

Reconstruction of Late Holocene environmental changes based on analysis of core sediments from Kaicho Temple

*Tomoya Ina¹, *Daisuke Suzuki¹, *Keito Tsutahara¹

1. Shizuoka Prefectural Iwata Minami High School

1. Introduction

Studies of historical records show that many Mw 8 class earthquakes have occurred along the Nankai and Suruga troughs, central Japan, with a recurrence interval of 90–270 years since the AD 684 earthquake. Coseismic uplift did not recorded during the 1707 Hoei and 1498 Meio earthquakes, but the AD 1854 Ansei-Tokai earthquake caused coseismic uplift of ~1 m in coastal areas west of Suruga Bay, including the Shimizu Plain. Thus, we studied the environmental changes of late Holocene from the geological record of Kaicho Temple in Shimizu-ku, Shizuoka city, Shizuoka Prefecture, and examined the history of coseismic uplift prior to the 1498 Meio earthquake. The temple was built at AD 1011 in the beach ridge at an altitude of about 4 m. (Fig.1) This history can help to constraint age of emergence of land in the study area.

2. Method

We drilled two 14m boring cores, cut the core in the vertical direction, investigated deposits, took soft X-ray photographs and made columnar sections. (Fig.2) We used ¹⁴C dating of leaves. We collected and preserve core samples every 1 cm. We analyzed the grain size and performed CNS elemental analysis.

3. Result

At site 1, deposits change upward from gravelly sand, through clay to alternations of sand and gravel beds. Gravelly sand and clay yield many intertidal molluscs such as *Umbonium moniliferum*. Foraminifera is not found from clay. The C/S ratio in clay deposit is ~0.7, except for the most upper part (6.3). The boundary between clay and well-sorted fine-grained sand is sharp. Alternations of sand and gravel beds yield wood fragments but not molluscs. ¹⁴C ages of leaves from the clay show AD 398 to 539.

At site 2, deposits change upward from sand, through clay to alternations of sand and gravel beds. Lower sand and clay beds yield molluscs. Foraminifera is not found from clay. The C/S ratio in clay deposit is 0.6-1.0. The boundary between clay and well-sorted fine-grained sand is sharp. In X-ray photograph, weak lamina can be observed in fine-grained sand. A woody debris bed with open matrix is found from sand and gravel beds. The ¹⁴C age of leaves in woody debris bed represent AD 258 to 428.

4. Discussion

Based on occurrence of intertidal molluscs, we think that the clay bed at -0.45-0.25 m above sea level (core depth: 4.90-4.20 m) at site 1 and at -0.12-0.20 m above sea level (core depth: 3.92-3.60 m) at site 2 were deposited in muddy tidal flat. This interpretation is supported by C/S ratio. The clay bed is overlain by alternation of sand and gravel beds. Sand beds are characterized by good size sorting and weak lamina. There is a woody debris bed in alternation of sand and gravel beds. These are commonly found in deposits in the backshore area which is only exposed to waves under extreme events with high tide and

storm surge. The uppermost gravel bed is interpreted as deposits of beach ridge.

It is noteworthy that sedimentary environment changed from intertidal muddy tidal flat to backshore area. Since shoreface area exists between both areas, a lack of shoreface deposit indicates that relative sea-level fell abruptly. Based on ^{14}C age of leaves, sea-level fall took place at AD 398-428. Because eustatic sea-level was stable in this interval, abrupt sea-level fall can be interpreted as coseismic uplift.

5. Conclusion

To clarify the history of large earthquakes along Suruga Trough, central Japan, we studied the sediment, fossil contents and TS contents of two sediment cores collected at Kaichoji Temple in the coastal area of the Shimizu Plain. The results can be summarized as follows.

1: We identified the sharp boundary in lithology between the clayey deposit and the overlying well-sorted sandy deposit at 0.20-0.25 m above sea level. This change indicates that sedimentary environments suddenly changed from tidal muddy flat to backshore area, suggesting coseismic uplift associated with rupture of Suruga Trough.

2: The results of ^{14}C dating show that the uplift took place at AD 398-428.

Keywords: coseismic uplift, Nankai and Suruga troughs, late Holocene, Shimizu Plain, facies analysis

