

## Mode of occurrence of "Calyptogena" species from the Pleistocene Urago Formation of the Kazusa Group, Kamakura, Japan

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A cold-seep assemblage dominated by "Calyptogena" species occurs in tuffaceous sandstones, mostly cemented by authigenic carbonates, in the Pleistocene Urago Formation of the Kazusa Group at Ten-en, Kamakura City, Pacific side of central Japan. We studied the assemblage based on the exposures and 25.5m- and 40m-long sediment cores that were recovered perpendicularly to general bedding plane in the area.

The strata at Ten-en consist mainly of muddy sandstone, tuffaceous sandstones with cross-laminations, massive tuffaceous sandstones, and pumice beds. Some of them are cemented by authigenic carbonates of micritic dolomites and isopachous microspar rim cements. Carbon isotopes of those dolomites ( $\delta^{13}\text{C}$ : -37 to -26 per mil PDB) revealed that they were precipitated in the environments influenced by an anaerobic methane oxidation. Petrological observation revealed that some of biogenic and authigenic carbonates were evidently dissolved and recrystallized, and might be dolomitized during diagenetic processes.

The sandstones with cross-laminations are characterized by both planar and trough-shaped foresets, and consists of medium to very coarse sand grains. These cross-laminations show a predominant paleocurrent direction towards the northeast. The "Calyptogena" fossils occur in the basal part of the each sandstone bed with their commissure planes parallel to beddings, mostly in disarticulated and convex-up in positions, in which bivalve shells are arranged in concordant with the current directions estimated by sandstone foresets.

We interpreted that "Calyptogena" assemblages of Ten-en had been reworked during sandstone depositional processes, but not moved further from their original habitats because the assemblages are associated with authigenic carbonates evidently influenced by an anaerobic methane oxidation that had provided nourishments to the cold-seep assemblages.

**Keywords:** cold-seep assemblage, authigenic carbonate, cross-bedding, shell orientation, paleocurrent, indigenous