

ICES Identification Leaflets for Plankton

Fiches d'Identification du Plancton

LEAFLET NO. 178

Dominant Species in Phytoplankton Blooms

1. *Emiliana huxleyi* (Lohmann) Hay and Mohler

Division: Chrysophyta
(or Haptophyta)
Order: Coccosphaerales
Family: Coccolithaceae

by

JOACHIM JAHNKE

Institut für Biologie I (Botanik)
Abteilung für Systematik und Geobotanik
RW Technischen Hochschule Aachen
Melaten, Worringer Weg
D-5100 Aachen, Deutschland

Editor

J. A. LINDLEY

Natural Environment Research Council
Plymouth Marine Laboratory
Prospect Place, West Hoe, Plymouth PL1 3DH, England

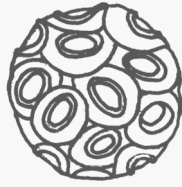
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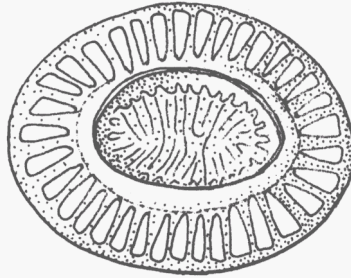
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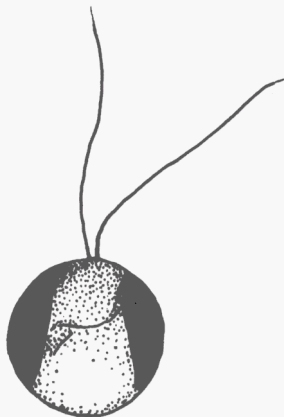


Figure 1: C-type cell. Figure 2a: Single placolith. Figure 2b: Single placolith, side view. (Figure 2 drawings after SEM microphotos in Reinhardt, 1972, and Holligan *et al.*, 1983). Figure 3: S-type cell.

Emiliana huxleyi (Lohmann) Hay and Mohler

Classification

Division: Chrysophyta (or Haptophyta)
Class: Haptophyceae (Prymnesiophyceae)
Order: Coccosphaerales
Family: Coccolithaceae
Species: *Emiliana huxleyi*
Synonyms: *Coccolithus huxleyi* (Lohmann) Kamptner, 1943
Emiliana huxleyi (Lohmann) Hay and Mohler, 1967
Gephyrocapsa huxleyi (Lohmann) n. comb. Reinhardt, 1972
Pontosphaera huxleyi Lohmann, 1902

Description

Emiliana huxleyi: a globular cell of 5 to 8 μm in diameter which reaches 10 μm at its maximum. Its cell size depends upon the duration of the light period and on the light intensity. Large cells are produced at long light periods and high light intensities while small cells occur at short light periods and low light intensities (Paasche, 1967).

In each cell there are two chloroplasts of yellow or greenish-yellow colour.

Three cell types have been distinguished by Klaveness and Paasche (1971):

1. Coccolith-forming cell type (C-type);
2. Naked non-motile cell type (N-type);
3. Naked motile cell type (S-type).

1. C-type: (see Figs. 1, 2a, 2b)

C-type cells are usually found in natural plankton communities. Their surface is covered by one or more layers of elliptic heterococcoliths which are termed placoliths (Fig. 2). These may reach 2 to 3 μm in length. Heterococcoliths consist of different calcareous microcrystals. The placoliths are shaped like cuff-links with two elliptic discs connected by an intermediate wall (Figs. 2a, 2b). Their fine structure can only be revealed by electron-microscopy. The placolith of *Emiliana huxleyi* has a pattern of radial lines on its ventral side. With polarized light the placolith discs become light when the nicols are arranged crosswise (Reinhardt, 1972). Lohmann (1902) and Schiller (1930) have described C-type cells bearing two equal flagellae of 7–10 μm in length. C-type flagellae-bearing cells have not yet been seen in culture (Braarud, 1963; Klaveness and Paasche, 1971).

2. N-type:

Morphologically, the N-type differs from the C-type mainly in the absence of placoliths. Both types lack organic scales which are the characteristic features of Haptophyceae. Organic scales can only be distinguished by electronmicroscopy.

3. S-type: (see Fig. 3)

S-type cells may, like N-type cells, occur spontaneously in cultures of C-type cells. S-type cells bear two smooth acronematic flagellae as well as the haptophycean-typical feature of organic scales. No Haptonema has been discovered so far.

Braarud (1963) described a fourth cell type of *Emiliana huxleyi* that may develop from the C-type. It was observed to be amoeboid motile, naked, and did not bear any flagellae.

The three types (C-, N-, and S-cells) appear to be states of the normal life cycle of *Emiliana huxleyi*.

In natural plankton communities, cell sizes of *Emiliana huxleyi* vary between 5 and 6 μm , allowing it to be distinguished from other Coccolithophorids (e.g., *Coccolithus pelagicus* and *Gephyrocapsa oceanica*, greater than 20 μm and approximately 10 μm respectively). In addition, the placolith size of *Emiliana huxleyi* (3 μm at maximum) differs clearly from those of the ones mentioned above (10 μm and 5 μm respectively).

Distribution

Emiliana huxleyi occurs within the biogeographical limits of the subantarctic and subarctic (Tromsø region). It is not only cosmopolitan in the oceans and Sargasso Sea, but occurs in the North Sea and the Mediterranean Sea. Also, it is found in low-salinity waters close to the coast as well as in inshore waters, such as fjords, where it may occur in great numbers. *E. huxleyi* is able to tolerate wide ranges in salinity and temperature. It has been found in natural plankton communities in the temperature range of 0 to $\geq 20^\circ\text{C}$. Cultures were successfully grown at salinity levels between 6 and 45. (Reviewed in Braarud *et al.*, 1953; Paasche, 1968; Reinhardt, 1972).

Notes on blooms

Blooms in Norwegian waters: Birkeness and Braarud, 1952; Berge, 1962. Patches of *Emiliana huxleyi* along the outer margin of the northwest European continental shelf between 45 and 60°N: Holligan *et al.*, 1983.

No toxic effects of *Emiliana huxleyi* blooms have been identified.

Taxonomic references

Braarud *et al.*, 1953; Deflandre, 1952; Hay *et al.*, 1967; Kamptner, 1943; Kamptner, 1958; Loeblich and Tappan, 1973; Lohmann, 1902; Reinhardt, 1972; Schiller, 1930.

References

- Berge, G. 1962. Discoloration of the sea due to *Coccolithus huxleyi* "bloom". *Sarsia*, 6: 27–40.
- Birkeness, E. and Braarud, T. 1952. Phytoplankton in the Oslo Fjord during a "*Coccolithus huxleyi* – summer". *Avhandl. Norske Vid.-Akad. Oslo, I, Mat.-Naturv. Kl.*, 2: 1–23.
- Braarud, T. 1963. Reproduction in the marine Coccolithophorid *Coccolithus huxleyi* in culture. *Publ. staz. zool. Napoli*, 33: 110–116.
- Braarud, T., Ringdal Gaarder, K. and Grøntved, J. 1953. The phytoplankton of the North Sea and adjacent waters in May 1948. *Rapp. Proc.-verb. Cons. int. Explor. Mer.*, 133: 89 pp.
- Braarud, T., Deflandre, G., Halldal, P. and Kamptner, E. 1953. Terminology, nomenclature, and systematics of the Coccolithophoridae. *Micropaleontology*, 1: 157–159.
- Deflandre, G. 1952. Classe de Coccolithophoridés (Coccolithophoridae Lohmann, 1902). *In* *Traité de zoologie 1 (1), Phylogénie. Protozoaires: généralités. Flagellés*. Ed. by P. P. Grassé. Paris.
- Hay, W. W., Mohler, H. P., Roth, P. H., Schmidt, R. R. and Boudreaux, J. E. 1967. Calcareous nannoplankton zonation of the Cenozoic of the Gulf coast and Caribbean–Antillean area, and transoceanic correlation. *Trans. Gulf Coast Ass. Geol. Soc.*, 17: 428–480.
- Holligan, P. M., Viollier, M., Harbour, D. S., Camus, P. and Champagne-Philippe, M. 1983. Satellite and ship studies of coccolithophore production along a continental shelf edge. *Nature*, 304 (5924): 339–342.
- Kamptner, E. 1943. Zur Revision der Coccolithineen-Spezies *Pontosphaera huxleyi* Lohm. *Anz. Akademie Wiss. Wien*, 11: 43–49.
- Kamptner, E. 1958. Betrachtungen zur Systematik der Kalkflagellaten, nebst Versuch einer neuen Gruppierung der Chryomonadales. *Arch. Protistenk.*, 103: 54–116.
- Klaveness, D. and Paasche, E. 1971. Two different *Coccolithus huxleyi* cell types incapable of coccolith formation. *Arch. Mikrobiol.*, 75: 382–385.
- Loeblich, A. R. Jr. and Tappan, H. 1973. Annotated index and bibliography of the calcareous nannoplankton VII. *J. Pal.*, 47(4): 715–759. (Further annotated indices are cited in it!)
- Lohmann, H. 1902. Die Coccolithophoridae, eine Monographie der Coccolithen bildenden Flagellaten, zugleich ein Beitrag zur Kenntnis des Mittelmeerauftriebs. *Arch. Protistenk.*, 1: 89–165.
- Paasche, E. 1967. Marine plankton algae grown with light-dark cycles. I. *Coccolithus huxleyi*. *Physiol. Plant.*, 20: 946–956.

- Paasche, E. 1968. Biology and physiology of coccolithophorids. *Ann. Rev. Microbiol.*, 22: 71–86.
- Paasche, E. and Klaveness, D. 1970. A physiological comparison of coccolith-forming and naked cells of *Coccolithus huxleyi*. *Arch. Mikrobiol.*, 73: 143–152.
- Reinhardt, P. 1972. Coccolithen. Kalkiges Plankton seit Jahrmillionen. Die neue Brehm-Bücherei 453, 99 pp. A. Ziemsen Verlag.
- Schiller, J. 1930. Coccolithineae. *In* *Kryptogamen-Flora von Deutschland, Österreich und der Schweiz 10. Bd., 2. Abt.*, 89–267. Ed. by L. Rabenhorst. Leipzig.

EDITORIAL NOTE

ICES Identification Leaflets for Plankton (Fiches d'Identification du Plancton)

Originally entitled *Fiches d'Identification du Zooplankton*, the series was renamed (from no. 172) *Fiches d'Identification du Plancton* following the decision to include phytoplankton. Now, from no. 178, in accordance with a further decision of the Council, the title is given in English with the French title as a subtitle.

The inclusion of phytoplankton was initiated during the editorship of the late G. A. Robinson with the help of Dr G. T. Boalch. After the untimely death of Mr Robinson the editorship passed to K. Vagn Hansen until 1990. It is due to their efforts, including liaison with the Baltic Marine Environment Protection Commission who were also working towards production of phytoplankton identification sheets, that these first contributions on phytoplankton are now published.

At the Statutory Meeting in 1983, the Council decided that the leaflets on phytoplankton would initially include key species recorded in phytoplankton blooms, toxic species, and groups presenting particular problems with identification. The leaflets published now include the last one to have been edited by Mr Robinson, on the coccolithophore *Emiliania huxleyi*, blooms of which have been observed from satellites over vast areas of ocean, and two on groups of potentially toxic phytoplankton species.

J. A. LINDLEY
Editor