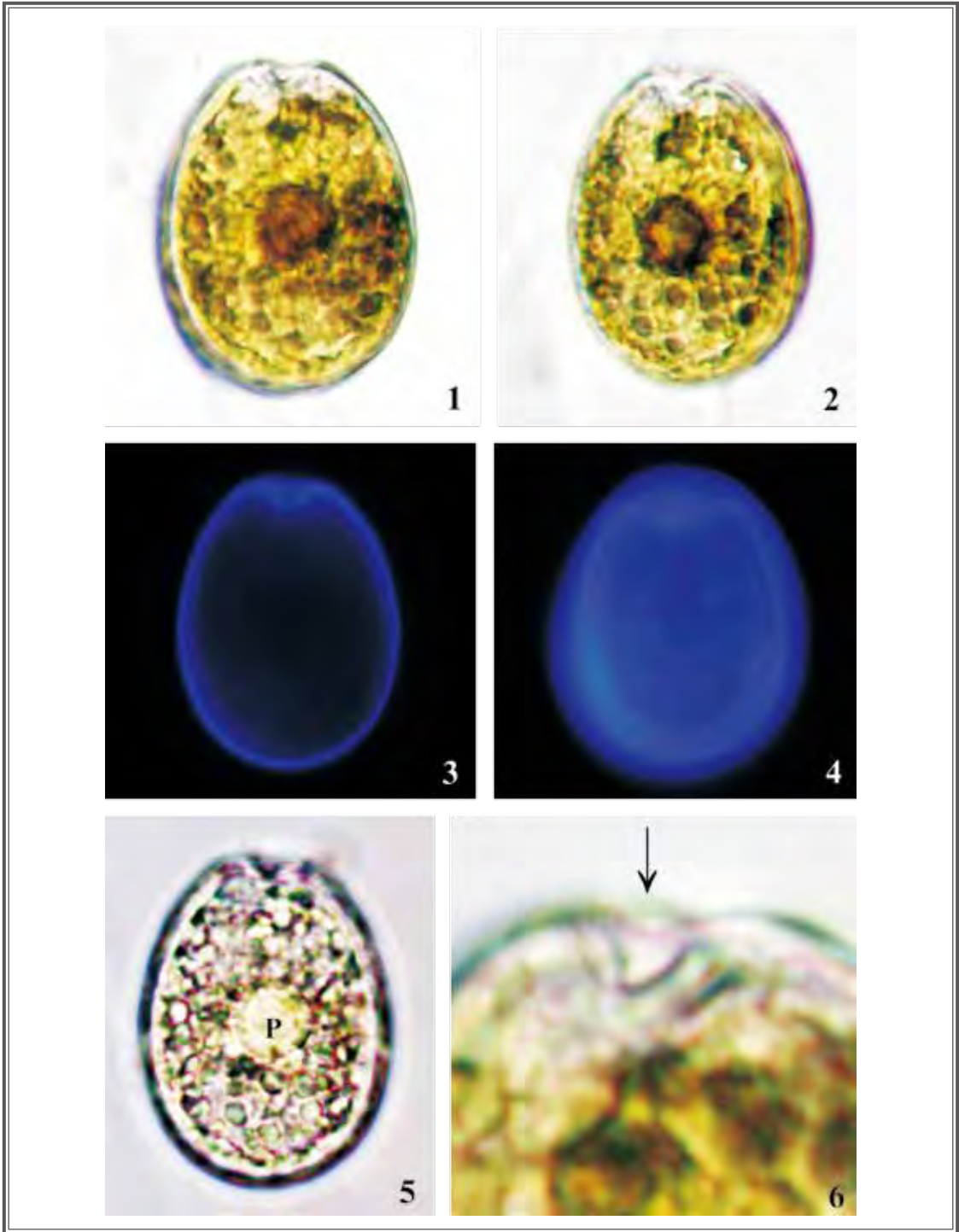
Toxicology: *P. lima* is capable of producing several different types of toxins such as fast-acting toxin (FAT), prorocentrolide, and diarrhetic shellfish poisoning (DSP) related toxins including okadaic acid (OA), Dinophysistoxin-1 (DTX1), Dinophysistoxin-2 (DTX2) and Dinophysistoxin-4 (DTX4). Toxicity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

參考文獻 References:

- Faust, M. A. and Gullede, R. A. 2002. *Identification Harmful Marine Dinoflagellates*, United States National Herbarium 42:60-61, 139.
- Faust, M. A., Moestrup, O., Larsen, J. and Lindley, J. A. (Eds) 1999. ICES *Identification Leaflets for Plankton No.184*. Potentially Toxic Phytoplankton 3. Genus *Prorocentrum* (Dinophyceae). pp. 12-14.
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利瑪原甲藻。圖 1-3：殼面觀顯示細胞呈倒卵形或長方形。圖 4：殼甲中央範圍以外散佈殼甲孔。圖 5：細胞中央有澱粉核 (P)。圖 6：右殼面前側可見 v 形凹陷 (箭咀)。

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

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

異名 Synonyms : *Exuviaella minima* Pavillard 1916, *Prorocentrum triangulatum* Martin 1929, *Exuviaella marie-lebouriae* Parke & Ballantine 1957, *P. cordiformis* Bursa 1959, *P. mariae-lebouriae* (Parke & Ballantine 1957) Loeblich III 1970

描述 : 微小原甲藻的細胞細小，兩側扁平，呈三角、橢圓、圓形或心形，細胞長 10 – 23 微米，寬 10 – 15 微米，有一短頂刺。殼甲表面佈滿短刺及散佈小孔，前端寬大而截尾，右殼面頂端有淺小 V 形凹陷。右殼面稍為偏側，由八片小甲及兩個孔組成（一個較大的鞭毛孔及一個較小的輔助孔）。細胞核大致呈橢球形，位於後側。細胞有大澱粉核及兩個液泡。

毒性 : 微小原甲藻可產生導致貝類中毒的蛤仔毒素（肝臟毒素），令人類腸胃不適或死亡。香港的藻株疑有毒性，但尚未能確定。

地區分佈 : 微小原甲藻廣泛分佈沿海水域，這種藻在日本、澳洲、中國東海水域及中國南海水域包括香港是常見紅潮品種。在中國曾造成養殖魚類大量死亡及在日本造成貝類死亡的記錄。

這種藻是香港常見的紅潮品種，由 1986 年至今先後在吐露港及東北部海域合共錄得 46 宗紅潮，1995 年及 1998 年藻華期間引致魚類死亡。

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.

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.

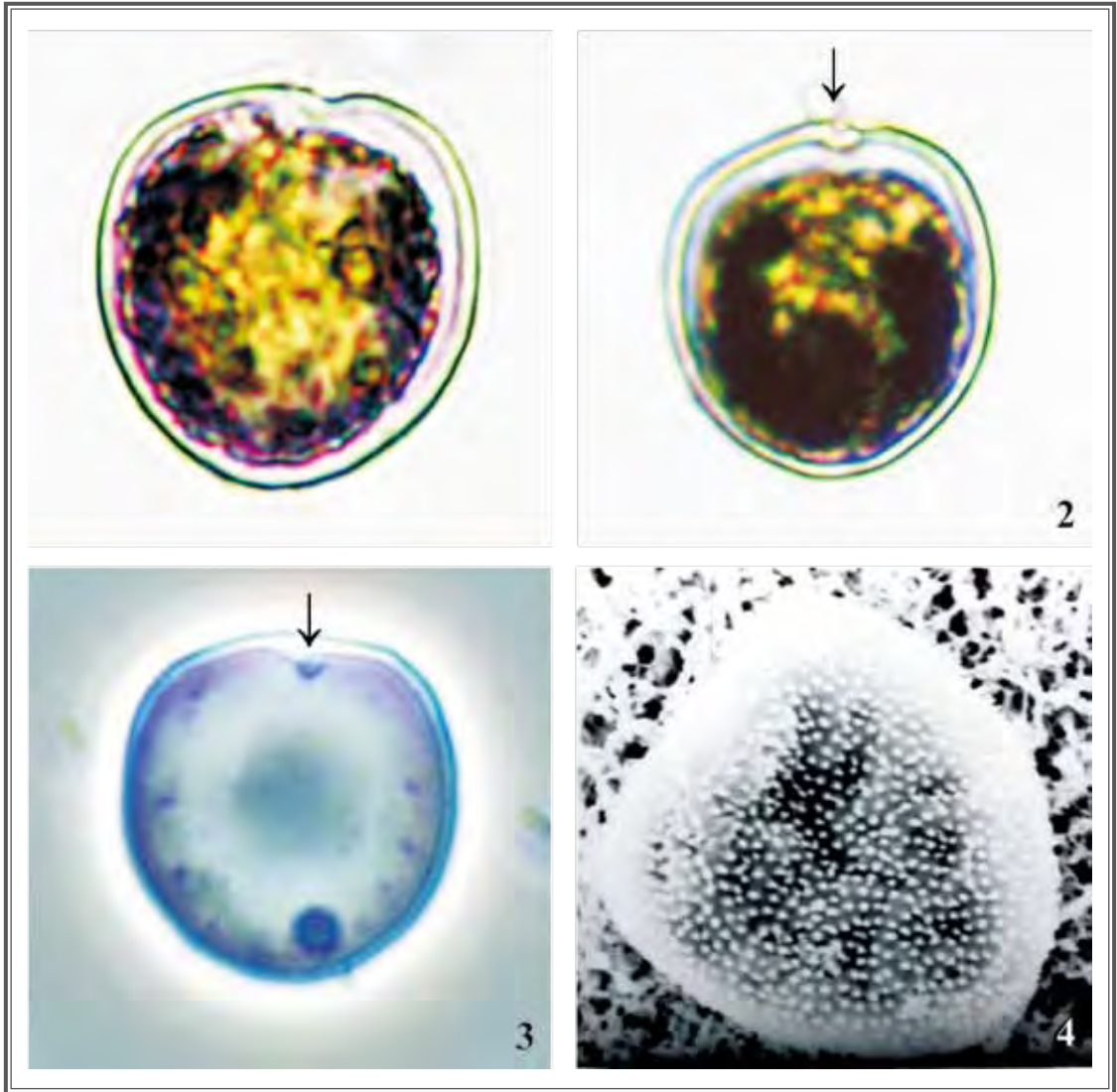
Regional distribution: *P. minimum* widely distributed in coastal waters. It is a common red tide causative species in Japan, Australia, East China Sea, South China Sea including Hong Kong. It has been reported to cause fish kill in China and shellfish kills in Japan.

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 Northeastern waters since 1986 and fish kills were reported during the blooms in 1995 and 1998.

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- Faust, M. A. and Gullledge, R. A. 2002. *Identification Harmful Marine Dinoflagellates*, United States National Herbarium 42:65, 143.
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- Heimann, K., Roberts, K. R. and Wetherbee, R. 1995. Flagellar apparatus transformation and development in *Prorocentrum micans* and *P. minimum* (Dinophyceae). *Phycologia*, 34(4):323-335.

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微小原甲藻。圖 1-2：細胞頂面觀，可見短頂刺（箭咀）。圖 3：右殼面前端可見 V 形凹陷（箭咀）。圖 4：掃描電子顯微鏡圖片顯示殼甲表面佈滿短刺。

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.

慢原甲藻

Prorocentrum rhathymum Loeblich, Sherley & Schmidt 1979

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 μm long, 20 – 27 μm 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.

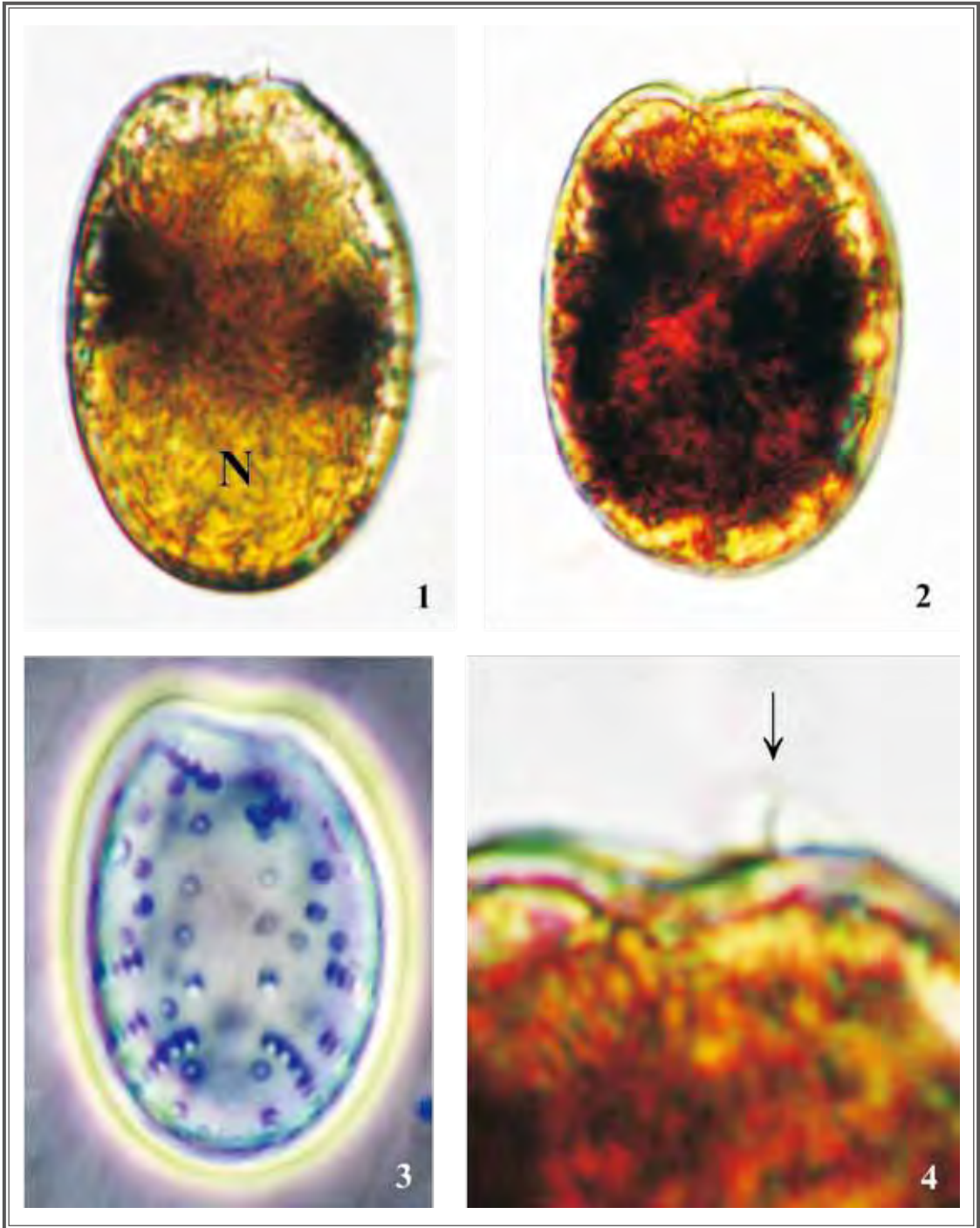
Toxicology: *P. rhathymum* is capable of producing haemolytic and fast-acting toxin (FAT). Toxicity of the Hong Kong strain is uncertain.

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:

- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 422. UNESCO publishing.
- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 62-63. Denmark.

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慢原甲藻。圖 1-2：細胞側面觀顯示細胞呈橢圓形；細胞核位於細胞的下方部份 (N)。圖 3：刺絲泡小孔呈放射形排列。圖 4：圍鞭毛區展示翼狀頂刺 (箭咀)。

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 : 網狀原角藻是單一細胞的小至中型藻，大致呈球形至橢圓形，細胞體長 28 – 53 微米，寬 25 – 45 微米。環溝位於細胞中心位上方，其上下位移只有一個殼環帶寬度，下殼片比上殼片長。殼片表面有密集的網狀紋，每個網狀紋中心的凹陷處有一小穴。第一片頂甲片呈菱形，有一小腹孔。

毒性 : 網狀原角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 : 網狀原角藻很少出現在亞洲海域，在香港水域亦為罕見，不曾在香港引致紅潮，過去只錄得極低濃度。

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.

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.

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.

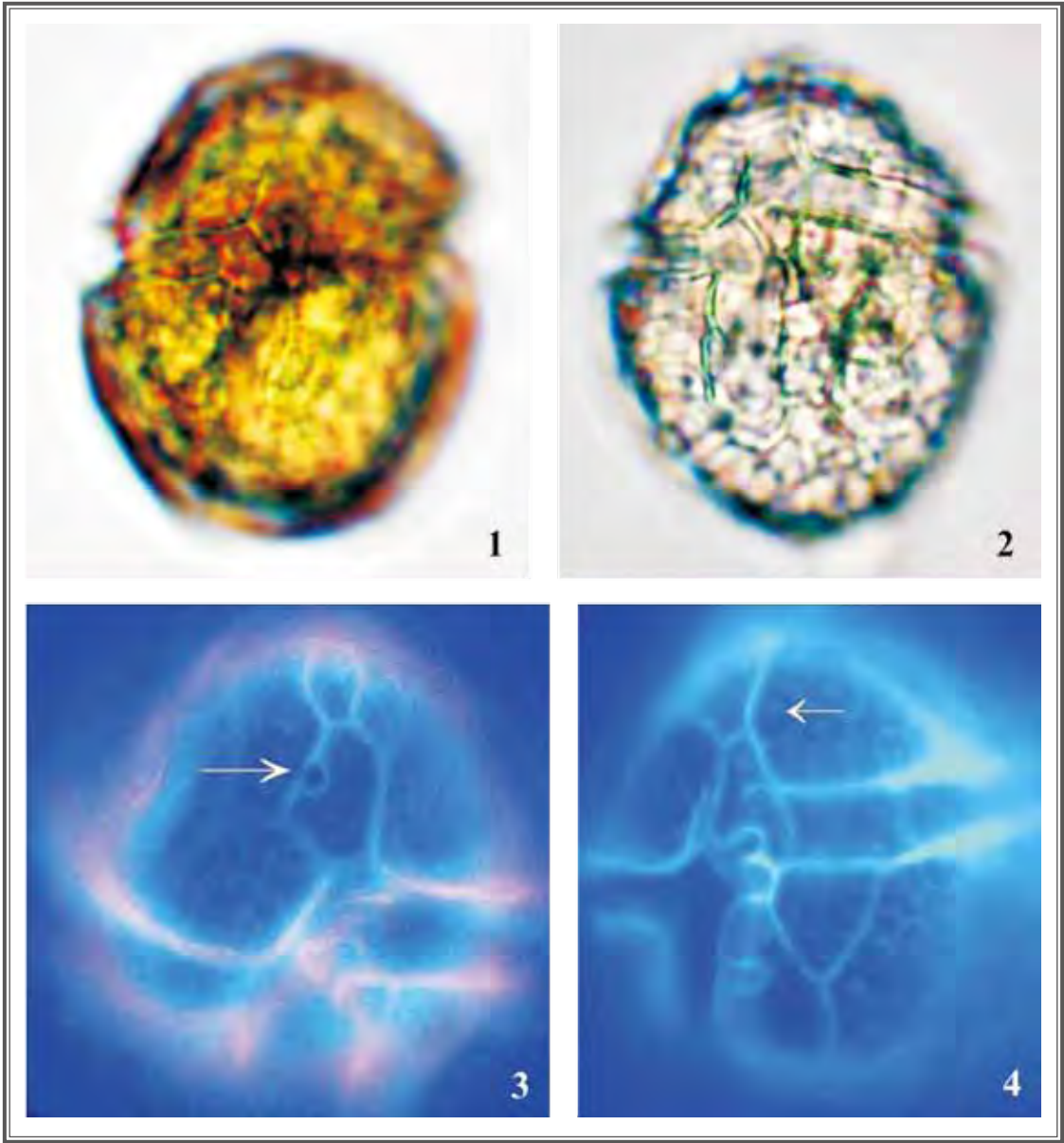
參考文獻 References:

Fukuyo, Y., Takano, H., Chihara, M. and Matsuoka, K. 1990. *Red Tide Organisms in Japan-An Illustrated Taxonomic Guide*. pp. 110-111. Uchida Rokakuho, Co., Ltd. Tokyo, Japan.

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Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 215, 409. UNESCO publishing.

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網狀原角藻。圖 1-2：細胞正面觀顯示殼片表面有明顯密集的網狀紋；下殼片比上殼片長。圖 3：第一片頂甲片呈稜角，有一小腹孔（箭咀）。圖 4：每個網狀紋中心的凹陷處有一小穴（箭咀）。

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)，是一種導致貝類毒素中毒。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，不會在香港引致紅潮。

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 antapical 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.

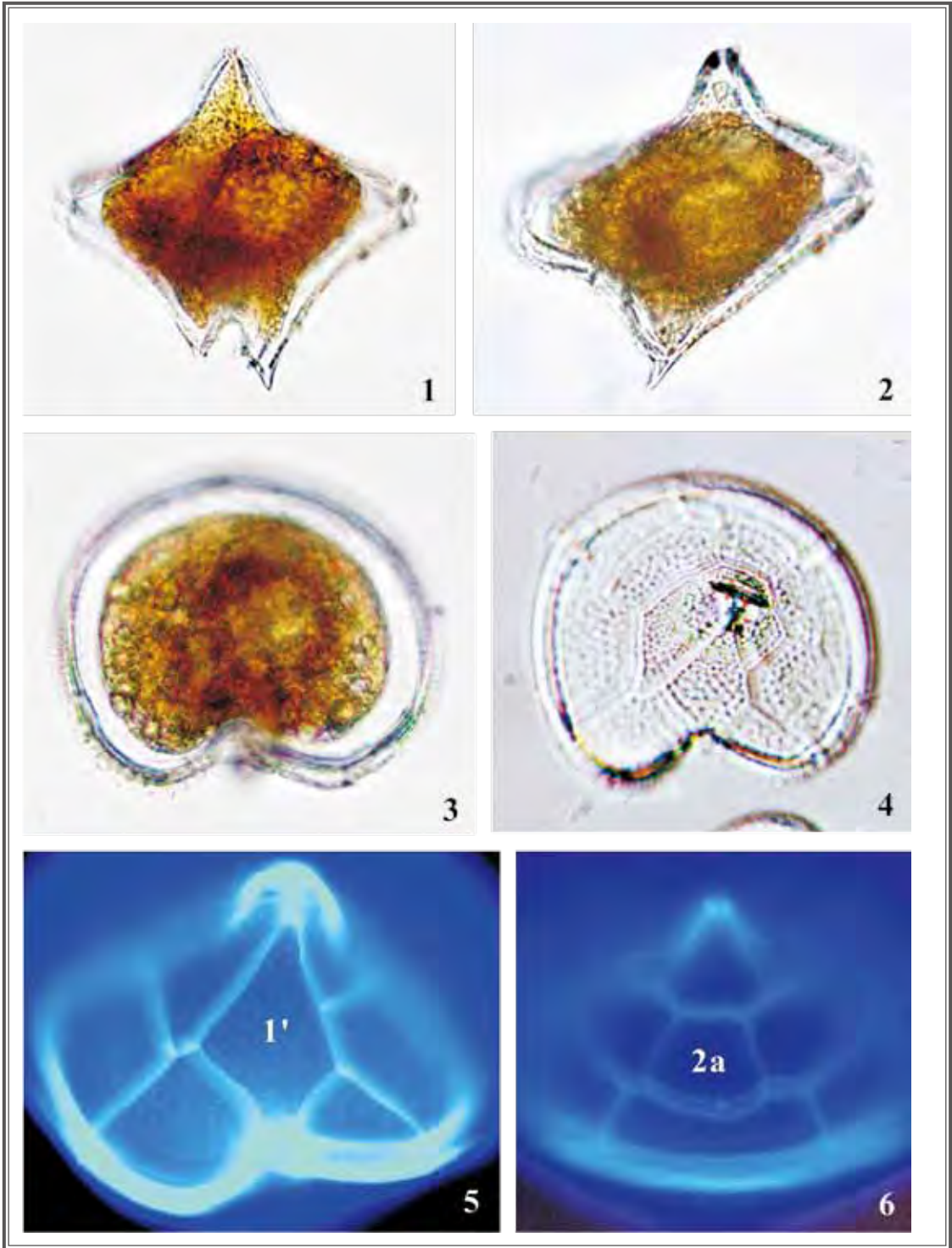
Regional distribution: *P. crassipes* has very few occurrence record found in Asia waters and it seldom occurs and only very low concentrations had been detected in Hong Kong. It has not caused red tide in Hong Kong.

參考文獻 References:

Hallegraeff, G. M. et al., 2010. Algae of *Australia-Phytoplankton of Temperate Coastal Waters*. pp. 197. Canberra & CSIRO publishing.

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厚甲原多甲藻。圖 1：細胞正面觀顯示邊底部短角較邊闊長。圖 2：側面觀。圖 3：頂面觀。圖 4：殼片表面呈網狀紋。圖 5-6：殼片排列顯示第一頂甲片是五邊形而中間甲片是四邊形。

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

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

描述 : *Takayama pulchella* 是不具殼片甲藻，為單一細胞，呈倒卵形，背腹略扁平，細胞長 13 – 27 微米，寬 12 – 25 微米。頂槽呈 S 形，逆時針方向環繞細胞頂端。上殼為半球狀，下殼截尾及有坑槽，正面觀可見一尖削的縱溝侵入體伸進上殼少許。縱溝下殼段較橫溝區闊。細胞核頗大，呈橢球形，位於細胞左側。細胞有多個不規則形葉綠體，中央有澱粉核。

毒性 : 據外國文獻記載 *T. pulchella* 可導致魚類死亡。香港的藻株疑有毒性，但尚未能確定。

地區分佈 : *T. pulchella* 曾經在澳洲、日本及中國南海水域形成紅潮。這種藻於 2011 年在香港吐露港引發 1 宗紅潮，但沒有造成魚類死亡。常見於香港海域，細胞濃度低。

Description: *Takayama pulchella* is an unarmoured 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.

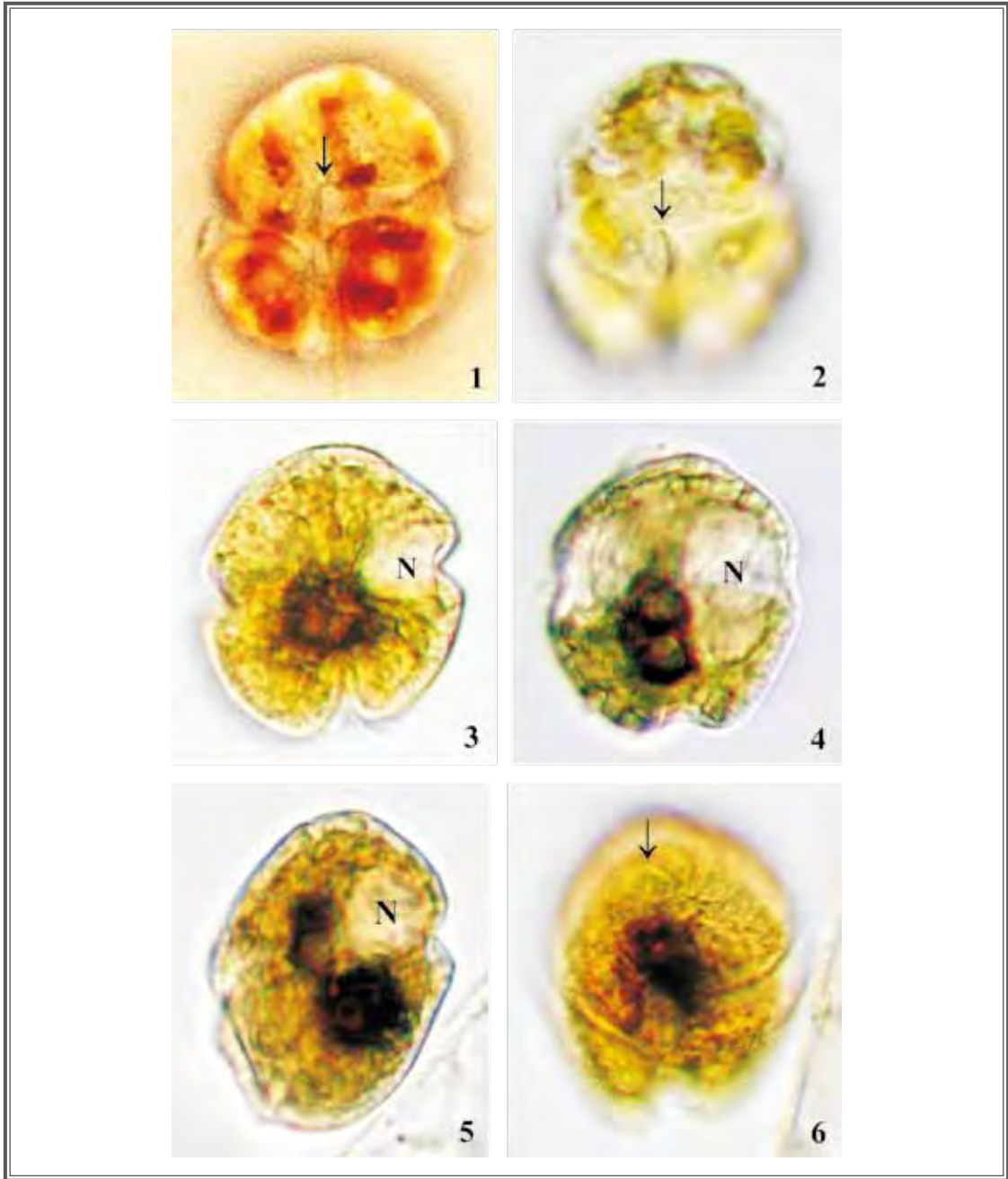
Toxicology: *T. pulchella* is a toxic species which causes fish kill according to overseas findings. Toxicity of the Hong Kong strain is uncertain.

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.

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- De Salas, M. F., Bolch C. J. S., Botes L., Nash G., Wright S. W. and Hallegraeff G. M. 2003. *Takayama* gen. nov. (Gymnodiniales, Dinophyceae), a new genus of unarmored dinoflagellates with sigmoid apical grooves, including the description of two new species. *Journal of Phycology*, 39:1233-1246.
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- Hou, J. J., Lai H. Y., Lei H. L. and Huang, B. Q. 2008. Study on detection of in situ growth rate of *Takayama pulchellum*. *Acta Hydrobiologia Sinica*, 32(2):141-147.

DINOPHYCEAE



Takayama pulchella 。圖 1-2：活細胞正面觀，可見尖削的手指狀縱溝侵入體伸進上殼（箭咀）；葉綠體各有澱粉核。圖 3-4：以魯哥氏液固定的細胞，顯示細胞核 (N) 大而呈橢球形，位於細胞左側。圖 5：細胞左側面觀顯示細胞核接近細胞背側。圖 6：S 形頂槽環繞細胞頂端（箭咀）。

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

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: *Takayama tasmanica* 是不具殼片甲藻，為單一細胞，呈卵形，背腹略扁平，細胞長 16–34 微米，寬 14–32 微米。頂槽呈 S 形，逆時針方向環繞細胞頂端。上殼為半球狀，下殼截尾及有坑槽，正面觀可見一尖削的縱溝侵入體伸進上殼少許。縱溝下殼段較橫溝區闊。細胞核頗大、多裂，呈 C 形，佔據整個細胞上殼。細胞有多個不規則形葉綠體，呈放射排列於細胞外圍，中央有澱粉核。

毒性: 據外國文獻記載 *T. tasmanica* 可導致魚類死亡。香港的藻株疑有毒性，但尚未能確定。

地區分佈: *T. tasmanica* 於印度、澳洲有記錄。這種藻不曾在香港水域導致紅潮，在香港的東北水域有記錄，細胞濃度低。

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.

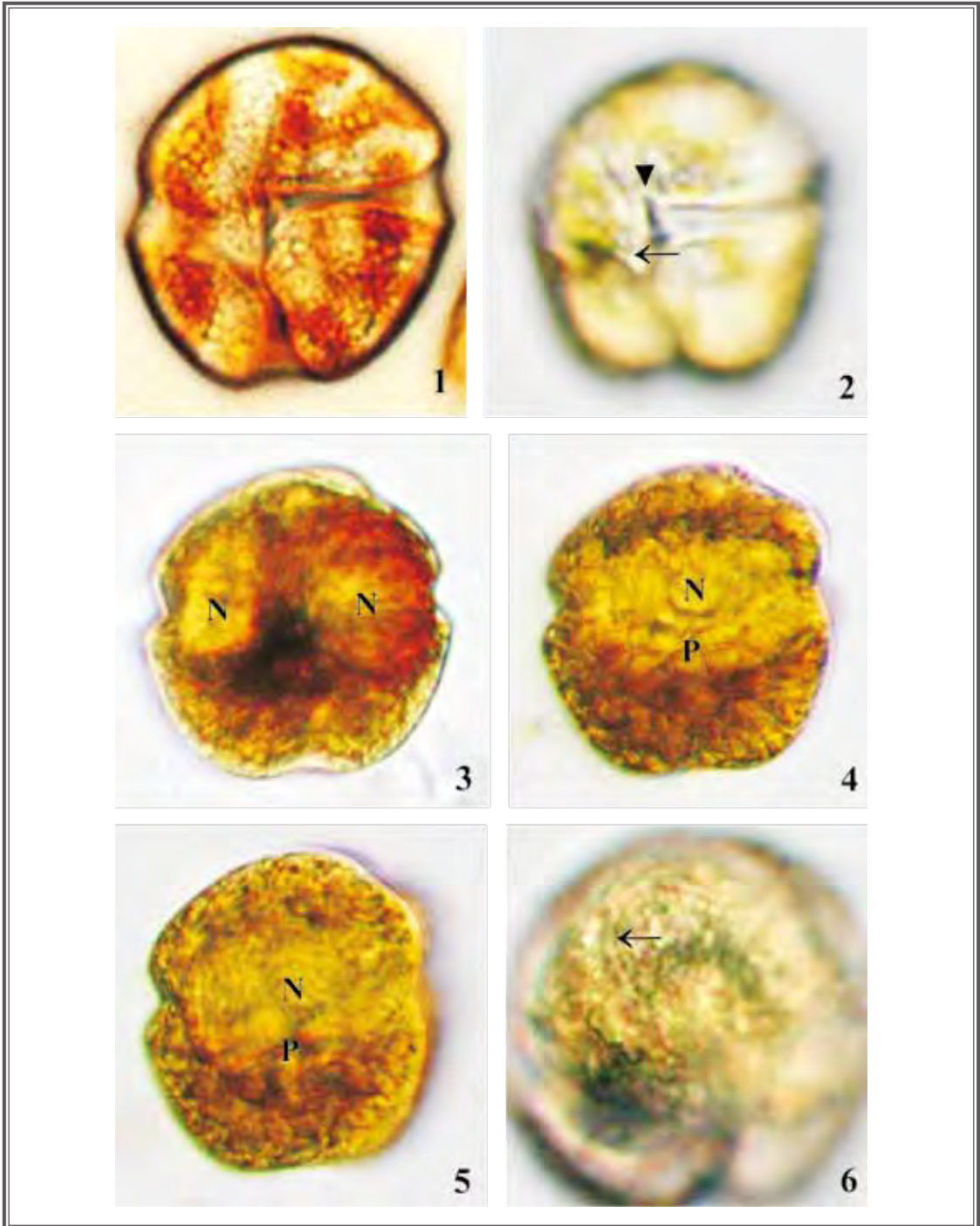
Toxicology: *T. tasmanica* is a toxic species which causes fish kill according to overseas findings. Toxicity of the Hong Kong strain is uncertain.

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.

參考文獻 References:

- De Salas, M. F., Bolch C. J. S., Botes L., Nash G., Wright S. W. and Hallegraeff G. M. 2003. *Takayama* gen. nov. (Gymnodiniales, Dinophyceae), a new genus of unarmoured dinoflagellates with sigmoid apical grooves, including the description of two new species. *Journal of Phycology*. 39:1233-1246.
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DINOPHYCEAE



Takayama tasmanica。圖 1-2：活細胞正面觀，尖削的手指狀縱溝侵入體伸進上殼（箭頭），頂槽橫溝末端有一小孔或裂紋（箭咀），不規則形葉綠體，呈放射排列。圖 3-5：以魯哥氏液固定的細胞，顯示細胞核 (N) 大而佔據整個細胞上殼。圖 6：S 形頂槽環繞細胞頂端（箭咀）。

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

門 Phylum : 定鞭藻門 Haptophyta

綱 Class : 定鞭藻綱 Prymnesiophyceae

目 Order : 棕囊藻目 Phaeocystales

科 Family : 棕囊藻科 Phaeocystaceae

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，曾經在越南、中國東海水域及中國南海水域包括香港形成紅潮。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.

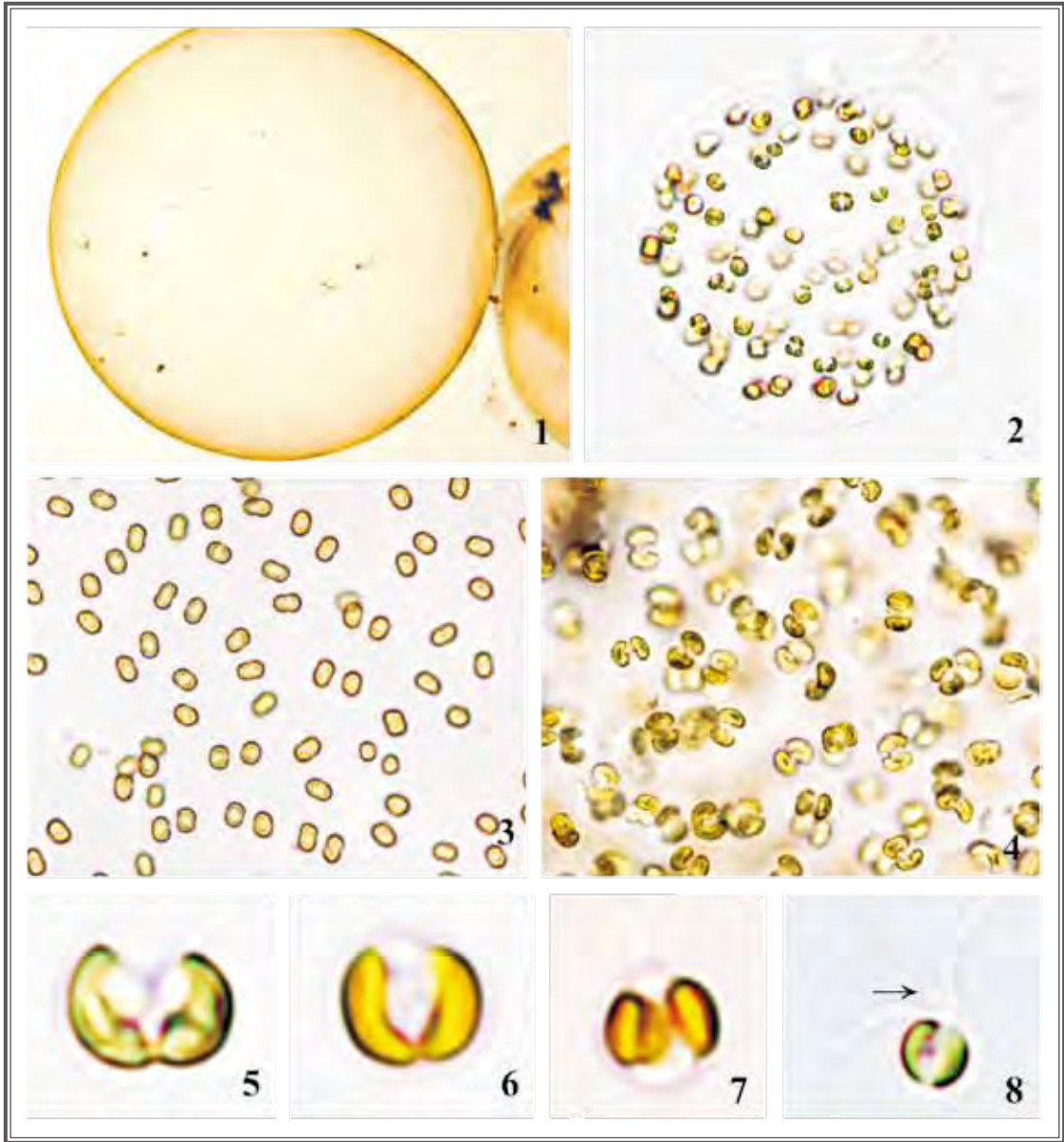
Regional distribution: *P. globosa* is widely distributed in temperate coastal and oceanic waters and known to cause red tides in Vietnam, East China Sea and South China Sea including Hong Kong. It has been reported to cause mortality of caged lobster in Vietnam and fish kill in China.

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.

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- Hallegraeff, G. M., Anderson, D. M. and Cembella, A. D. (Eds). 2003. *Manual on Harmful Marine Microalgae*. pp. 449-450. UNESCO publishing.
- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 138-139. Denmark.

PRYMNESIOPHYCEAE



球形棕囊藻。圖 1：活體球狀群落 (直徑 8 毫米)。圖 2：活培養群落 (直徑 95 微米)。圖 3：個別細胞散佈於群落表面。圖 4-5：以魯哥氏液固定的細胞。圖 6-7：非動性活細胞，可見有黃褐色葉綠體而沒有鞭毛。圖 8：動性活細胞 (游動個體)，可見有兩根鞭毛及一根定鞭毛 (箭咀)。

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).

海洋褐胞藻

Chattonella marina (Subrahmanyam) Hara & Chihara 1982

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 : *Hornellia marina* Subrahmanyam 1954

描述 : 海洋褐胞藻是長方或倒卵形單一細胞藻，後端有小尖尾，細胞側面觀不對稱，略呈扁平，細胞長 30 – 70 微米，寬 12 – 33 微米。兩根長度相約的鞭毛與細胞長度大約相同，由前端凹陷底部伸出。淚珠形細胞核位於細胞中央，細胞有大量綠色或黃褐色橢球形葉綠體呈放射形排列，葉綠體內有澱粉核。周邊細胞質有緊密的電子粒子 (嗜鐵性)，沒有伸縮泡、眼點及黏液泡。

毒性 : 根據外國文獻記載海洋褐胞藻可產生神經性、溶血性毒素和血凝複合物，可引致魚類死亡。

地區分佈 : 海洋褐胞藻曾經在日本、黃海、中國南海水域包括香港形成紅潮。這種藻在日本造成魚類死亡的記錄。

海洋褐胞藻曾於 2001 年、2003 年、2004 年及 2012 年在香港東北部、東南部及南部海域導致 5 宗紅潮，於 2001 年發生的紅潮曾引致魚類死亡。此外這種藻在東北部、東部及南部水域有記錄，但出現頻率及濃度俱低。

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.

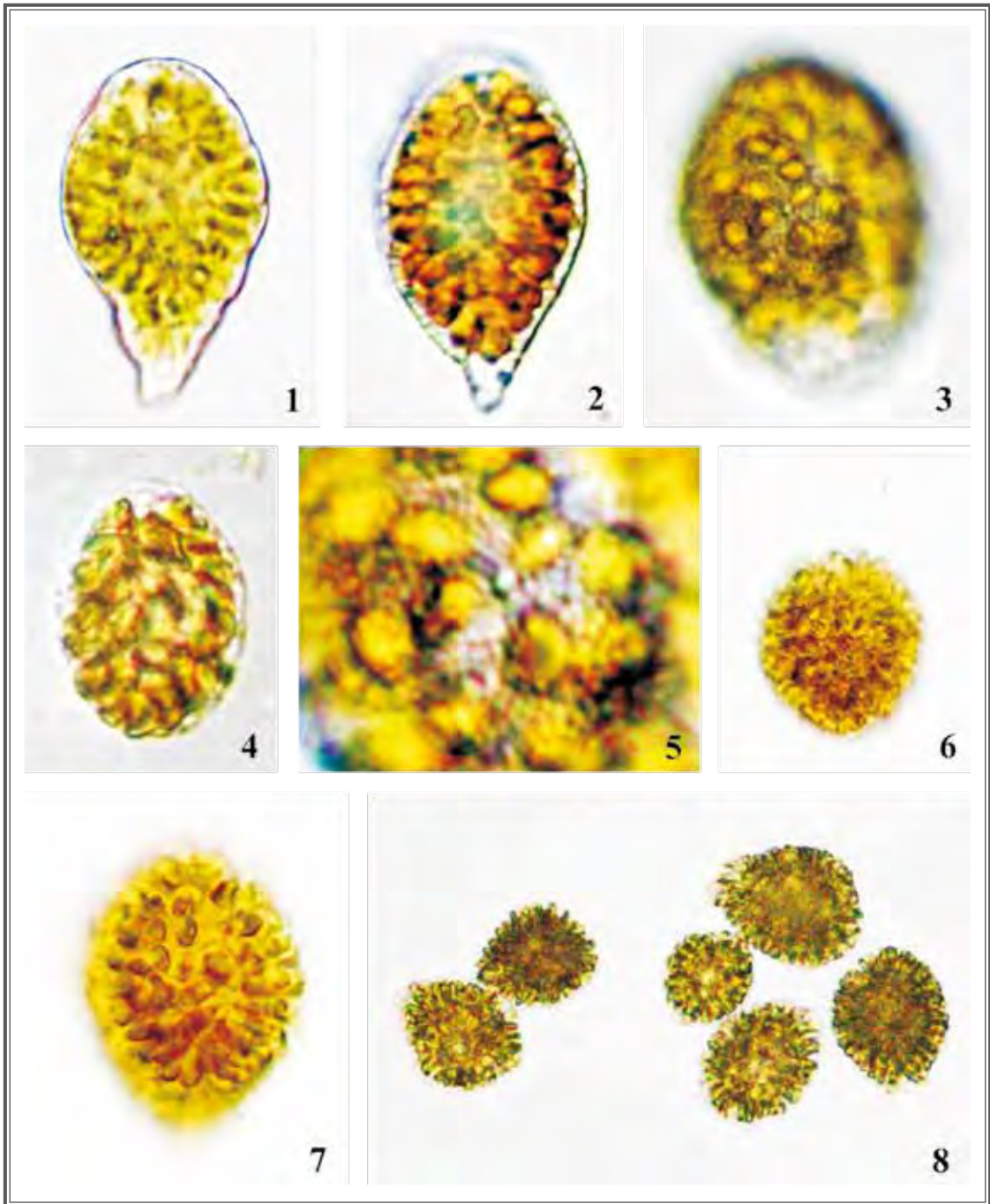
Regional distribution: *C. marina* is known to cause red tides in Japan, Yellow Sea and South China Sea including Hong Kong. It has been reported to cause fish kill in Japan.

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.

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- Fukuyo, Y., Takano, H., Chihara, M. and Matsuoka, K. 1990. *Red Tide Organisms in Japan-An Illustrated Taxonomic Guide*. pp. 336-337. Uchida Rokakuho, Co., Ltd. Tokyo, Japan.
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- Larsen, J. and Nguyen, N. L. (Eds). 2004. *Potentially toxic microalgae of Vietnamese waters. Opera Botanica 140*. Council for Nordic Publications in Botany. pp. 152. Denmark.

RAPHIDOPHYCEAE



海洋褐胞藻。圖 1-2：活細胞佈滿放射形排列的綠色或黃褐色橢球形葉綠體；後端有尾突。圖 3：活培養細胞。圖 4：細胞停止游動後開始團縮。圖 5：細胞表面佈滿電子致密（嗜鐵性）粒子。圖 6-8：以魯哥氏液固定的不同形狀細胞。

Chattonella marina. Figures 1-2: Live cells showing numerous green to yellowishbrown ellipsoid 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 : 海洋褐胞藻卵形變種是單一細胞藻，細胞頗為扁平，呈卵形或倒卵形，長 39 – 100 微米，寬 24 – 50 微米。兩根長度相約的鞭毛呈不同活動模式，由細胞前端凹陷底部伸出。細胞有大量黃褐色橢球形葉綠體成放射形排列，當中含小泡。葉綠體內有澱粉核，周邊細胞質有緊密的電子粒子（嗜鐵性），沒有伸縮空泡、眼點及黏液泡。

毒性 : 根據外國文獻記載海洋褐胞藻卵形變種可產生氧自由基、過氧化氫複合物，可能引致魚類死亡。

地區分佈 : 海洋褐胞藻卵形變種曾經在日本、中國南海水域包括香港形成紅潮。這種藻曾在日本造成魚類死亡。

在 1991 年及 2001 年海洋褐胞藻卵形變種曾在香港東北部及南部海域造成四宗紅潮，2001 年藻華期間更引致魚類死亡。此外這種藻在香港東北部、東部及南部水域有記錄，但出現頻率及濃度俱低。

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.

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

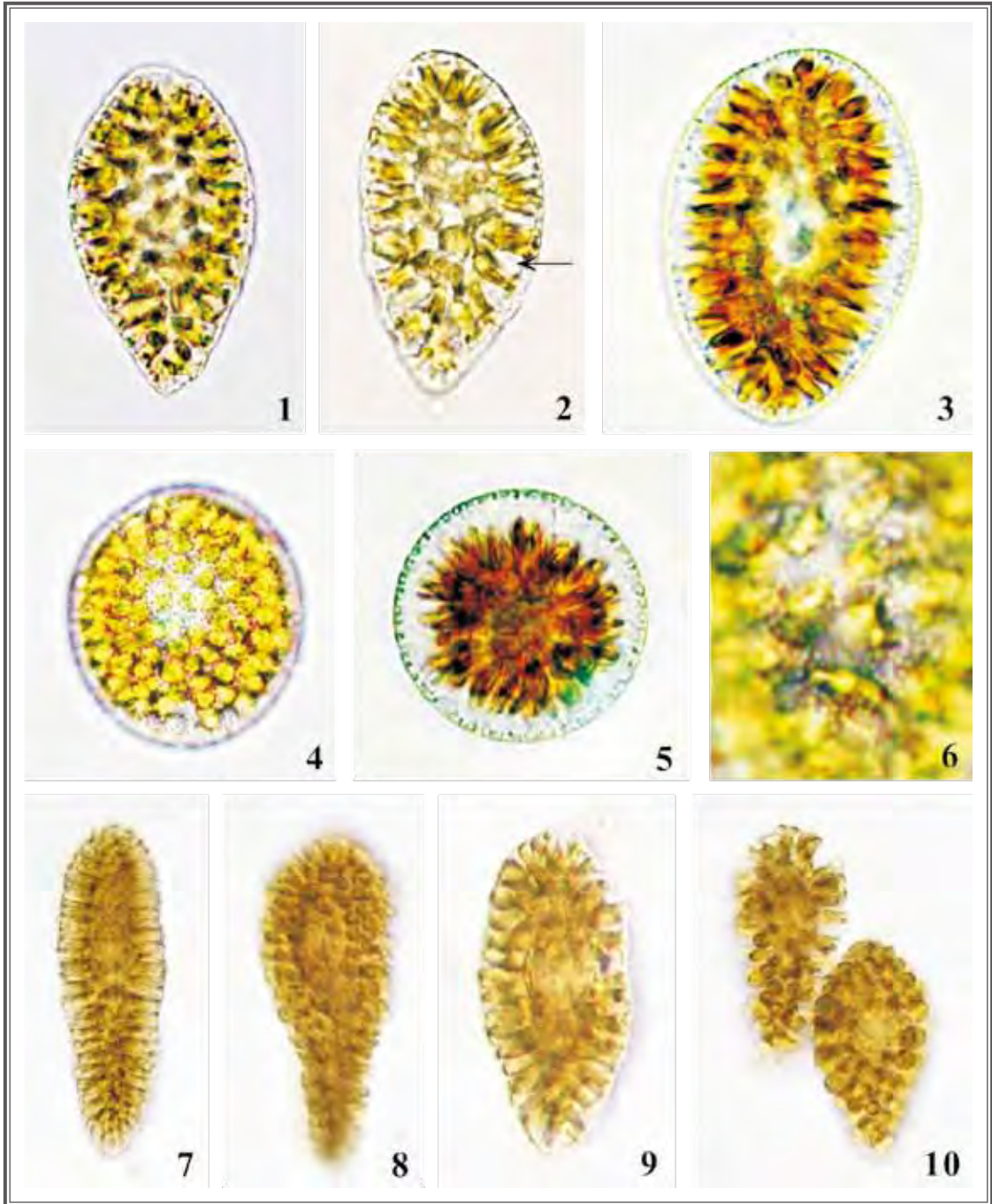
Regional distribution: *C. marina* var. *ovata* is known to cause red tides in Japan and South China Sea including Hong Kong. It has been reported to cause fish kill in Japan.

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.

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- Demura, M., Noël, M. H., Kasai, F., Watanabe, M. M. and Kawachi, M. 2009. Taxonomic revision of *Chattonella antiqua*, *C. marina* and *C. ovata* (Raphidophyceae) based on their morphological characteristics and genetic diversity. *Phycologia*, 48(6):518-535.

RAPHIDOPHYCEAE



海洋褐胞藻卵形變種。圖 1-3：活體細胞佈滿放射形排列的黃褐色橢球形葉綠體；葉綠體當中含小泡（箭咀）；細胞中央有淚珠形大細胞核。圖 4-5：活體細胞停止游動後開始團縮。圖 6：細胞表面佈滿電子致密（嗜鐵性）粒子。圖 7-10：以魯哥氏液固定的不同形狀細胞。

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.

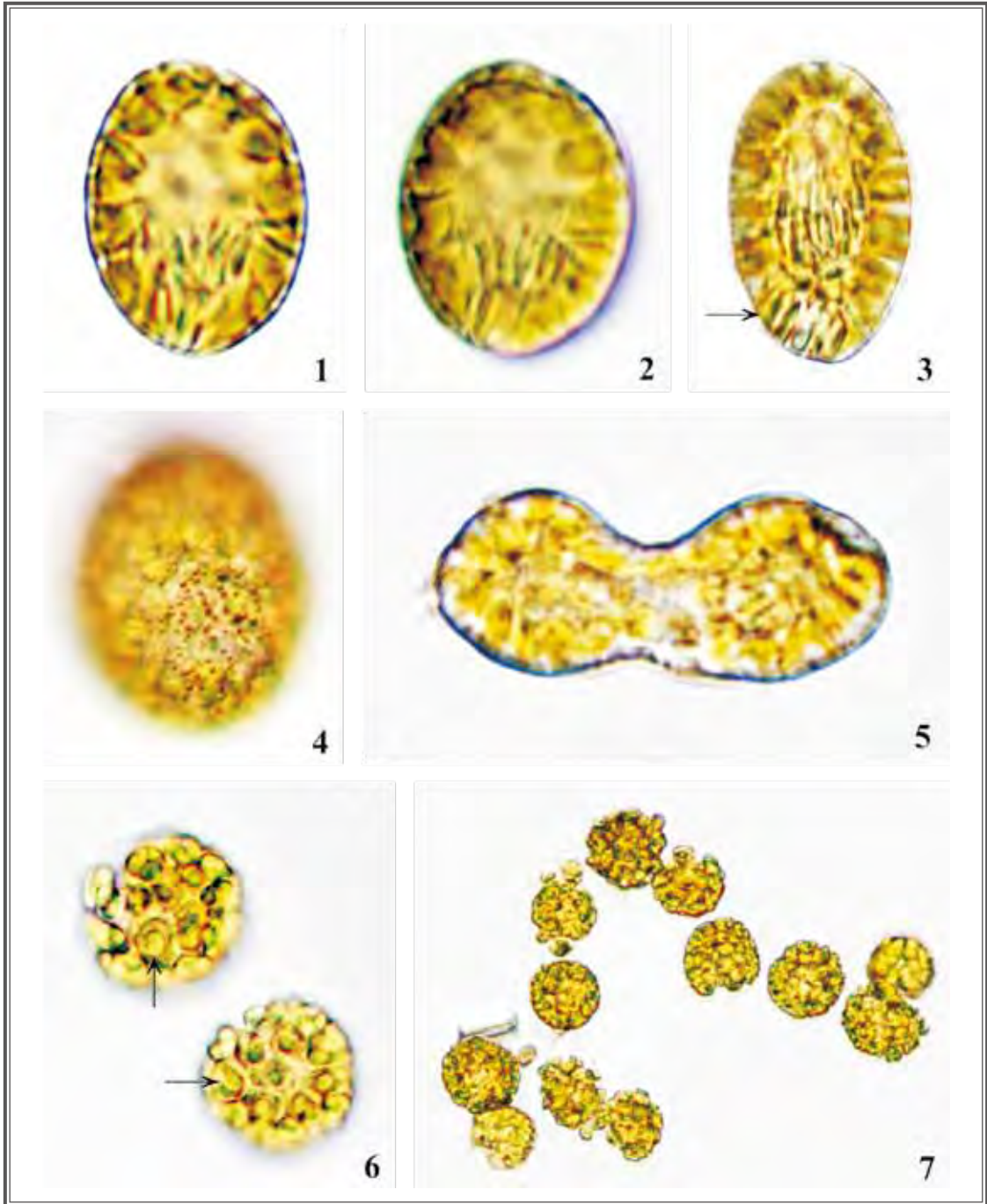
Regional distribution: *F. japonica* is distributed in temperate coastal waters and known to cause red tides in Japan, Australia, New Zealand and Hong Kong. It has been reported to cause fish kill in Japan.

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 occasionally detected in Hong Kong waters.

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RAPHIDOPHYCEAE



針胞藻。圖 1-3：活體細胞顯示卵形或倒卵形狀，佈滿盤狀金褐色葉綠體；細胞後端有數個桿狀黏液泡，密集排列（箭咀）。圖 4：細胞表面有許多電子致密粒子。圖 5：細胞正進行分裂。圖 6-7：以魯哥氏液固定的細胞，可見每個葉綠體內含有一個澱粉核（箭咀）。

Fibrocapsa japonica. Figures 1-3: Live cells showing ovate to obovate shape with numerous discoid, 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，體內各有一澱粉核。淚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.

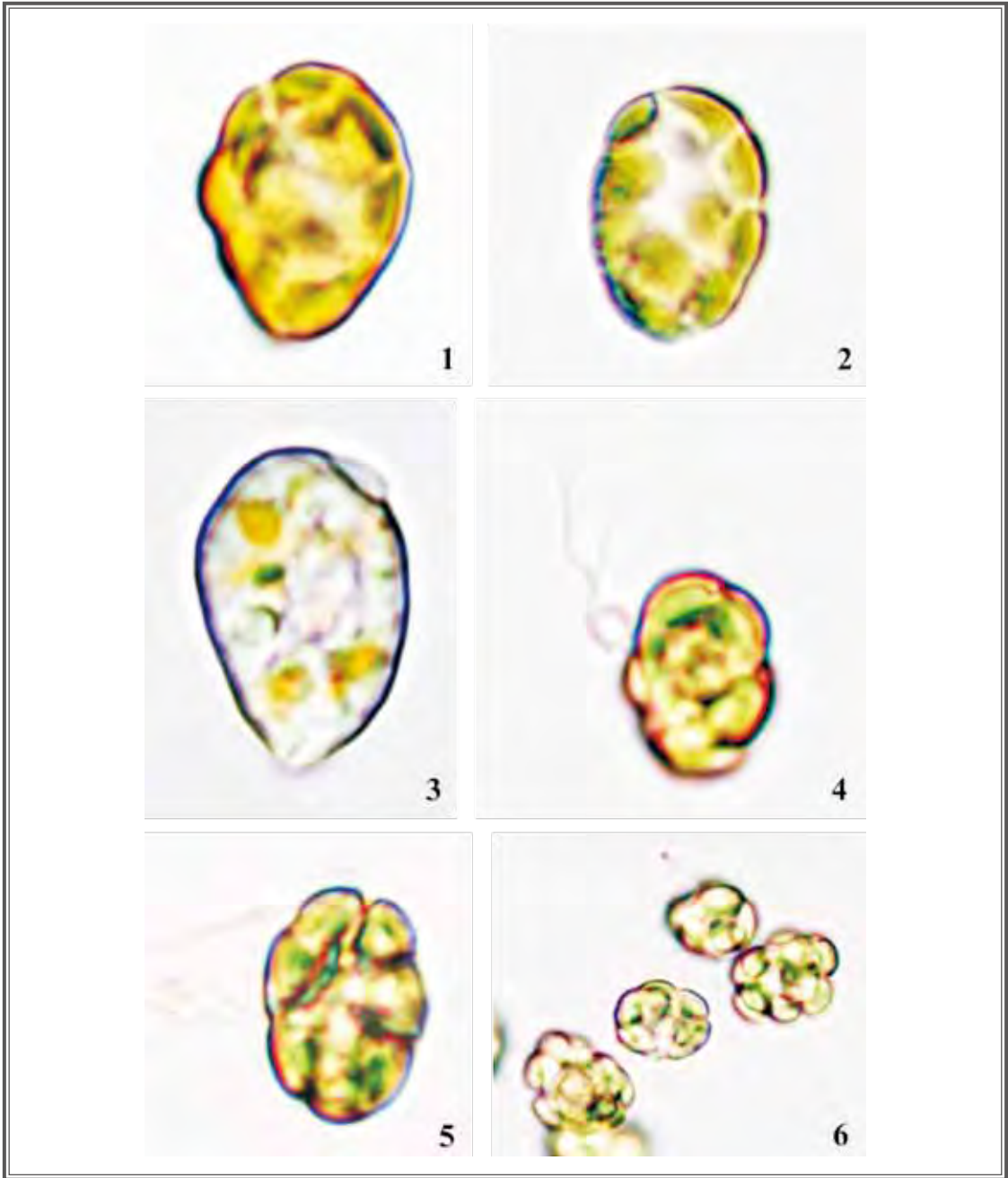
Regional distribution: *H. akashiwo* is widely distributed in temperate and subtropical coastal areas and known to cause red tides in Japan, East China Sea and South China Sea including Hong Kong. It is a dominant red tide causative species in Japan.

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.

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RAPHIDOPHYCEAE



赤潮異彎藻。圖 1：活細胞側面觀顯示背腹略為扁平；佈滿盤狀黃褐色葉綠體；各有澱粉核。圖 2：活細胞背腹面觀。圖 3：老化培養細胞。圖 4-6：以魯哥氏液固定的細胞。

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.

詞彙

GLOSSARY

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、鱈藻毒素及扇貝毒素的鱈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，可在水體游動。橫鞭毛位於細胞對分的槽溝中（橫溝）。縱鞭毛與橫鞭毛成直角，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.

殼頂孔：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.

微藻：單細胞或群落的微生物，包括多種的光合及異養原生物，常見於淡水及海洋環境。這是一類極多樣性的生物，包括矽藻綱、纖毛蟲類、綠藻綱、隱藻綱、藍藻綱、矽鞭藻綱、甲藻綱、針胞藻綱、定鞭藻綱、裸藻綱及綠色鞭毛藻綱等。

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, Dictyochophyceae, Dinophyceae, Raphidophyceae, Prymnesiophyceae, Euglenophyceae, Prasinophyceae etc.

微囊藻毒素：微囊藻毒素是藍藻產生的非核糖體環肽，屬於藍藻毒素，可導致植物及動物劇烈中毒，包括人類，尤其對動物肝臟造成極大危害。

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.

黏液泡：囊狀結構的細胞組織，透過細胞小孔釋出黏膜或黏液線體。

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

神經性貝類中毒：食用積聚了雙鞭甲藻毒素及衍生物的貝類而引起的非致命疾病，主要徵狀包括唇、舌、喉嚨及手腳刺痛及 / 或麻痺。

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.

麻痺性貝類中毒：足以致命的疾病，食用經蛤科毒素及 / 或其衍生物污染的貝類。神經系統病徵包括唇部及指頭刺痛、麻痺和熾熱感，如情況嚴重可出現呼吸停頓，可在 24 小時內致命。

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.

孔紋：殼面上較淺的凹陷處。

Poroid: Shallow surface depressions of valve surface.

前橫溝：在具殼片的藻類中，在上殼片接觸橫溝的殼片。

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

針胞藻綱：真核性藻內的細小組別，品種包括海藻及淡水藻。所有針胞藻綱品種均為單細胞和一對鞭毛，但無細胞壁。

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。定鞭毛在生命週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 thecate 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.

鳴謝

ACKNOWLEDGEMENTS

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。

We would like to acknowledge members of the Red Tide/HAB Experts Advisory Group for their invaluable advices and continuous support to our research and management work. Special thanks go to Professor Yasuwo Fukuyo and his colleagues of the University of Tokyo Asian Natural Environmental Science Center for providing comments on this booklet. We sincerely thank Dr. Doris Au of the Biology and Chemistry Department of the City University of Hong Kong for providing assistance with Environmental Scanning Electron Microscope (E-SEM) for identification, and Ms. Twinnie Tso of the Government Laboratory for conducting domoic acid analysis with Liquid Chromatography – Mass Spectrometry (LC – MS). We are also thankful to all who have reported sightings of red tide and provided information and photos to the AFCD and those who assisted in species identification.

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作者 : 羅秉全、李燕琼 (漁農自然護理署)
資料搜集及編輯 : 朱振華、李麗芬、區智敏、張翠珊 (漁農自然護理署)
圖片及攝影 : 羅秉全 (漁農自然護理署)
出版 : 漁農自然護理署
版次 : 2008 年第 1 版，2013 年第 2 版
設計及圖像處理 : 嘉昱有限公司
印刷 : 政府物流服務署
國際書號 : 978-988-12021-1-6

Author : Stanley P. C. LAW and Fion Y. K. LEE
(Agriculture, Fisheries and Conservation Department)
Research and editing : Jim C. W. CHU, Virginia L. F. LEE, Vivian C. M. AU, and
Stephanie C. S. CHEUNG
(Agriculture, Fisheries and Conservation Department)
Figures and photography : Stanley P. C. LAW
(Agriculture, Fisheries and Conservation Department)
Publisher : Agriculture, Fisheries and Conservation Department
Edition : First edition 2008, Second edition 2013
Design and Photo editing : Cheer Shine Enterprise Co. Ltd
Printing : Government Logistics Department
ISBN : 978-988-12021-1-6

漁農自然護理署

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