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Sedimentary processes and depositional environments of a continuous marine succession across the Lower–Middle Pleistocene boundary: Kokumoto Formation, Kazusa Group, central Japan

Naohisa Nishida^{a,*}, Osamu Kazaoka^b, Kentaro Izumi^c, Yusuke Suganuma^{d,e},
Makoto Okada^f, Takeshi Yoshida^b, Itaru Ogitsu^b, Hiroomi Nakazato^g, Shun Kameyama^b,
Atsushi Kagawa^b, Masaaki Morisaki^b, Hisashi Nirei^h

^a Geological Survey of Japan, AIST, 1-1-1 Central 7, Higashi, Tsukuba, Ibaraki 305-8567, Japan

^b Research Institute of Environmental Geology, Chiba, 3-5-1, Inagekaigan, Mihama, Chiba 261-0005, Japan

^c National Institute for Environmental Studies, 16-2, Onogawa, Tsukuba, Ibaraki 305-856, Japan

^d National Institute of Polar Research, 10-3, Midoricho, Tachikawa, Tokyo 190-8518, Japan

^e Department of Polar Science, SOKENDAI, 10-3, Midoricho, Tachikawa, Tokyo 190-8518, Japan

^f Ibaraki University, 2-2-1, Bunkyo, Mito, Ibaraki 310-8512, Japan

^g National Institute for Rural Engineering, NARO, 2-1-6, Kannondai, Tsukuba, Ibaraki 305-8609, Japan

^h Japan Branch of Geoscience for Environmental Management, International Union of Geological Science, 1277-1, Kamauchiya, Motoyanagi, Katori, Chiba 287-0025, Japan

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ABSTRACT

The Chiba composite section of the Kokumoto Formation in central Japan is a remarkable, thick marine succession and is a candidate for formal recognition as the Global Boundary Stratotype Section and Point (GSSP) for the base of the Middle Pleistocene stage. Although there have been numerous studies of the Kokumoto Formation, the sedimentology of the formation, particularly in the Chiba composite section, has been unclear. We use field observations and laboratory analyses to elucidate the sedimentary processes and depositional environments of the formation. The Chiba composite section includes the Matuyama–Brunhes paleomagnetic reversal, which is the primary guide for the Lower–Middle Pleistocene boundary, along with multiple tephra deposits that provide isochronous correlational tie points. One bed, Byk-E (also known as Ontake-Byakubi Tephra), immediately underlies the paleomagnetic reversal and hence provides a useful widespread marker for the boundary. The predominant silty beds of the Chiba composite section are intensely bioturbated and lack evidence of episodic deposition such as slumps or muddy turbidites. However, minor sandy beds intercalated within the silty section, particularly in its lower part, are either (1) fining upward sequences with faint planar or ripple laminations and an erosional base, or (2) sequences containing abundant mud clasts in a poorly sorted sand matrix with a sharp base and an irregular top surface. The silty beds are interpreted to be hemipelagite formed by deposition of fine-grained suspended material under stable and calm bottom-water conditions. The sandy deposits are interpreted to be sediment gravity-flow deposits (i.e., turbidites and debrites). These sedimentary processes and the trace fossil assemblage indicate that the Chiba composite section was formed in a continental slope environment. The depositional environments of the Chiba composite section, together with tephrostratigraphy, make it suitable for high-resolution studies on the paleoenvironment, paleoclimate, and paleoceanography of the northwest Pacific Ocean across the Lower–Middle Pleistocene boundary; it is therefore a suitable candidate to become the GSSP for the Middle Pleistocene.

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* Corresponding author.

E-mail address: n.nishida@aist.go.jp (N. Nishida).

1. Introduction

The Lower to Middle Pleistocene is an important geological period that is characterized by gradual changes in climate systems that affected the evolution of biota (e.g., [Head and Gibbard, 2005](#); [Head et al., 2008](#)). The Chiba composite section in the Kokumoto Formation of central Japan is a thick and continuous marine

succession that straddles the Lower–Middle Pleistocene boundary and the well-recognized Matuyama–Brunhes paleomagnetic reversal ([Niitsuma, 1976](#); [Okada and Niitsuma, 1989](#); [Suganuma et al., 2015](#)). Because the Matuyama–Brunhes paleomagnetic reversal serves as the primary reference for the Lower–Middle Pleistocene stage boundary ([Head and Gibbard, 2005](#)), the Chiba composite section (Tabuchi, Yanagawa, and Kogusabata sections)

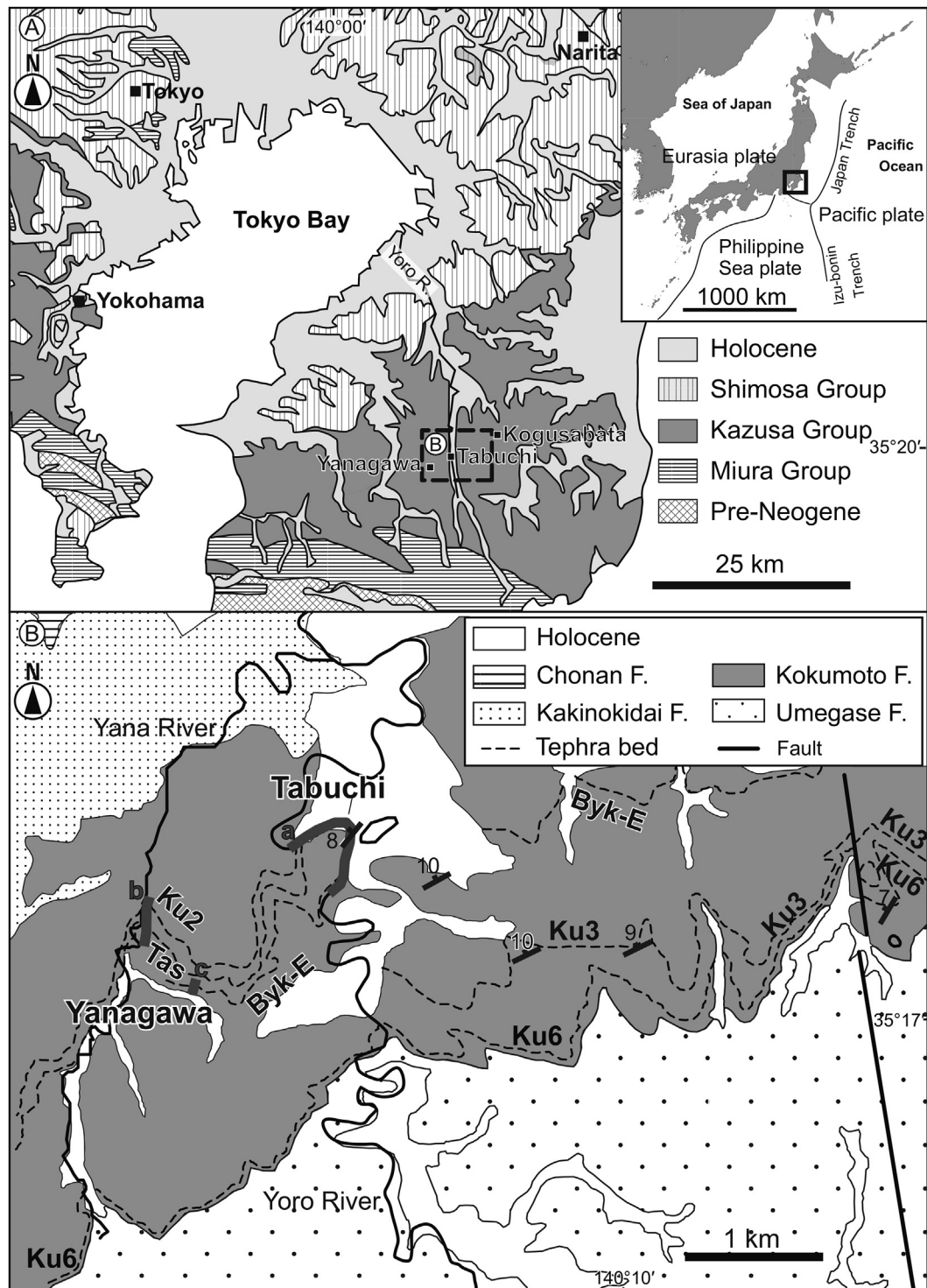


Fig. 1. A: Regional geological map of the Boso Peninsula, central Japan. B: Geological map showing the distribution of the Kokumoto Formation and the location of the Chiba composite section. Modified from [Kazaoka et al. \(2015\)](#).

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