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# Sea-level variations during Marine Isotope Stage 7 and coastal tectonics in the eastern Seto Inland Sea area, western Japan

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ABSTRACT

Relative sea-level (RSL) observations for Marine Isotope Stage (MIS) 7 were obtained from three sites (Higashinada, Kakogawa and Mitsu) of the eastern Seto Inland Sea area, western Japan. We evaluated the magnitude of sea-level highstands during MIS 7 and the local tectonics based on RSL records of this coastal area. For this purpose, we analyzed diatom assemblages and sedimentary sulfur, and carried out tephra analysis. We also constructed a linear age model to determine the depositional ages of the sediments using altitudes of astronomical age control points obtained mainly from the present diatom data. At the Mitsu site, RSLs were estimated to be −22.87 ± 0.50 m at the MIS 7.5 highstand peak (234.6 ka), below −20.17 m at 211.2 ka, and below −20.00 m at 209.9 ka. With a tectonic subsidence rate of 0.11 ± 0.02 m/ka since the Last Interglacial Maximum at the Mitsu site, the elevation of the tectonically corrected MIS 7.5 highstand peak may have been +2.94 ± 5.19 m. The tectonically corrected sea-level elevations during MIS 7.3 are inferred to have been below +3.06 ± 4.72 m at 211.2 ka and below +3.09 ± 4.70 m at 209.9 ka. Comparisons between the diatom-inferred RSLs and the isotopically derived sea-level curve indicate that the MIS 7.3 highstand peak was above −18 m and may have been lower than the MIS 7.5 and 7.1 highstands. Based on the isotopically derived sea-level curve and the RSL data from Higashinada and Kakogawa, a tectonic subsidence rate of 0.26–0.32 m/ka was derived for Higashinada and a tectonic uplift rate of >0.17 m/ka and <0.29 m/ka was derived for Kakogawa. A relative uplift rate of >0.43 m/ka and <0.61 m/ka was derived along the traverse from Higashinada to Kakogawa. The uplift rate derived for Kakogawa relative to Mitsu is > 0.26 m/ka and <0.42 m/ka. These values indicate the intensity of crustal movements associated with active faulting of the Rokko–Awaji fault system along this tectonically active coast.



## 1. Introduction

In the Osaka and Harima-nada sedimentary basins in the eastern Seto Inland Sea area, western Japan (Fig. 1), fluvial–lacustrine and marine environments have alternated since the late Early Pleistocene, corresponding to glacial and interglacial periods, respectively (e.g., Itihara, 1993). The aquatic environments of these basins changed from freshwater to marine or marine–brackish as sea level rose at the beginnings of past interglacial periods. This environmental change enables investigation of local climate dynamics (e.g., Kitaba et al., 2009, 2011) and sea-level variations (e.g., Kariya et al., 2010) during the Quaternary.

The Osaka and Harima-nada sedimentary basins are marked by numerous Quaternary active faults (Fig. 1A and B). In this tectonically active area, crustal movement caused by active faulting has been evaluated using methods that have evolved out of studies of relative sea-level (RSL) variations during the Holocene (Sato et al., 2001, 2003, 2006). Reconstructions of previous interglacial periods can help us to further understand the dynamics of crustal movement in this area. Although a sequence of multiple marine terrace surfaces is developed on the coast of Harima-nada (e.g., Tanaka, 1989), its timing is poorly constrained. Using a tephrochronological method, the formative age of one of the upper terrace surfaces has been determined to reflect the sea-level

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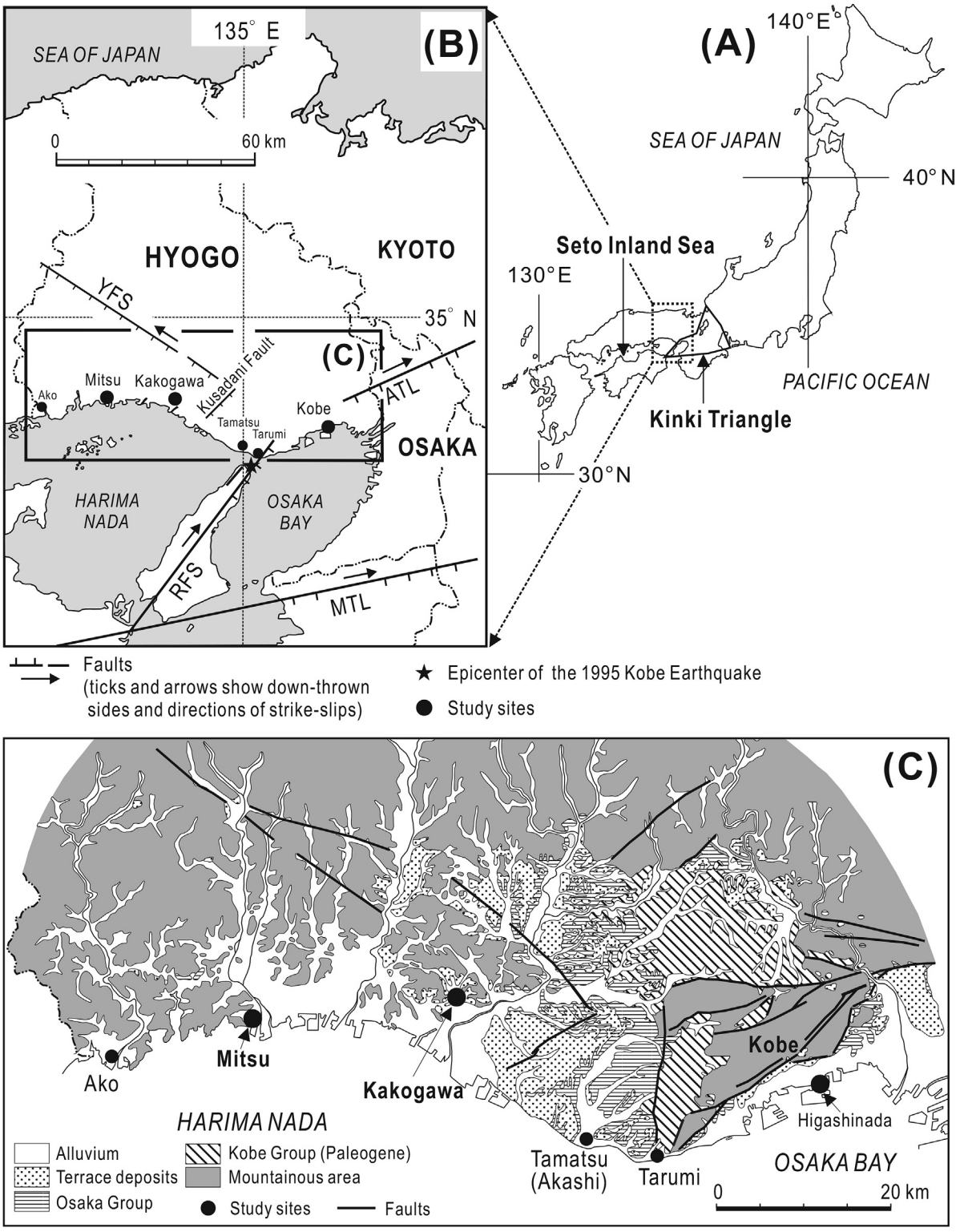


**Fig. 1.** Maps of the eastern part of the Seto Inland Sea. (A) Location map of the Kinki Triangle tectonic region (after Toda et al., 1998). (B) Distribution of active faults in the Osaka and Harima-nada basin area and the study sites. ATL: Arima–Takatsuki Tectonic Line, RFS: Rokko–Awaji fault system, YFS: Yamasaki fault system, MTL: Median Tectonic Line. (C) Geological map and location of the study sites. Main active faults are shown (modified from Okada et al., 2000).

highstand associated with Marine Isotope Stage 7 (MIS 7) (Sato et al., 1999).

In this study, we investigate changes in the depositional environments of these basins in response to eustatic sea-level variations during MIS 7. For this purpose, we analyze two cores: one from Osaka Bay and another from a site on the coast of Harima-nada. Data from these cores are used along with existing data of the upper terrace deposits (Sato et al., 1999) to evaluate the

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