

Coccolithophora pelagica (Wallich) from the Channel.

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With a Figure in the Text and 1 Table.

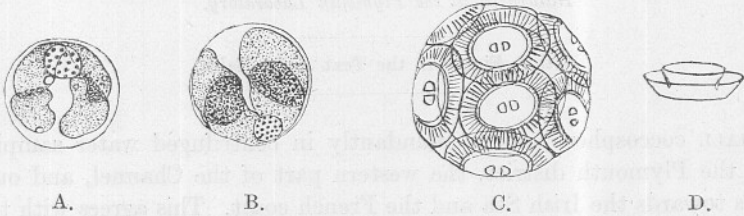
A SMALL coccosphere occurs abundantly in centrifuged water samples from the Plymouth district, the western part of the Channel, and outwards towards the Irish Sea and the French coast. This agrees with the species described by Ostensfeld (1899) as *Coccosphaera atlantica*, from the North Atlantic, which Lohmann (1902) considers identical with Wallich's *Coccosphaera pelagica* (1877). Lohmann, therefore, unites the two species as *Coccolithophora pelagica*, and in this he is followed by Ostensfeld (1908), the generic name of *Coccosphaera* being preoccupied by Perty (1852) for a small green flagellate.

The chief difference between *C. pelagica* and *C. atlantica* is in the number of coccoliths (16 to 36 in the former, 10 to 17 in the latter). The overlapping of the margins of the Coccoliths in *C. atlantica* is another difference, but it appears likely from Wallich's drawings that he had only taken the inner margins into consideration, and, therefore, regarded the coccoliths of *C. pelagica* as not overlapping. His measurements, which cover an extensive range, embrace those of *C. atlantica*. It seems, therefore, that *C. atlantica* is to be regarded as the same species as *C. pelagica*, the coccoliths having a similar form, and that Lohmann and Ostensfeld are justified in bringing them together.

Coccolithophora pelagica thus includes Murray and Blackman's *C. pelagica* (1898), Huxley's "Coccospheres" (1868, Plate 4, Figs. 6, c, d, e, and 7, b and c), and Ostensfeld's *C. atlantica* (1899, 1900). The coccoliths described by Joly and Dixon (1897) and the coccospheres by Dixon (1900) from the Irish Sea also belong to this species.

The Channel specimens agree entirely with Ostensfeld's *C. atlantica* and Dixon's *C. pelagica*, having usually from 10 to 11 coccoliths (in the largest 15 to 17), and the cells vary little in size, the average diameter being from 19 to 25 μ , 27 μ being the largest seen. Dixon found no chromatophores; Ostensfeld (1908) describes it as having 2 (?). In the Channel specimens examined alive typical dark yellow chromatophores were present. By dissolving off the coccoliths four chromatophores in each cell could be made out, which were

so close together that they appeared as one when still covered by the skeleton. There is apparently no flagellum; in the living organism none could be seen, which is in accord with other observers. The nucleus, which is as Ostenfeld describes it, with minute masses of chromatin regularly distributed throughout, occurs at the base of the chromatophores, where they come close together.



A. Treated with methyl green and 5% acetic, showing chromatophores and nucleus.
 B. Treated with weak acetic, showing the same.
 C. Alive.
 D. Coccolith.

Weak acetic acid dissolves the coccoliths easily and leaves the chromatophores yellow; methyl green with 5% acetic dissolves the coccoliths almost at once, and stains the nucleus and chromatophores so that they are plainly seen.

The accompanying table gives records of this species from the water-bottle samples taken by Dr. Atkins during various hydrographic cruises in the Channel and outside in 1921-1922. The letters refer to the stations given by him in the chart (1922, page 754), the explanation of which are here repeated:—

- L1. In the fairway of Plymouth Sound below the Laboratory near the Mallard Buoy. Lat. $50^{\circ} 22' N.$, long. $4^{\circ} 08' W.$
- L2. In the fairway between the western extremity of the Breakwater and the Cornish coast, north of Cornwall.
- L3. Off Rame Head, on the line between the Breakwater Lighthouse and the Eddystone.
- L4. Half-way between Rame Head and the Eddystone. Lat. $50^{\circ} 15' N.$, long. $4^{\circ} 13' W.$
- L5. Eddystone, 10 miles S. $42^{\circ} W.$ from Breakwater Lighthouse.
- L6. Half-way between the Eddystone and the International Station. E1, viz. 5 miles on a S.W. course. Lat. $50^{\circ} 06' N.$, long. $4^{\circ} 20' W.$

E1. Ten miles S.W. from the Eddystone. Lat. $50^{\circ} 02' N.$, long. $4^{\circ} 22' W.$ Depth 40 fathoms. Bottom samples 70 metres.

E1, E2, E3 lie on an approximately S.W. course from Plymouth to Ushant; N1 and N2 are on a line joining Ushant and Cork Harbour, N2 being south of the Bishop Light, Scillies; E7 is S.E. from the Wolf Light off the Lizard; X6 Whitsand Bay, approximately in a line with E1.

From these records *C. pelagica* is seen to occur close to the shore and outwards, reaching as far as N2 and E6, which are some way outside the Channel. The only time it is recorded as common is at E3 (both at the surface and at 100 metres) in March, and at E1 at 5 metres in October (1922). These are both stations about equally distant from land (ca. 20 miles), E1 from Plymouth, E3 from the French coast. The species occurs at all depths from the surface to 100 metres, which was the greatest depth at which the water-bottle was used. It appears to be an oceanic form which can come near the shore, but has its usual habitat in the open sea. It lives in water of pH value between 8.11 and 8.29, at a salinity of 31.62 to 35.48‰ , and can occur between the temperature $9^{\circ}.40$ and $16^{\circ}.7$ C. It was found to be most numerous at the temperature $9^{\circ}.9$ – $14^{\circ}.10$ C., salinity 35.25‰ – 35.38‰ , pH 8.16–8.17 in March and October. It occurs almost all the year round, being apparently less common in June, July, and August than in the remaining months. It is probably very abundant in the Plymouth district, for it is present inside many of the plankton organisms which were examined for food both from inside the Sound and outside as far as Station E1, and its coccoliths have long been known to be common in the bottom deposits from the Sound and outside. The coccoliths are frequently found built into the cases of tintinnids, as described by Lohmann (1913), but usually in the Channel it was *Tintinnopsis beroidea* and *T. ventricosa*, and only a few were used among the usual sand grains in each case.

The following animals contained coccoliths: *Calanus finmarchicus* (13), *Pseudocalanus elongatus* (10), *Temora longicornis* (5), *Acartia clausi* (17), *Centropages typicus* (3), *Corycaeus anglicus* (4), zoëa of Crab indet. (3), zoëa of *Corystes* (4), *Porcellana* larva (4), *Eupagurus* larva (3), *Crangon* larva (2), *Pandalus* larva (5), *Galathea* larva (2), *Gebia* larva (1), *Axius* larva (1), *Calocaris* larva (3), Euphausiid larva (5), *Echinospira* (1), *Auricularia* (1), Terebellid larva (9), Polynoid larva (1), *Actinotrocha* (1). In the case of a *Calanus* (Polperro N.N.W., Looe N. $\frac{1}{2}$ E., 25.8.21) several whole coccospheres (*Coccolithophora pelagica*) were still in the stomach, and in another a whole *Pontosphaera Huxleyi*. In one small Pouting, *Gadus luscus* (3 mm. long), a whole *Coccolithophora pelagica* was found (Lebour, 1917). It is not often, however, that the whole organisms are seen in

the alimentary canal of any of these animals. As is shown, the coccoliths have been found inside copepods, larval decapods, larval mollusks, larval annelids, larval echinoderms, and *Actinotrocha*.

Pontosphaera Huxleyi Lohmann, the only other coccosphere so far known in this district is found less frequently, but may easily be passed over owing to its small size. Dr. Allen has very often obtained pure cultures of this species from samples of water taken from various parts of the Sound and outside, so that it must really be exceedingly common. The present records show it to occur in August, February, and May, from comparatively near the shore (X6, L2, and L3) and from E1, from the surface to the bottom (70 metres). The only record of it inside an animal is in the above-mentioned *Calanus*. It occurred in the microplankton in 1916 fairly frequently, when the water samples were regularly centrifuged (Lebour, 1917).

It is thus seen that these two species are common in the district, and so far no others have been observed. From the notes given above they must be important members of the phytoplankton, and, at any rate in the case of *Coccolithophora*, are noteworthy as nourishment for the plankton-eating animals.

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