Holocene paleoenvironmental changes based on biomarker analysis at the western part of the Kawachi plain, Osaka, Japan

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1. Introduction

To reconstruct past environmental variation in the Quaternary strata of the Osaka plain, analysis of microfossil assemblages such as foraminifera and ostracods have been conducted by previous studies (e.g., Umeda et al, JPGU2018). Although these microfossil assemblages provide estimates on the hydrospheric environments, their occurrence is mainly limited to marine deposits. In this study, the organic biomarker molecules derived from terrestrial and aquatic organisms have been investigated in the Holocene sediments of Sakuranomiya East drill core to reconstruct the past variations in the source of organic matter (OM) and depositional environments at the western part of the Kawachi plain.

2. Analytical methods

Biomarker analysis was performed on the 20 sediment samples of an 18 m long Sakuranomiya East core, which have been drilled at Sakuranomiya East park (altitude + 0.5 m), Miyakojima, Osaka City. The Sakuranomiya East core is consist of the Holocene Nanba Formation and divided into 4 units; the lower unit (SH-1; altitude -19.50 to -17.60 m) consists of medium sand to mud layers, SH-2 (altitude -19.50 to -17.60 m) consists of medium sand to fine sand layer, SH-3 consist of mud layer (SH-3: altitude -16.00 to -8.90 m), and SH-4 (altitude -8.90 to -1.60 m) consists of mud to fine sand layers. Biomarker analysis was performed at 20 horizons spanning SH-1 to SH-4 including mud and sand layers. Lipids were ultrasonically extracted from sediments with dichloromethane and methanol, and subsequently divided into 3 fractions (hydrocarbons, ethers/esters/ketones, and polar lipids), then analyzed by GC and GC-MS. Polar fractionation was derivatized prior to analysis. Compounds were identified based on mass spectra and relative retention time and quantified with GC-FID.

3. Results and discussion

n-Alkyl lipids (*n*-alkanes, *n*-alcohols, *n*-fatty acids) and terrestrial plant biomarkers such as friedelin and sawamilletin were identified as major compounds. The predominance of long-chain ($>C_{22}$) *n*-alkanes and *n*-alcohols with a significant amount of terrestrial plant biomarkers indicated the overall predominance of terrestrial OM throughout the studied core. This is reasonable considering that the core site is located in the incised valley of the paleo-Yamato River (Mitamura and Hashimoto, 2004). Meanwhile, the amount and chain-length distributions of biomarkers also reconstructed variations in the contribution of fluvially transported terrestrial OM. The decreasing long-chain components of *n*-alcohols from SH-1 to SH-2 were considered to coincided with sea-level rise; rapid expansion of inner bay over the Kawachi plain increased a distance from the retreating estuary which supplied terrestrial OM. The high relative concentration of sawamilletin observed in SH-2 might reflect the input from coastal Graminae vegetation at 8ka. The gradual increase of long-chain *n*-alcohols in the upper SH-3 to SH-4 initiates around the highest sea level period of ca. 6.4 ka indicating the increasing fluvial input of terrestrial OM with the progradation of river delta. In addition, an increased *n*-alkane Paq index observed in SH-4 suggests the higher input of aquatic macrophytes at ca. 4ka. In the upper part of SH-3, a higher contribution of short-chain *n*-fatty acid ($< C_{21}$) were observed. Short-chain *n*-fatty acids are considered mainly derived from aquatic organisms including planktons and bacteria. Oshiro (2018MS) estimated the bottom environment of these horizons as closed inner bay and reported the occurrence of *Buccella frigida*, detritivore foraminifera frequently occur in OM

rich bottom sediments. Therefore, the upper part of SH-3 is characterized by the enhanced marine production along with increasing terrestrial OM input, probably deposited under the influence of estuary circulation.

Keywords: Biomarker, Osaka plain, paleoenvironmental changes

