

Original article

Further observations on *Vexillarius cancellifer* Jordan & Chamberlain

Observations supplémentaires sur Vexillarius cancellifer Jordan & Chamberlain

Harald Andruleit^a, Richard W. Jordan^{b,*}

^a Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Stilleweg 2, 30655 Hannover, Germany

^b Department of Earth & Environmental Sciences, Faculty of Science, Yamagata University, 1-4-12 Kojirakawa-machi, Yamagata 990-8560, Japan

Abstract

A single specimen of an unusual dimorphic coccosphere was encountered in the subtropical North Atlantic. Despite its poor condition, it was formally described in 1993 as a new lower photic zone species, *Vexillarius cancellifer* Jordan & Chamberlain. Since then, the species has only been reported twice, with little or no additional information to the original diagnosis. In 2005, a new specimen was found in the Java upwelling system in the southeastern Indian Ocean, and like the type specimen, it was collected from the lower photic zone. The distal portions of the tubular coccoliths are far more complete in the new specimen. We therefore provide an emended diagnosis for this rare genus and species.

© 2016 Published by Elsevier Masson SAS.

Keywords: Coccolithophorid; Indian Ocean; Lower photic zone; *Vexillarius*

Résumé

Un seul spécimen d'une coccosphère dimorphique insolite a été retrouvé dans l'Atlantique subtropicale septentrionale. En dépit de son mauvais état, il a été formellement décrit en 1993 comme une nouvelle espèce de la zone photique inférieure, *Vexillarius cancellifer* Jordan & Chamberlain. Après cela, seulement quelques spécimens ont été signalés, en apportant peu ou pas d'informations supplémentaires au diagnostic initial. En 2005, un nouveau spécimen a été trouvé dans le système de remontée d'eaux profondes de Java dans le Sud-Est de l'Océan Indien. Tout comme le spécimen type, il a été recueilli dans la zone photique inférieure. Les parties distales des coccolithes tubulaires sont beaucoup plus complètes dans le nouveau spécimen. Nous fournissons donc un diagnostic éméndé pour ce genre et espèce rare.

© 2016 Publié par Elsevier Masson SAS.

Mots clés : Coccolithophoridé ; Océan Indien ; Zone photique inférieure ; *Vexillarius*

1. Introduction

Like other phytoplankton groups, some coccolithophorids appear to be adapted to living in deeper photic waters (Sournia, 1982). This so-called 'shade flora' situated in the 'lower photic zone' seemingly benefits from an ecological compromise—i.e. higher nutrient concentrations, but lower light levels. However, little is actually known about the shade flora species, since they have not been successfully cultured or studied live under natural conditions. Thus, their phylogeny, cell ultrastructure

and pigment composition are unknown. Yet, various workers have speculated that some genera may be related to the Rhabdosphaeraceae (e.g. *Turrilithus* Jordan et al.: Jordan et al., 1991; *Solisphaera* Bollmann et al.: Bollmann et al., 2006) or Papposphaeraceae (e.g. *Vexillarius* Jordan & Chamberlain: Andruleit & Young, 2010) and that some may be heterotrophic rather than autotrophic (Brand, 1994). Until recently, most coccolithophorid species belonging to the shade flora had no geological record or were only known from the Quaternary. However, the discovery of fossilised lower photic zone assemblages from coastal Tanzania suggests that this specialised habitat was already established in the Paleocene (Bown et al., 2009).

Although some lower photic species were described over 100 years ago (e.g. *Deutschlandia anthos* Lohmann; Lohmann,

* Corresponding author.

E-mail address: sh081@kdw.kj.yamagata-u.ac.jp (R.W. Jordan).

1912—usually classified in *Syracosphaera*), it was not until the pioneering papers of Okada & Honjo (1973) and Okada & McIntyre (1977), that a discrete lower photic flora was recognised. Since then, many taxa have been found and continue to be added (e.g. Jordan et al., 1991; Jordan & Chamberlain, 1993; Hagino & Okada, 1998; Bollmann et al., 2006; Young & Andruleit, 2006; Aubry & Kahn, 2007) – see an up-to-date list in Jordan (2009). Some of these genera are now known to exhibit morphotypic variation or to be more diverse with new species being added (e.g. *Florisphaera* Okada & Honjo: Quinn et al., 2005; Kahn & Aubry, 2012; *Gladiolithus* Jordan & Chamberlain: Hagino & Okada, 1998; Bown et al., 2009). On the other hand, some remain enigmatic, rarely reported and poorly described. One such taxon is *Vexillarius cancellifer* Jordan & Chamberlain.

A single specimen of *V. cancellifer* was encountered at Station 11290 (26° 10.5'N 30° 00.4'W) in the subtropical North Atlantic at a depth of 200 m. It had collapsed on the filter, was incomplete and many of the tubular coccoliths were broken at the distal end (Jordan & Chamberlain, 1993). Ordinarily, it would be unwise to describe a new species based on a single specimen in such poor condition. However, it was unique, unlike anything else in the literature and thus the authors felt the need to document it formally. At the time, it was hoped that by describing it, further specimens would be found by other workers and the description could be emended. Unfortunately, the species has only been recorded twice since then, with one specimen being illustrated from the Gulf of Mexico (Young et al., 2003; Andruleit & Young, 2010) and others mentioned in a Supplementary Data Table from the Hawaiian Ocean Time (HOT) series study (Thierstein et al., 2004; downloadable from http://www.coccoco.ethz.ch/Thierstein&al_Table_S2.pdf).

Herein, we report the finding of a well-preserved specimen of *V. cancellifer* from the Indian Ocean, resulting in a new interpretation of its coccolith morphology and emended genus and species descriptions. Its relationship to other species is also discussed.

2. Material and methods

A water sample was obtained from 100 m water depth using a C.T.D. rosette at station GeoB 10067-2 (9° 8.93'S 119° 17.49'E; sea-bed depth 1135 m) on 6 Sept. 2005 by scientists aboard the German research vessel *Sonne*, during Leg 3 of cruise SO184 to the eastern Indian Ocean off Java (Hebbeln et al., 2005). Approximately 3.4 litres were filtered without further treatment through a polycarbonate filter (0.45 µm porosity) using a vacuum pump (200 mbar), and then dried for several hours at 50 °C. A portion of the filter was then fixed onto an aluminium stub and coated with gold, and observed in a field emission scanning electron microscope (FEI Sirion 200 SEM).

3. Systematic part

Genus *Vexillarius* Jordan & Chamberlain, 1993 emend.

Emended generic description: Dimorphic coccosphere consisting of heterococcoliths. Ordinary (body) coccoliths

are simple dishes. Tubular coccoliths bearing quadrangular appendages.

Type species: *Vexillarius cancellifer* Jordan & Chamberlain

Vexillarius cancellifer Jordan & Chamberlain, 1993 emend. Figs. 1–10

1993. *Vexillarius cancellifer* nov. sp.—Jordan et Chamberlain, pp. 313–314, pls. 1–3, figs. 1–5.

2003. *Vexillarius cancellifer* Jordan & Chamberlain—Young et al., p. 78, pl. 36, fig. 6.

2004. *Vexillarius cancellifer* Jordan & Chamberlain—Thierstein et al., tab. S2.

2010. *Vexillarius cancellifer* Jordan & Chamberlain—Andruleit & Young, pl. 3, fig. E.

Emended species description: Coccosphere shape unknown, but approximately 3.5–5.0 µm in diameter (excluding appendages), bearing about 50–70 ordinary (body) and 30–35 tubular coccoliths. Body coccoliths are elliptical, measuring 0.25–0.50 µm × 0.85–1.25 µm and 0.20–0.25 µm in height, with a ring of elements supporting a wall of rectangular plates (one corner of which is raised to form a zig-zag margin). The central area consists of about 8 laths arranged in 4 longitudinal rows, with an additional 2 laths sometimes spanning the short axis. Each tubular coccolith with a quadrangular appendage attached at the proximal end to an elliptical dish-like base, subtended by a thin base plate with a central perforation on the proximal side, and a low wall of approximately 16 plates arising from the periphery of the base plate and flaring outwards distally. Basal plate dimensions similar to those of body coccoliths. Appendage about 4.75–5.0 µm long, composed of brick-like elements, with long shaft about 0.2 µm wide, but markedly flaring at the distal end (0.875–1.25 µm at its widest point) with a straight (not curved) margin. A quadrat attached to the distal end of the appendage is connected to four strips of similar length, 0.65–0.80 µm long, arranged across the open end of the appendage in a consistent pattern. Each strip with a small distal spine near the appendage margin. Other end of each strip (i.e. that projecting into the middle of the tubular opening) abuts against another strip via a groove in the middle of the latter strip. The strips form a framework (or latticework) that is slightly rotated with respect to the margin.

Note: Although Jordan & Chamberlain (1993) assumed that the tubular coccoliths were equatorially placed, it is not possible to confirm this from the 3 broken specimens illustrated so far. Given that few species possess equatorial coccoliths, it is more likely that the tubular coccoliths are distributed in a polar or circumflagellar position.

4. Discussion

4.1. New details on coccolith structure

The new specimen featured in Fig. 1 clearly shows that the distal end of the quadrangular tubular appendage is more strongly flared than originally proposed by Jordan & Chamberlain (1993; their fig. 3), and that the point where the

Download English Version:

<https://daneshyari.com/en/article/4751436>

Download Persian Version:

<https://daneshyari.com/article/4751436>

[Daneshyari.com](https://daneshyari.com)