

## Sedimentary facies of the Byakubi-E tephra bed (Byk-E) just below the Matuyama-Brunhes Polarity Chronozone boundary in Boso Peninsula, central Japan

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The Byakubi-E tephra bed (Byk-E) is a white pumiceous fine ash deposit with 1.0-7.0 cm thick, and is sandwiched between dark gray sandy silt layers in the middle part of the Kokumoto Formation (Kazusa Group).

The Byk-E is located at approximately 0.8 m below the Matuyama-Brunhes Chronozone boundary (MBB) in the Chiba composite section (along the Yoro, Yanagawa and Kokusabata rivers) in central part of the Boso Peninsula (Suganuma et al., 2015; Kazaoka et al., 2015). The middle part of the Kokumoto Formation across MBB is extremely well exposed in the Chiba composite section, and this section is a candidate of Global Boundary Stratotype Section and Point (GSSP) for the Lower-Middle Pleistocene boundary (Head et al., 2008; Head and Gibbard, 2015). The base of the Byk-E would serve as an appropriate level for of the L-M Pleistocene GSSP, because that is a clear lithofacies boundary just below the MBB (Kazaoka et al., 2015).

It has been revealed that a distribution of the Byk-E in the Boso Peninsula (Kazaoka et al., 2015) and its source volcano (Takeshita et al., 2015), however, there is no detailed report on the sedimentary facies of this tephra bed. Therefore, we carried out a detailed observation of the sedimentary facies of the Byk-E in four outcrops (Yoro and Yanagawa rivers, Mt. Daifuku, and Tateyama). As a result of the observation, following three points were found in neither outcrop. 1) There is not a clear lamina in the Byk-E. 2) Mud clasts are not observed in the Byk-E. 3) The base of the Byk-E doesn't cut trace fossils in the underlying layer. Additionally, in the three outcrops except the Yoro River section, the thin layer consisting of fine volcanic ashes is found in a basement of the Byk-E. These results clearly show that the Byk-E is a primary fall-deposits, and conformably overlies the underlying silty layers.

Keywords: Byk-E, Lower-Middle Pleistocene boundary, GSSP, Sedimentary facies, Chiba composite section

## Zircon LA-ICP-MS U-Pb dating on some Quaternary tephras in Boso Peninsula

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Zircon U-Pb dating using LA-ICP-MS was applied to some Quaternary tephras in Boso Peninsula, central Japan. Accurate age determination of these tephras is of critical importance because they are relevant to a candidate site for the Global Boundary Stratotype Section and Point of the early-middle Pleistocene boundary. Recently, a precise zircon SHRIMP U-Pb age of  $0.773 \pm 0.007$  Ma from a tephra just below the Matuyama-Brunhes (MB) boundary was reported (Suganuma et al., 2015). Here, we show other precise zircon LA-ICP-MS U-Pb ages from the Ks11 and Ch2 tephras above the MB boundary. The Ks11 tephra yielded a weighted mean age of  $0.52 \pm 0.04$  Ma and the Ch2 tephra yielded a weighted mean age of  $0.61 \pm 0.02$  Ma, both of which are in agreement with the stratigraphy. The good agreement between zircon U-Pb ages and the stratigraphy validates the reliability of the established stratigraphy and our dating approach. These U-Pb ages should help to further establish Japanese and worldwide Pleistocene chronostratigraphy.

Keywords: U-Pb dating, zircon, tephra, Matuyama-Brunhes boundary

Orbital and suborbital scale paleoceanographic features for marine isotope stage 19 from the Chiba section well correlated with those from Osaka Bay and North Atlantic

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Chemical and magnetic data of a 54-m long core drilled near the Chiba section, Tabuchi provide excellent proxies of sea-level variations. The Ca/Ti ratio, magnetic susceptibility, ARM, and ARM/magnetic susceptibility values measured every 1 cm interval show variations well correlated with those from the oxygen isotope data from planktonic foraminifera fossils. The existence of such correlations reflects combined effects of changes in biogenic calcium carbonate production, accumulation rate (a.r.) and grain size of clastics due to sea-level variations. The Ca/Ti curve, a best sea-level proxy, shows precession-related signals correlated with highstands 19.3 and 19.1, and lowstand 19.2. The orbitally tuned Ca/Ti curve represents a number of centennial scale features well correlated with those of sea-level proxies from Osaka Bay and North Atlantic. In consideration of a.r. variability, the age model for the Chiba section was refined with more control points between the orbital scale control points, adjusting to the astronomical time scale for the Osaka Bay core that has a uniform a.r. In the early MIS 19, the highest sea-level peak is preceded by a sea-level fall event, as in Osaka Bay. After MIS 19.2, there are many millennial scale fluctuation features, most of which are observed in the records from Osaka Bay and North Atlantic (IODP site U1313). These features are possibly global, and some of them are affected by eustatic sea-level changes. The MBB is dated at 777 ka in Osaka Bay, and 778 ka in the Chiba section and the North Atlantic.

Keywords: Chiba section, Matuyama-Brunhes boundary, Osaka Bay, North Atlantic, sea-level variation

## Planktonic foraminiferal biostratigraphy and paleoceanographic reconstruction of the Pleistocene Kokumoto Formation, Kazusa Group in the Boso Peninsula, Japan

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The Plio-Pleistocene Kazusa Group is widely distributed in the Boso Peninsula. The Matuyama-Brunhes reverse boundary (MBB) has been recognized in the Kokumoto Formation of the upper part of the Kazusa Group. To reconstruct a detailed paleoceanographic record of environmental change across the early-middle Pleistocene boundary, we carried out a faunal analysis of planktonic foraminifera from a sediment core (TB2) obtained from the Kokumoto Formation at Tabuchi, Ichihara City, Chiba Prefecture, central Honshu, Japan. We also reexamined a planktonic foraminiferal biostratigraphy extending from the Kokumoto Formation to the lower Kakinokidai Formation along the Yoro River section, in order to identify important planktonic foraminifera biohorizons.

The 54-m core mainly consists of massive siltstone with a key tuff bed (Byakubi-E) and covers marine oxygen isotope stages (MIS) 20.2 to 19.2 with a high sedimentation rate of 1–2 m/ka. Total 41 species belonging to 15 genera of planktonic foraminifera were detected from 59 samples of the TB2 core. We reconstructed sea surface temperature and salinity based on the planktonic foraminiferal assemblages by using the Modern Analog Technique and the Transfer Function method. The results clearly demonstrate the migration process of the Kuroshio front from stages 20 to 19. The biostratigraphic result of the Yoro River section indicates that the top occurrence datum of *Neoglobobulimina inflata* Kucera and Kennett is placed near the boundary between Kokumoto and Kakinokidai formations. This biohorizon has been dated as 0.73 ± 0.05 Ma at Ocean Drilling Program Site 1150 off the Sanriku region, Northwest Pacific (Domitsu and Oda, 2008, The Open Paleontology Journal, 1, 1–6). Combining with previous studies, we refined the planktonic foraminiferal biostratigraphy of the Kazusa Group.

Keywords: Kokumoto Formation, planktonic foraminifera, biostratigraphy, paleoceanography

Detailed variations in diatom assemblages across the Matuyama-Brunhes magnetic polarity boundary from a core collected adjacent to the Chiba section, central Japan

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We conducted diatom analysis of a core named TB2 of the Kokumoto Formation of the Kazusa Group drilled near the Chiba section, a candidate for the Early to Middle Pleistocene boundary. 71 taxa of diatoms were identified. The number of total valves is controlled by coastal species such as *Paralia sulcata*, *Cyclotella striata* + *C. stylorum*, and *Actinopterychus senarius*. The coastal species show variations well correlated with the ratio of Ca/Ti, a biological production proxy, and planktonic  $\delta^{18}\text{O}$ , representing the highest peak at 44.5-33.9m and the second one at 19.9-14.8m. The former is correlated with highstand MIS 19.3 and the latter with highstand MIS 19.1. This result suggests not only the biogenic production rate but the production of coastal diatom species increases as the sea-level rise. Cold diatom species of the Oyashio Current are dominant below a depth of 25 m, and warm species of the Kuroshio Current become dominant above it. This suggests occurrence of a large current system change during MIS 19.

Keywords: *Paralia sulcata*, MIS 19, Kokumoto Formation, Matuyama-Brunhes magnetic polarity boundary

## High resolution magnetostratigraphy of the Matuyama-Brunhes transition from oriented samples from the Chiba Section, central Japan

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Pleistocene sediments of the Kokumoto Formation in the upper part of the Kazusa Group, central Japan have been studied by many research groups. However, very few studies have focused on the marine isotope stage 19 interglacial including the Matuyama-Brunhes magnetic polarity boundary (MBB). In order to establish detailed magnetostratigraphy across the MBB, we collected oriented samples for magnetic analyses by drilling from 140 horizons of the Chiba Section, a candidate for the Global Boundary Stratotype Section and Point (GSSP) of the Early to Middle Pleistocene Boundary. We also collected block samples to pick up foraminifera fossils from 35 horizons for construction of oxygen isotope stratigraphy. Here, we first report preliminary results of paleomagnetic analyses. Progressive thermal demagnetizations reveal natural remanent magnetizations (NRMs) consist of two components demagnetized at or below 350 degrees Celsius and between 500 degrees Celsius and 680 degrees Celsius. The values of magnetic susceptibility measured at each step of thermal demagnetizations begin to increase from 400 degrees Celsius and decrease above 500 degrees Celsius. These results indicate that the samples include a ferromagnetic iron sulfide mineral such as greigite, which is decomposed below about 350 degrees Celsius, followed by oxidation to form magnetite and further to hematite, causing an increase and a decrease of magnetic susceptibility, respectively. Characteristic remanent magnetizations isolated above 350 degrees Celsius show that reverse and normal polarity continue from 1440 cm below to 60 cm above and from 290 cm to 430 cm above the Byakubi tephra (Byk-E), respectively. Therefore, the Matuyama-Brunhes transition would lie between 60 cm and 290 cm above the Byk-E, which would require reviewing the previous MBB position in detail. The result of oxygen isotope analysis using fossils of *Bolivinita quadrilatera* will also be reported.

Keywords: Early to Middle Pleistocene GSSP, Chiba Section, Matuyama-Brunhes boundary, *Bolivinita quadrilatera*, MIS19, Byakubi-E