

On the taxonomy of *Reticulofenestra parvula* var. *tecticentrum* (Prymnesiophyceae)

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1. Introduction

In an ongoing effort to comprehensively elucidate the phylogeny of the coccolithophore genus *Gephyrocapsa* (Noelaerhabdaceae, Prymnesiophyceae) based on a combined analysis of extant coccolith morphology, molecular genetics, and the fossil record, we are revisiting species concepts of various forms in the group (Archontikis et al., 2023; Bendif et al., 2023). The enigmatic coccolithophore *Reticulofenestra parvula* var. *tecticentrum* (Okada & McIntyre) Jordan & Young was originally described by Okada & McIntyre (1977) from the Pacific Ocean. The form has been used for coccoliths with a moderately elevated distal shield, elements 0.1–0.2 µm wide that lack slits, and a highly calcified inner tube of variable width that almost entirely covers the central area (Okada & McIntyre, 1977; Hagino & Okada, 2001) (Plate 1). To our knowledge, this form has been recorded only from the upwelling zones of the equatorial and subtropical Pacific Ocean (Okada & Honjo, 1973; Okada & McIntyre, 1977; Hagino & Okada, 2001; Chang, 2019; our observations).

Recent studies of molecular genetics (Bendif et al.,

2016; Bendif et al., 2019; Filatov et al., 2021) have revealed that the species *Reticulofenestra parvula* is closely related to *Gephyrocapsa ericsonii*, and therefore had a common ancestor. Consequently, Bendif et al. (2016) recombined *R. parvula* as *Gephyrocapsa parvula* (Okada & McIntyre) Bendif, Probert, Young & von Dassow in Bendif et al. (2016), but in anticipation of morphological and/or genetic data, they did not taxonomically treat *R. parvula* var. *tecticentrum*. No morphological or genetic data have since become available, and the lack of a taxonomic treatment is becoming increasingly anomalous. To resolve the inconsistency, we herein propose the transfer of *R. parvula* var. *tecticentrum* into *Gephyrocapsa*. A precedent for our revision is provided by Young (2023) who recently recombined another form, *Reticulofenestra maceria* (Okada & McIntyre) Young in Young et al. (2003) as *Gephyrocapsa maceria* (Okada & McIntyre) Young (2023) on the grounds of having a very similar morphology and an almost identical coccolith size to *G. parvula*. However, until ‘*tecticentrum*’-type forms are successfully isolated in culture and molecular genetic data become available, we

refrain from formal taxonomic assessment of its status.

It is finally noteworthy that the transfer of *Reticulofenestra parvula* and *R. parvula* var. *tecticentrum* into *Gephyrocapsa* is not taxonomically inconsequential. While this is now a necessary approach to establish and propagate a framework that accurately reflects the evolutionary relationships of living *Gephyrocapsa*, it equally raises the need to revisit the morphological definitions of the two genera, *Reticulofenestra* and *Gephyrocapsa*, for both living and fossil forms. Clearly, combining molecular genetic studies with detailed analyses of fossil time series will be worthwhile prior to undertaking any such formal taxonomic re-definitions.

2. Taxonomy

Gephyrocapsa parvula (Okada & McIntyre) Bendif, Probert, Young & von Dassow in Bendif et al. (2016)

Gephyrocapsa parvula var. *parvula*

Plate 1, figs. 1–2

Description: Okada & McIntyre (1977), pp. 6–7.

Gephyrocapsa parvula var. *tecticentrum* (Okada & McIntyre) Archontikis & Bendif comb. nov.

Plate 1, figs. 3–4

Basionym: *Crenalithus parvulus* subsp. *tecticentrum* Okada & McIntyre (1977), *Micropaleontology*, **23**: 7, pl. 2, figs. 3–4, 7.

Synonym: *Reticulofenestra parvula* var. *tecticentrum* (Okada & McIntyre) Jordan & Young (1990), p. 15.

Description: Okada & McIntyre (1977), p. 7.

Habitat: Pacific Ocean.

Disclosure Statement

At least one of the authors is a member of the editorial board of the *Journal of Nannoplankton Research*. The peer-review process was guided by an independent editor, and the authors also have no other competing interests to declare.

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Plate 1

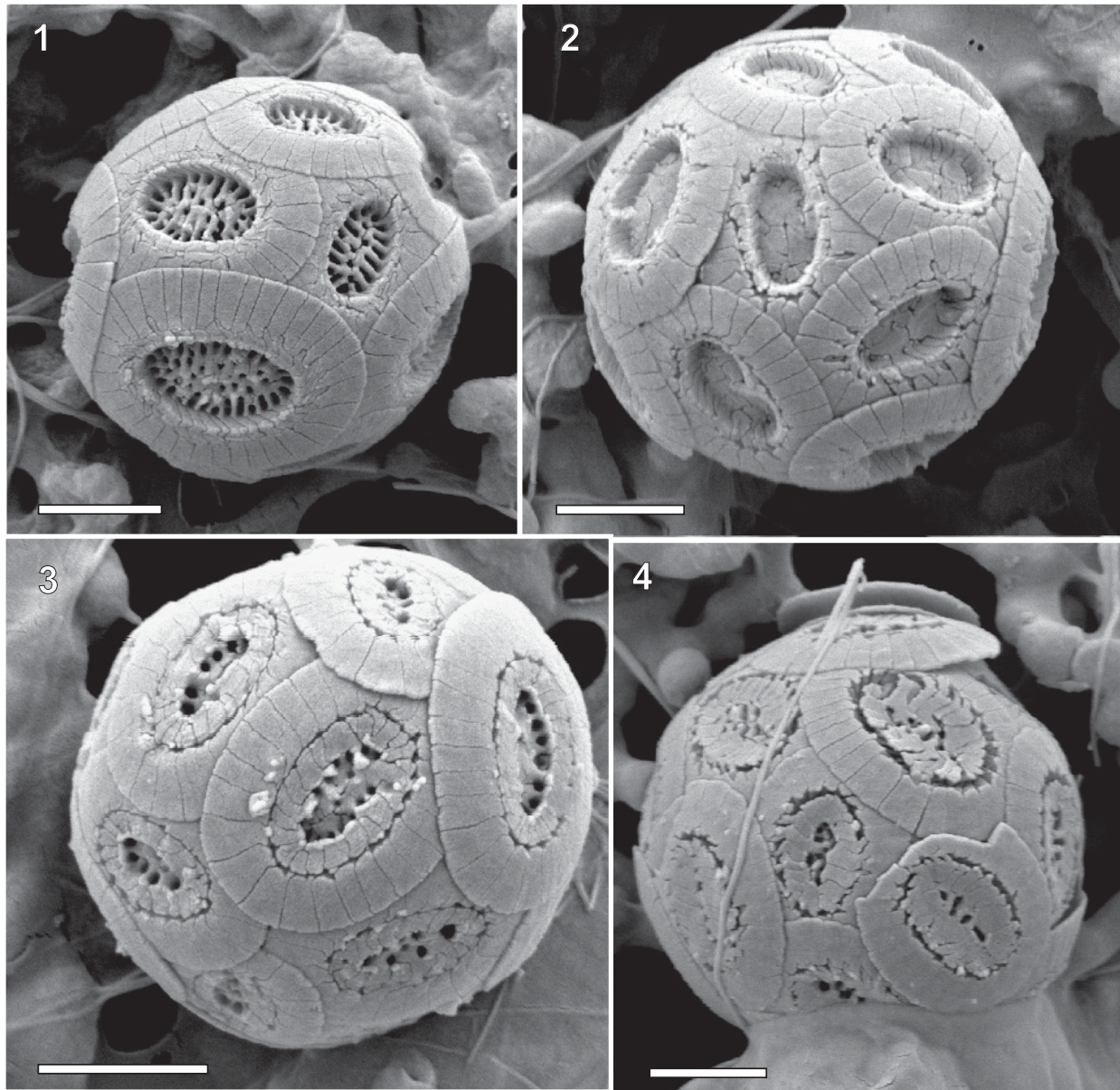


Plate 1: Scanning electron microscope images of *Gephyrocapsa parvula* var. *parvula* (1–2) and *Gephyrocapsa parvula* var. *tecticentrum* (Okada & McIntyre) Archontikis & Bendif comb. nov. (3–4). Scale bars = 1 μ m. Micrographs were obtained via an Ultra Plus Zeiss field emission scanning electron microscope at the Natural History Museum London, UK. **1.** Complete coccosphere showing coccoliths with elements lacking slits, a narrow inner tube and a delicate grill at the central area. Image code: OAKH-5_065 (Cruise KH69-4, Station 10, 10.017°N, -155°E, 50 m, 22 September 1969, North Pacific). **2.** Coccosphere bearing coccoliths, a narrow inner tube, and a solid lath-made plate in the central area. Image code: OAKH-5_003 (Cruise KH69-4, Station 10, 10.017°N, -155°E, 50 m, 22 September 1969, North Pacific). **3.** Complete coccosphere with coccoliths composed of elements with no slits, a noticeably thick inner tube, and a reticulate grill in the central area. Image code: OAKH-5_178 (Cruise KH69-4, Station 10, 10.017°N, -155°E, 50 m, 22 September 1969, North Pacific). **4.** Well-preserved coccosphere with coccoliths whose inner tube extends inwards and almost entirely covers the central area. Image code: OAKH-1_117 (Cruise Conrad 12, Station 66, 2.62°N, -148.2°E, 0 m, 11 March 1968, North Pacific).