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During Sea-Level Highstands:
A Global Synthesis with implications
for management of future coastal change

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Quaternary coastal morphology and sea level changes

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Relative sea-level history reconstructed from plant macrofossils at salt marshes of eastern Hokkaido (Japan). Implications to estimate recurrence interval of great earthquakes on Kurile subduction zones.

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Abstract

Plant macrofossils from Akkeshi and Onnetoh estuaries increase the documents of the late Holocene relative sea-level history along the Pacific coast of eastern Hokkaido, northern Japan.

The coastal environments of eastern Hokkaido are divided into upland (freshwater swamp), high marsh (salt marsh), low marsh (salt marsh), tidal flat, and subtidal zones, based on distributions of vascular plants and mosses.

Figura 1. A view of a salt marsh at Akkeshi, Hokkaido (Japan). *Carex subspathacea*, *Salicornia europaea*, *Phragmites communis* dominate on the low marsh.

Their plant remains are also expected to distribute relating to the sub-environments. Here we attempt to reconstruct relative sea-level changes using these vascular plant and moss assemblages.

Stratigraphy of Akkeshi and Onnetoh sites are previously studied by Sawai (2001) and Sawai et al. (2002). Beneath the Akkeshi estuary, thick inorganic mud with bivalves (*Crassostrea gigas*) passes upward into interbedded peat and peaty mud. Peat overlies the basal mud, and the lowest peat-over-mud contacts appear 1-3 m below modern mean tide level (MTL). The peat contains two or three interbeds of peaty mud. The top of the peat contains two volcanic ash layers. In Onnetoh, deposits contain sand, basal mud, and interbeded peat and peaty mud. The lowest mud-peat contact is 1.0-1.5 m below MTL. Sandy deposits appear only around the bottom of location near a tidal channel. The peat of the western marsh commonly includes three interbedded mud layers. In the eastern marsh, two such interbeds appear in the upper peat. Three layers of volcanic ash are seen in most core sediments. A set of two white ash layers is seen at about 30 cm below surface. Mud with little vegetation is distributed at the top of the sediments near the river. Two volcanic ash layers recognized both in the estuaries are identified as Ta-a (A.D.1739) and Ko-c2 (A.D.1694).

Plant macrofossils in peat and mud of Akkeshi record relative sea-level falls at least four times in the past 3000 years.

Each of these changes is shown by alternation of sand, inorganic mud, peaty mud, and peat, and by plant macrofossils in these deposits. Salt-tolerant vascular plants are commonly seen in muddy layers whereas peaty layers are dominated by a wide variety of freshwater vascular plants and mosses.

This sequential change means that the relative sea-level shifted drastically from position of salt marsh to upland. Radiocarbon ages and tephra shows that these changes dated to about 2000, 1200, 600, and 300 cal yr B.P.

In Onnetoh, six relative sea-level falls provided changes in vascular plants and mosses.

The earliest relative sea-level fall (2500 cal yr B.P.) might be correlated with sea-level fall which is reported in many regions in Japan.

Figura 2. An outcrop at Onnetoh estuary. Peat-over-mud contact shows a relative sea-level fall. A relative sea-level fall ca. 2500 yr BP provided black peat layer (arrow).

Three relative sea-level falls (1100, 550, and 300 cal yr B.P.) show synchroneity to Akkeshi's events. These records imply that the past relative sea-level falls occurred widely along the Pacific coast. Judging from stratigraphy, plant macro fossils, and degree of synchroneity of each emergence, the events are probably related to subduction along the southern Kuril-Kamchatka Trench.

References

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