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Observation of a Dimorphic Coccosphere

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With 1 Figure

North Atlantic
Pleistocene
Calcareous nannoplankton
Coccosphere

Contents

Zusammenfassung

Eine Coccosphäre mit Coccolithen von sowohl *Calcidiscus leptoporus* (MURRAY & BLACKMAN) LOEBLICH & TAPPAN als auch *Coccolithus pelagicus* (WALLICH) SCHILLER wurde in einer Sedimentprobe des späten Pleistozäns des nördlichen Nordatlantiks beobachtet.

Abstract

A coccosphere bearing coccoliths of both *Calcidiscus leptoporus* (MURRAY & BLACKMAN) LOEBLICH & TAPPAN and *Coccolithus pelagicus* (WALLICH) SCHILLER has been observed in a sediment sample of Late Pleistocene age from the northern North Atlantic.

1. Introduction

The existence of dimorphic coccospheres with placoliths referred to different species has rarely been reported. KAMPTNER (1941, Plate XV, Figs. 152–154) observed several specimens from Adriatic Sea plankton samples, of what he called "combined shells". Dimorphic coccospheres with placoliths of *Gephyrocapsa oceanica* KAMPTNER and *Emiliana huxleyi* (LOHMANN) HAY & MOHLER were observed by CLOCHIATTI (1971, Figs. 1–2) in recent sediments from the Mediterranean and by WINTER et al. (1979, Plate 1, Fig. 12) in water samples from the Gulf of Elat.

2. The Dimorphic Coccosphere Observed at DSDP Hole 552A

A coccosphere with placoliths of *Calcidiscus leptoporus* (MURRAY & BLACKMAN) LOEBLICH & TAPPAN and *Coccolithus pelagicus* (WALLICH) SCHILLER has been observed in the northern North Atlantic DSDP Hole 552A (56°N, 23°W, water depth 2311 m) in a sample 3.20 m subbottom (Fig. 1). The age of this level, calculated from oxygen isotope stratigraphy (SHACKLETON & HALL, 1984) is 177 kyrs. The coccosphere was observed in a scanning electron microscope (SEM). For the preparation, a small piece of sediment was suspended in water and the suspension was transmitted to a SEM stub using a capillary tube. Loose placoliths of *C. leptoporus* and *C. pelagicus* are common in the sample and coccospheres of *C. pelagicus* are present. Coccospheres of *C. leptoporus* are not observed in the sample, but these appear to be more fragile and are rarely preserved.

The dimorphic coccosphere observed in DSDP Hole 552A is ovoid and the diameter varies between approximately 22 and 24 μm. Three placoliths of *C.pelagicus* and about 15 placoliths of *C. leptoporus* are observed. One placolith of *C. pelagicus* lacks elements in the central area and the central opening is consequently enlarged. The lengths of the elliptical *C. pelagicus* placoliths are between about 10 and 13 μm. The diameter of the circular *C. leptoporus* placoliths varies between approximately 7 and 9 μm.

3. Discussion

As the treatment of the sample involves no centrifuging or filtering techniques, it appears unlikely that this coccosphere is a result of mechanical compaction. The coccosphere can represent either an intact cell which produced both *C. leptoporus* and *C. pelagicus* placoliths, or could be a spheric body covered by free placoliths unrelated to the host. Tintinnids and foraminifers can be covered by several kinds of coccoliths. However, the tests of these organisms are generally larger in size, non-spherical and not constructed of overlapping and interlocking coccoliths.

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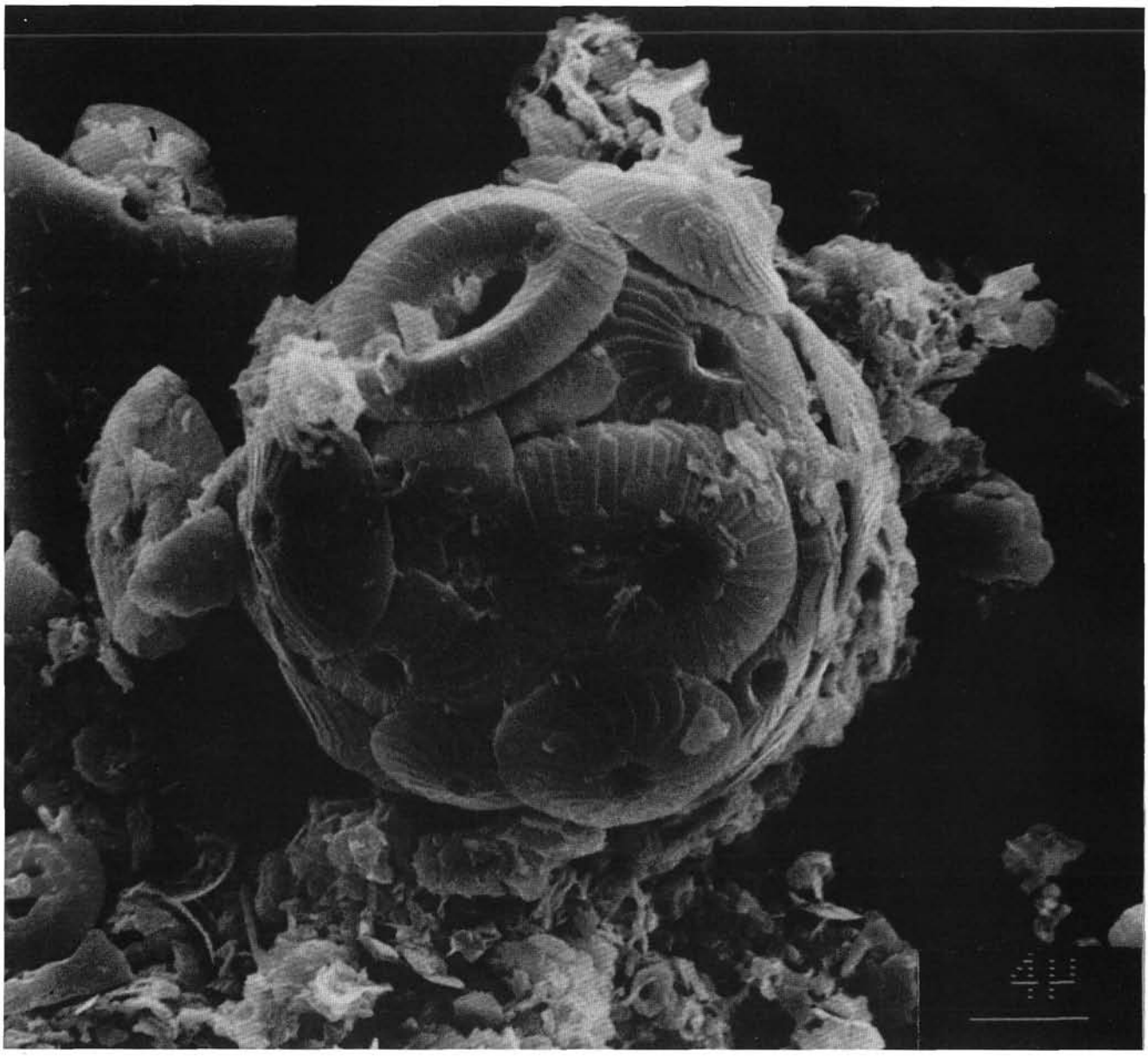

Fig. 1: Scanning electron micrograph of dimorphic coccosphere with placoliths of *Calcidiscus leptoporus* (MURRAY & BLACKMAN) LOEBLICH & TAPPAN (circular) and *Coccolithus pelagicus* (WALLICH) SCHILLER (elliptical).

Coccolithus pelagicus is a long-ranging species, appearing already in the Early Paleocene. It exhibits great morphological variations through time and also within a given stratigraphic layer (BUKRY, 1973). At present, this species has a restricted geographic distribution and occurs only north of the 15° isotherm in the North Atlantic and North Pacific (OKADA & MCINTYRE, 1977). *Calcidiscus leptoporus* appeared in the Miocene. It has been reported to have different ecophenotypes, distinguished by the number of elements forming the distal shield (MCINTYRE et al., 1970). Varieties B and C should have averages of 20 and 30 elements respectively. The placoliths of the dimorphic coccosphere seem to be intermediate between these, having about 23 or 24 elements. *C. leptoporus* is an eurythermal form which is common throughout the world oceans (OKADA & MCINTYRE, 1977).

The phenomenon of dimorphic coccospheres is poorly understood. KAMPTNER (1941), WINTER et al. (1971) and CLOCHIATTI (1971) suggested that dimorphic coccospheres represent an intermediate form between two evolutionary related species, or that they are hybrids. GARDER (1970, Figs. 4–6) has shown the presence of coccoliths designated as *Scyphosphaera apsteinii* LOHMANN and *Pontosphaera japonica* TAKAYAMA on the same cells in a Carribean plankton sample. However, this example of dimorphism is the natural state of the coccolithophorid and the two forms of coccoliths represent one biological species. In studies of living coccolithophorids, LEFORT (1971) observed that cells with two different kinds of coccoliths (*Cricosphaera carterae* BRAARUD & FAGERLAND, *Ochrosphaera verrucosa* SCHÜSSNIG) formed during a certain stage of the life-cycle. Although of distinctly different morphologies, she concluded that the two forms represented one biological species.

C. leptoporus and *C. pelagicus* are living today and their life-cycles are possible to observe. In particular *C. pelagicus* has been studied, it produces *C. pelagicus* placoliths at one stage and the holococcolith *Crystallolithus hyalinus* at another stage of the life-cycle (PARKE

& ADAMS, 1960). In fossil coccolith assemblages, the taxonomy has to be based on a morphospecies concept. Furthermore, fossil coccoliths usually are preserved as single plates which are disintegrated from the coccospheres. The true biological relationship between different morphospecies thus is difficult or impossible to resolve. However, fossil coccospheres do occur occasionally and the dimorphic coccosphere observed in Hole 552A represents an unusual exception. Hence, there is no reason for changing the status of the two morphospecies involved. The unexplained phenomenon of dimorphic coccospheres suggests, however, that further studies are needed on the biology of coccolithophorid algae.

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