Earthquake cycles recorded in salt marshes along the Pacific coast of eastern Hokkaido, northern Japan

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Along the coastline of eastern Hokkaido, there is a series of Pleistocene marine terraces recording net uplift trend of about 0.03 - 0.05 cm/yr (Okumura, 1996). These terraces are correlated by marker tephras and their chronology to middle and late Pleistocene. By contrast, tide gage data from the past 50 years shows this area subsiding at fast rate of about 0.9 cm/yr. This fast subsidence of southeastern Hokkaido cannot persist, if the uplifted Pleistocene terraces along the Pacific coast represent the net tendency of vertical movement. If the future seismic events were able to solve this contradiction, such cycles might record relative sea-level changes beneath salt marshes along the Pacific coast of eastern Hokkaido.

Diatom assemblages in peat and mud of the Akkeshi estuary record sudden emergence at least four times in the past 3000 years. Each of these emergence events is shown by alternation of sand, inorganic mud, peaty mud, and peat, and by diatom assemblages in these deposits. Suddenness is shown by a sharp contact between inorganic mud or peaty mud and overlying peat. Diatom assemblages and plant macro fossils in the sediments provide the amount of the change. Brackish-marine diatoms and salt-tolerant vascular plants are commonly seen in muddy layers, but by contrast, peaty layers are dominated by a wide variety of freshwater diatoms and freshwater vascular plants. 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 as well, four emergence events recorded changes in diatoms, vascular plants, moss, and pollens. The events show synchroneity to Akkeshi's events. These records imply that the past emergence events occurred widely along the Pacific coast. Judging from stratigraphy, fossil diatoms, plant macro fossils, pollen, and degree of synchroneity of each emergence, the events are probably related to subduction along the southern Kuril-Kamchatka Trench. Along the nearby Hokkaido coast, tide gages have recorded chronic submergence close to 1 cm/yr since the 1940s. If this modern submergence is due to strain accumulation and if the sudden emergence events represent strain release, the emergence events near Akkeshi may represent great thrust earthquakes.