

# Calcareous nannofossil biostratigraphy of the upper part of the Kiwada Formation and estimated marine environment change

\*Daisuke Kuwano<sup>1</sup>, Koji Kameo<sup>2</sup>

1. Division of Earth and Environmental Sciences, Graduate School of Science and Engineering, Chiba University, 2. Department of Earth Sciences, faculty of Science, Chiba University

The Kazusa Group, composed of the lower-middle marine Pleistocene sediments, distributes in the middle part of the Boso Peninsula along the Pacific side of Japan. A lot of geological studies have been conducted (e.g., Mitsunashi et al., 1959) because the Group has been considered to be one of the representative strata for the Quaternary due to well-exposed condition with many tephra layers and various kinds of microfossils. In particular, microfossil biostratigraphies (Oda, 1977; Sato et al., 1988) and the reconstruction of marine environment using microfossils (e.g. Igarashi, 1994) have been studied. Sato et al. (1988) applied nannofossil datums established at the North Atlantic Ocean (Takayama and Sato, 1987) to the formations of the Kazusa Group in order to clarify ages of them in the Group. Recent chronologic studies of nannofossil datums, however, enable us to discuss geological ages with higher resolution (e.g., Raffi et al., 2006) and thus, this study aims at establishing high-resolution calcareous nannofossil biostratigraphy in the upper part of the Kiwada Formation which were recognized a lot of nannofossil datums. Moreover, sea-surface environmental changes are also discussed based on nannofossil assemblages.

In this study, we studied the Kiwada formation along the Yuki River, one of the branches of the Yoro River. Thirteen genera and 19 species of calcareous nannofossils were found in 31 samples in this formation. As a result, the last occurrences of large *Gephyrocapsa* spp. and *Helicosphaera sellii* were recognized slightly above the key-tephra Kd1 and the key-tephra Kd17, respectively. The last occurrence of large specimens of *Gephyrocapsa* spp. may be located near MIS 35 based on Pickering et al. (1999). However, it is difficult to determine exactly the stratigraphic horizon of the last occurrence of *H. sellii* due to sporadic occurrences of this species and the presence of slump deposits in the middle part of the Formation. According to stratigraphic changes in environmental indicators, past movements of the Kuroshio front during the deposition of the upper part of the Kiwada Formation can be estimated. Abundant occurrences of a cool water taxon, *Coccolithus pelagicus* (Tanaka, 1991), are recognized above Kd6 and just below Kd1. Thus, two boundaries called the Kuroshio and Oyashio fronts temporarily had moved southward and comparatively cool surface waters occupied areas around the Boso Peninsula in 1.33 Ma and 1.21 Ma. The Kuroshio front has repeatedly moved northward and southward in short period after 1.21 Ma because repetitions of abundant occurrences of both *C. pelagicus* and a warm *Umbilicosphaera sibogae* are observed above Kd1.

## Reference

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Keywords: Calcareous nannofossil, Paleoceanography, Quaternary, Kazusa Group, Kiwada Formation