Recurrence of Kanto Earthquakes Revealed from Tsunami Deposits in Miura peninsula

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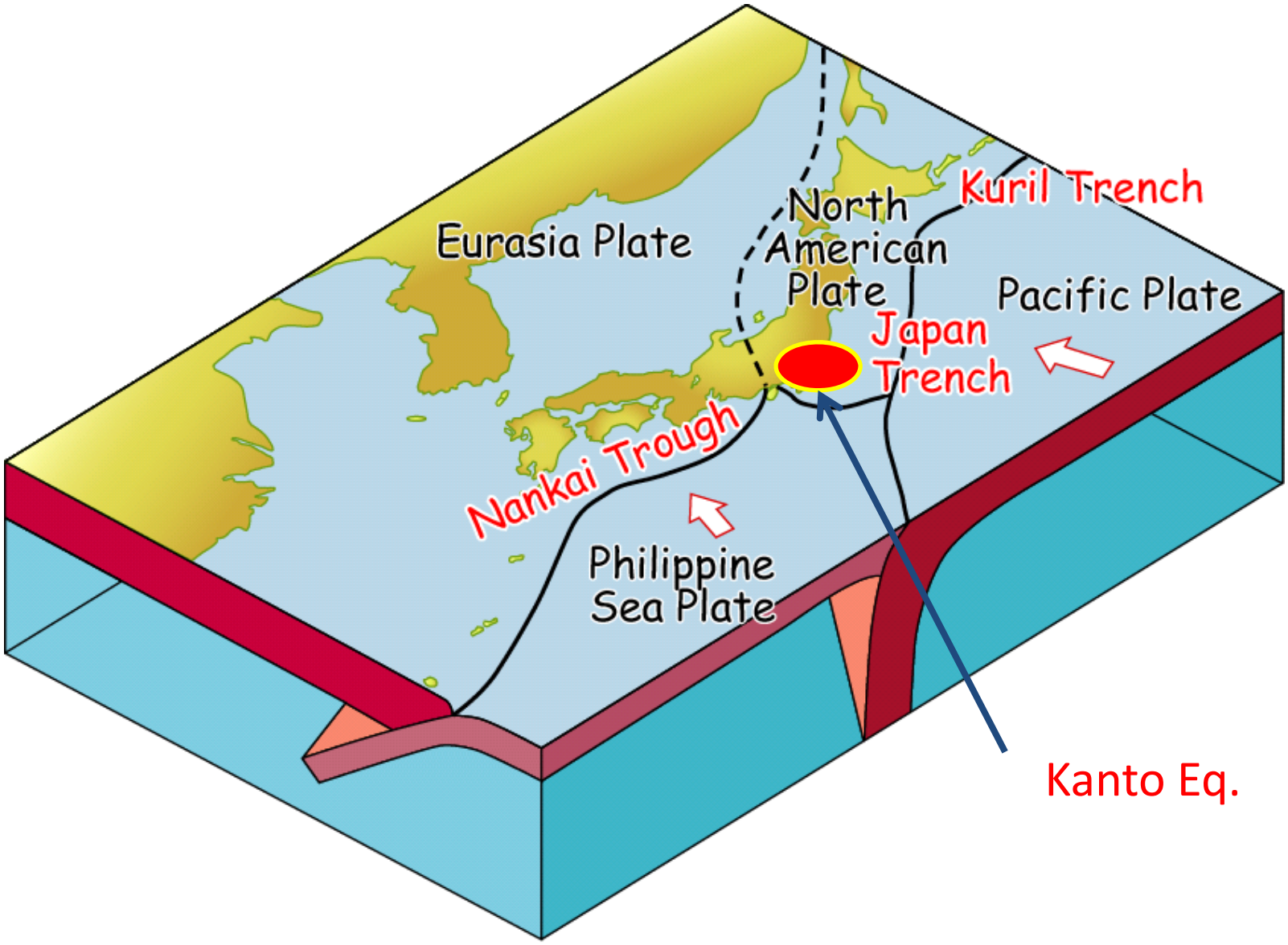
Plates around Japan



The 1923 Kanto earthquake

Damage in Yokohama City
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Tsunami Damage in Ito City
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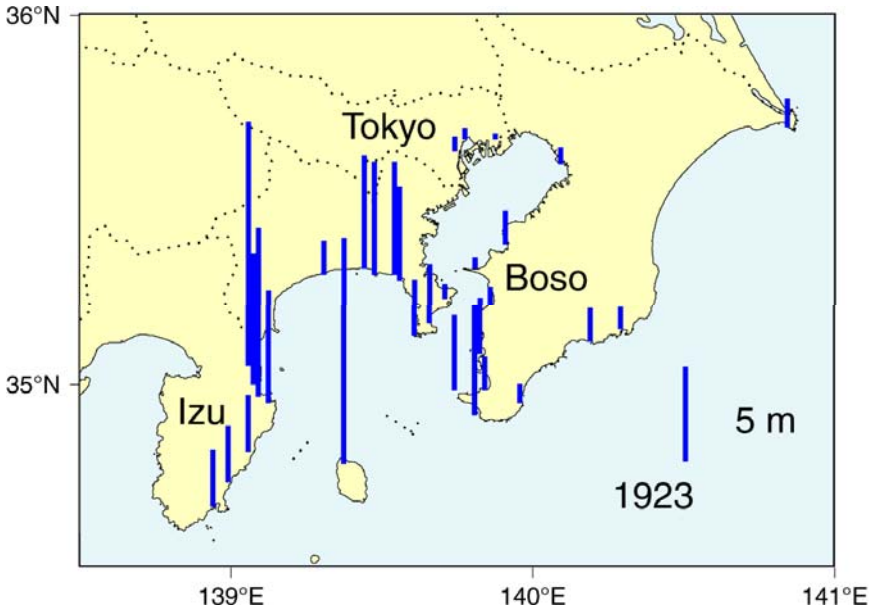
Total casualty ~ 100,000 (The worst earthquake disaster in Japan)

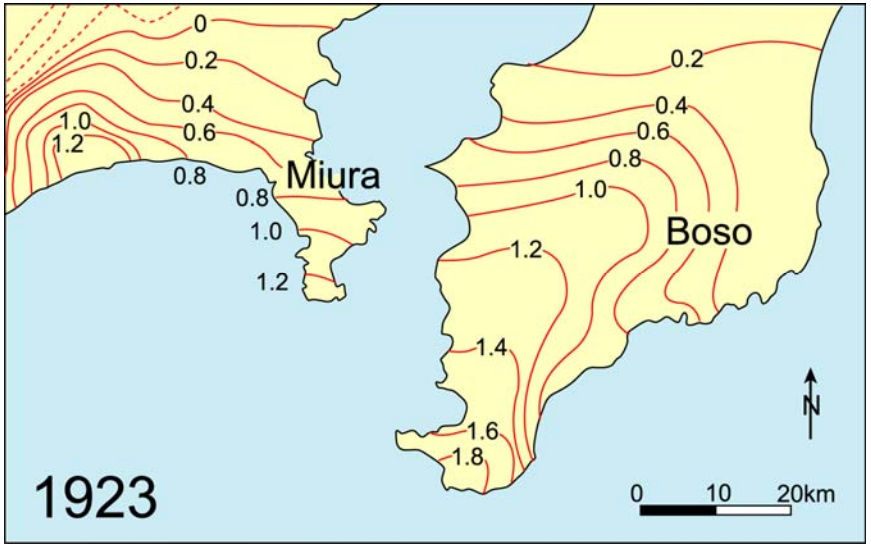
The 1923 (Taisho) Kanto earthquake

Tsunami Heights



Hatori (1975)

Crustal deformation

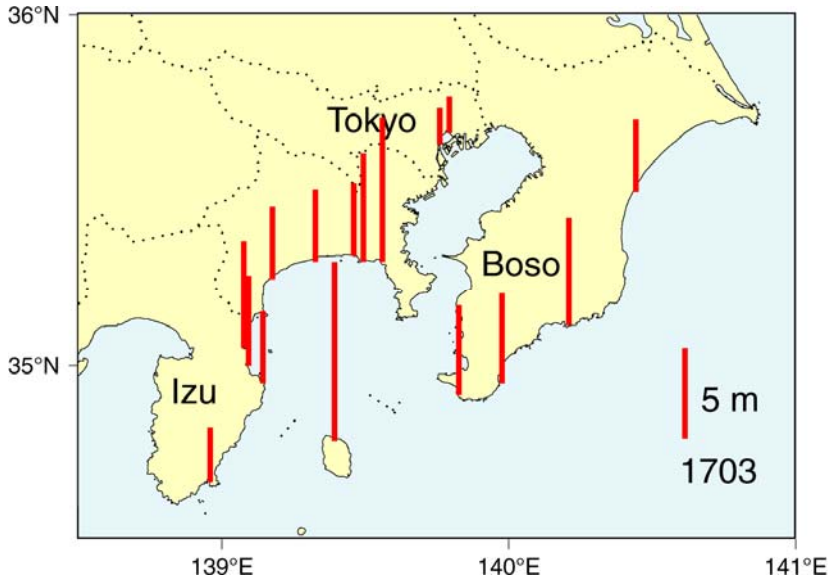


Miyabe (1931)

The 1703 (Genroku) Kanto earthquake

Previous earthquake at the plate boundary

Tsunami Heights



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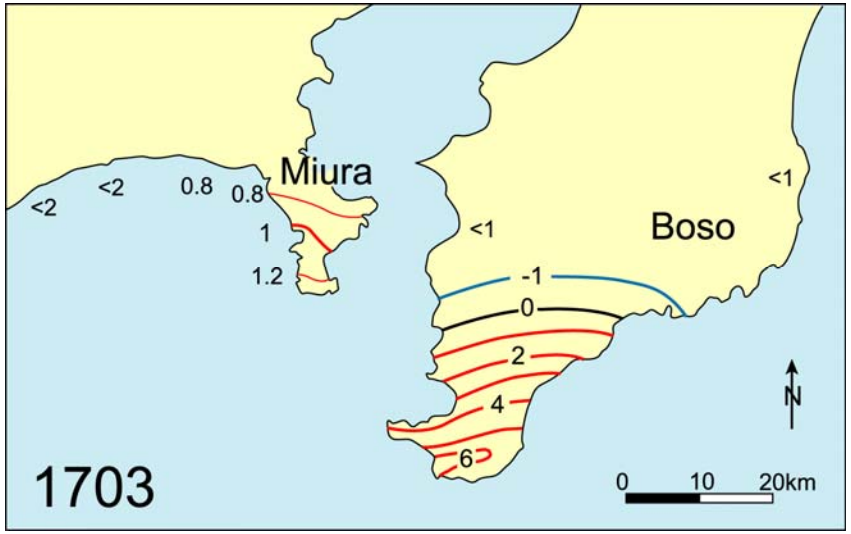
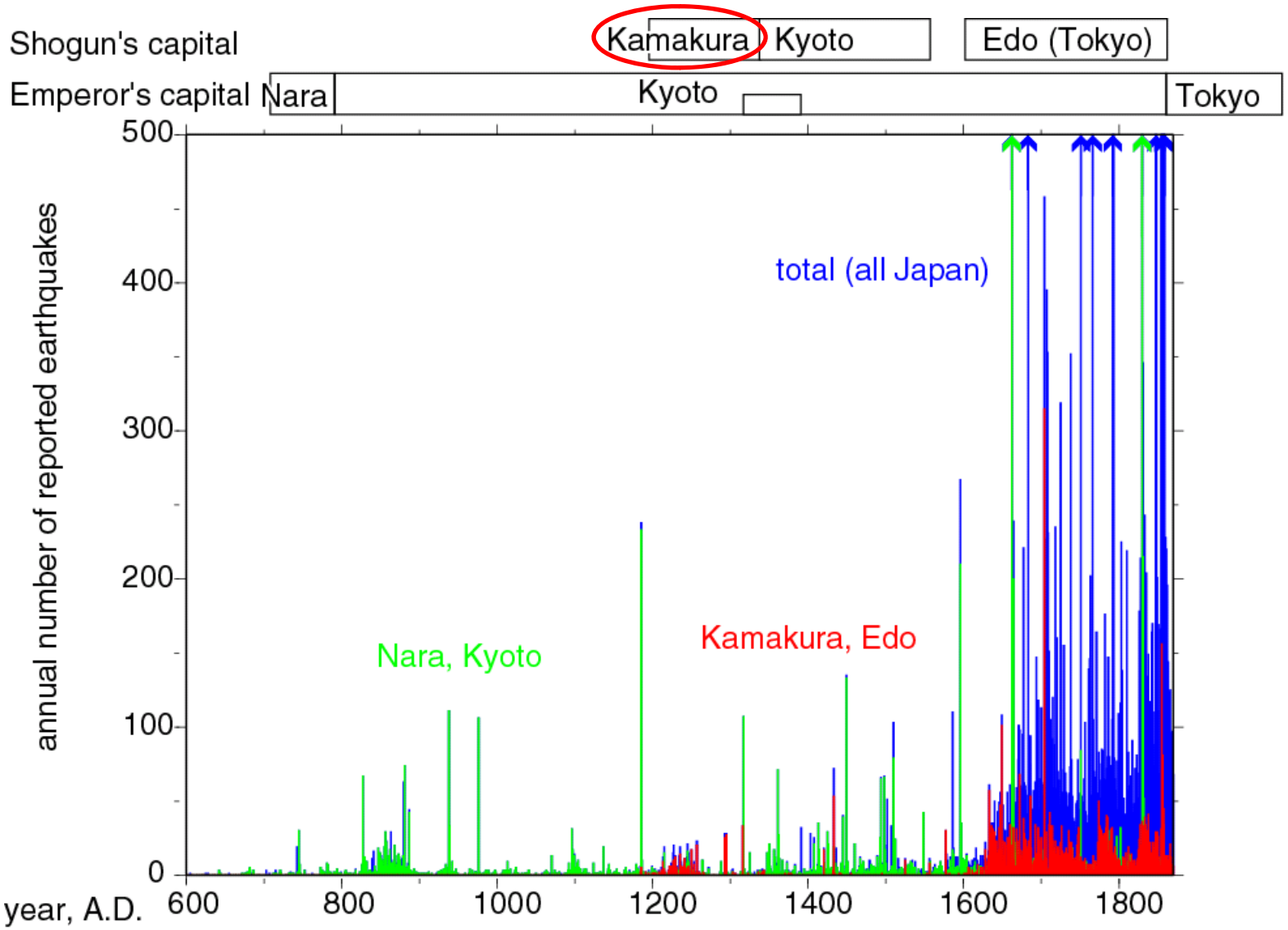


Shishikura (2003)

Larger tsunami on the Pacific coast of Boso peninsula

Larger uplift on the southern tip of Boso Peninsula

Historical records of earthquakes

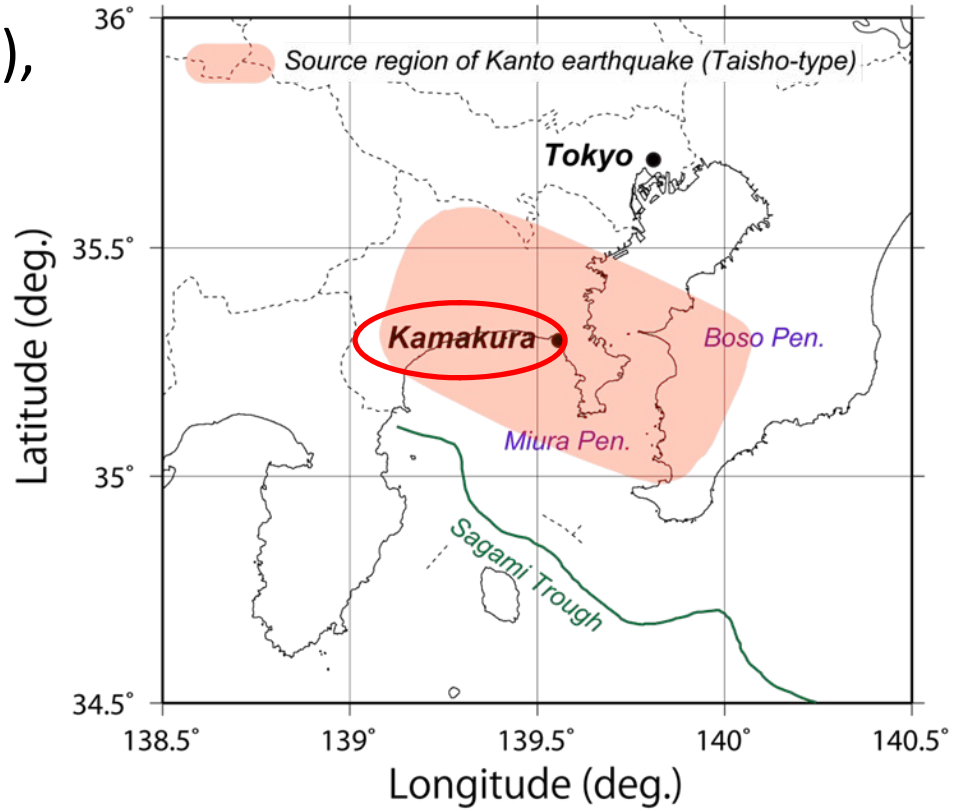


Ueda and Usami (1990)

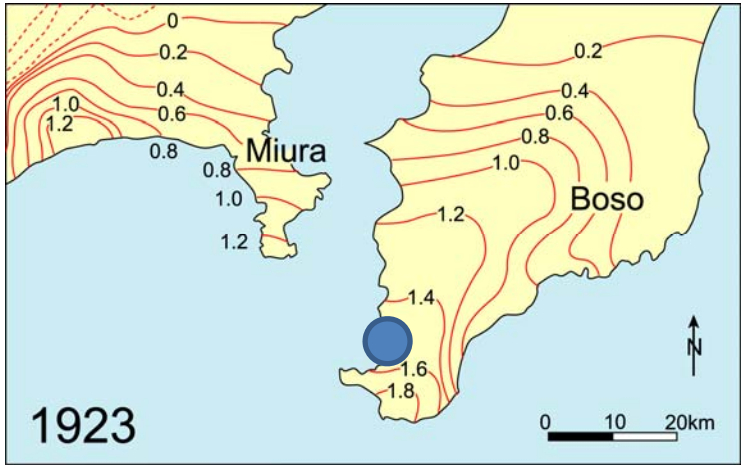
Historical records of earthquakes

During Kamakura Era (1192-1333), several damaging earthquakes were recorded, e.g.,

AD1257 M=7-7.5
AD1293 M~7
AD1433 M> 7



Geomorphological study



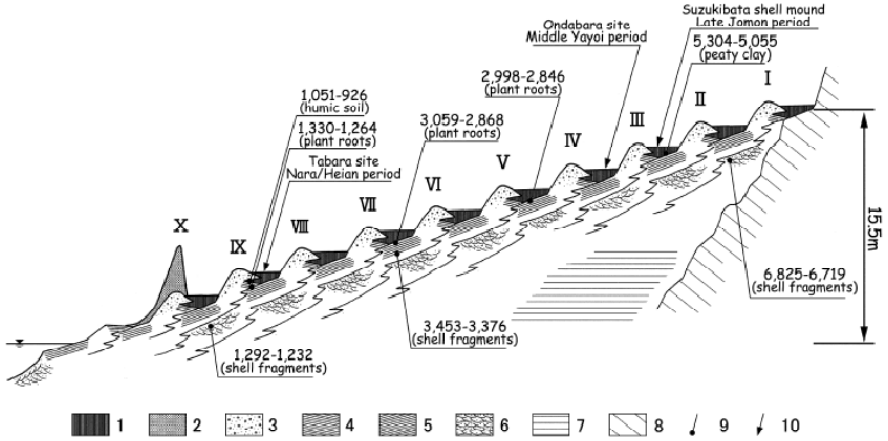
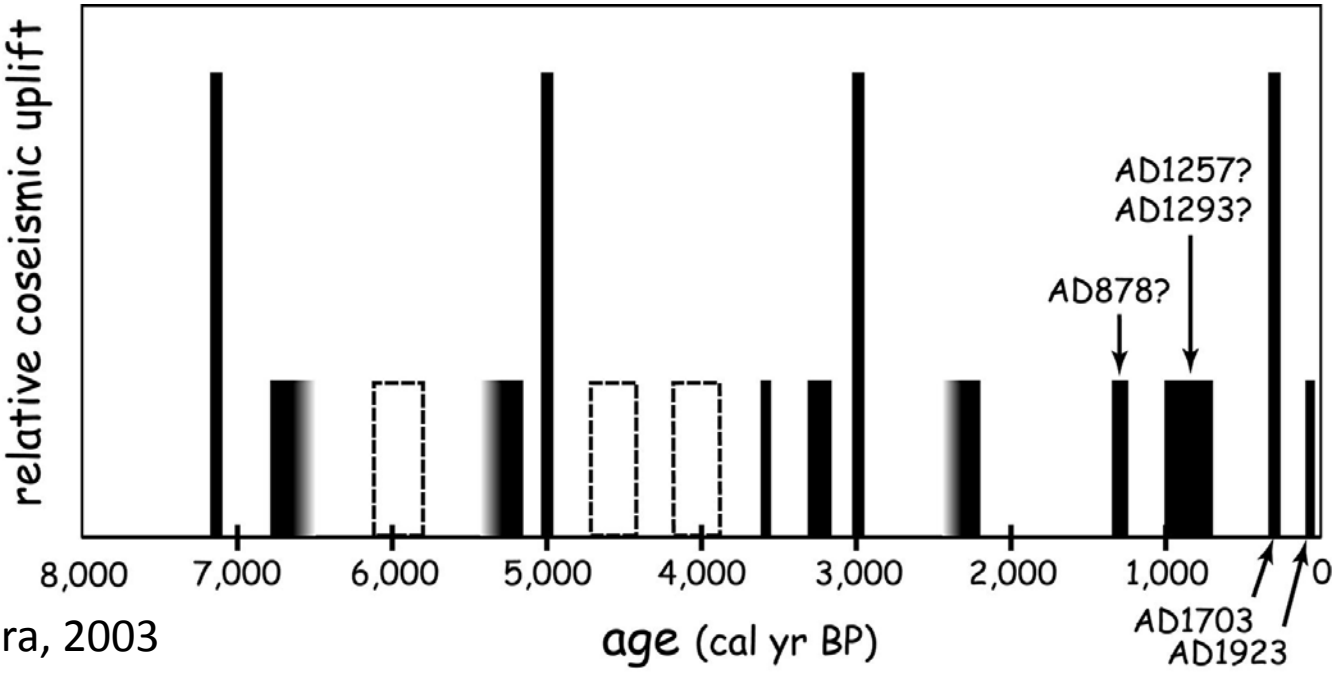
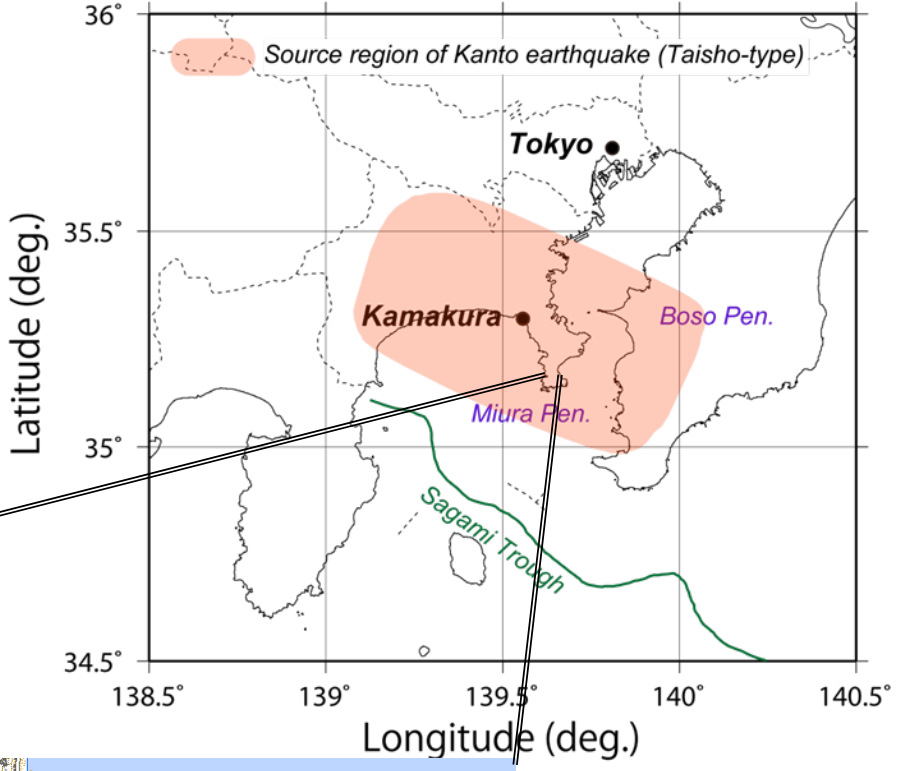


Fig. 10. Schematic cross-section of geology and geomorphology in the Iwai Lowland. 1: terrestrial deposit, 2: aeolian deposit, 3: beach ridge deposit, 4: backshore deposit, 5: foreshore deposit, 6: shoreface deposit, 7: marine clay, 8: bedrock, 9: location of radiocarbon sample (number means cal yrs BP), 10: location of archaeological site. Modified from Shishikura *et al.* (2001).

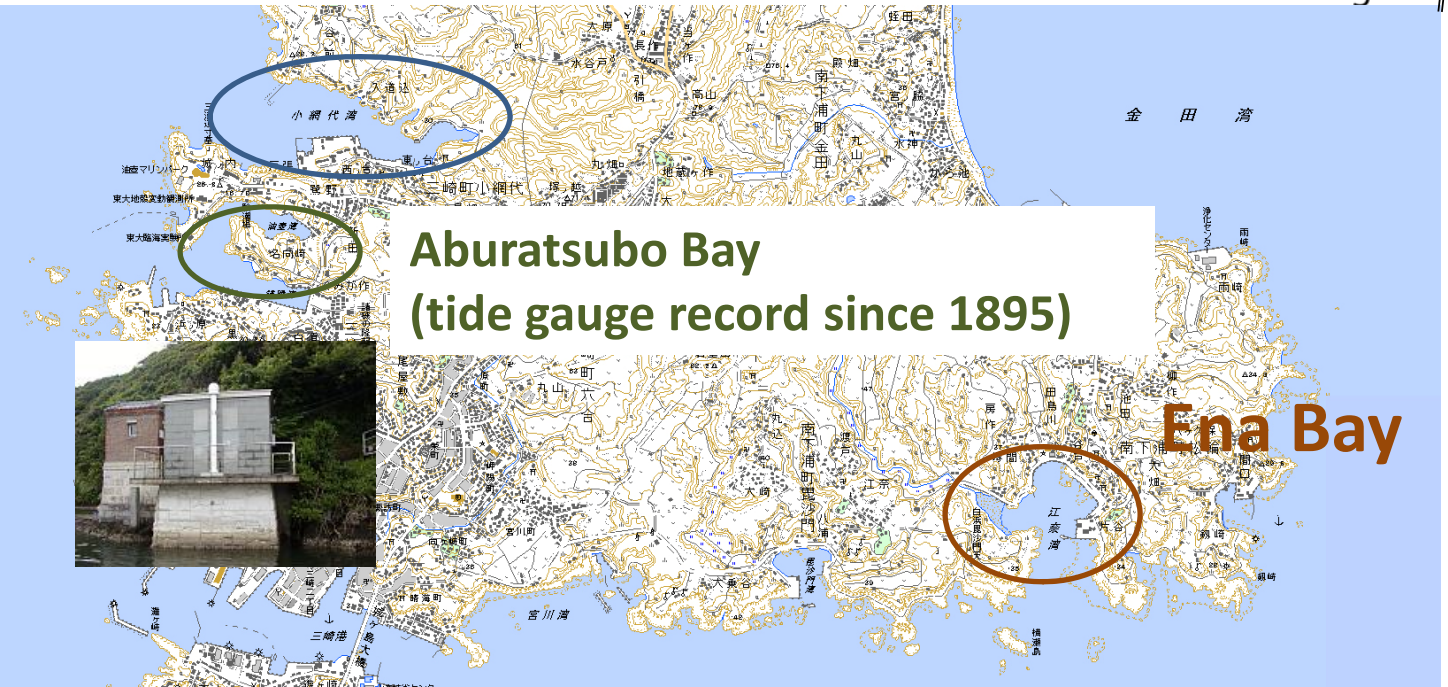


modified from Shishikura, 2003

Miura Peninsula



Koajiro Bay



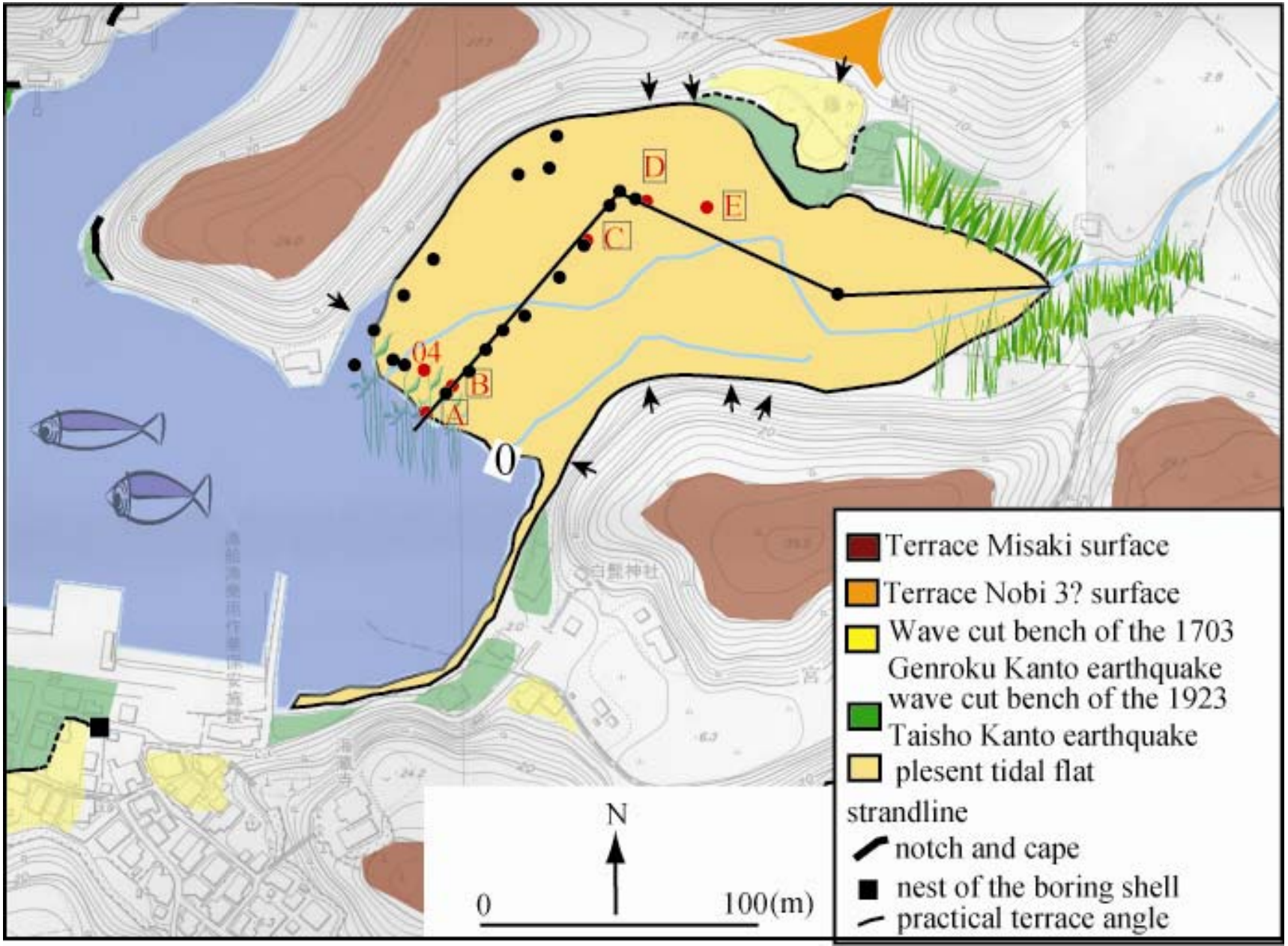
Aburatsubo Bay
(tide gauge record since 1895)

Ena Bay

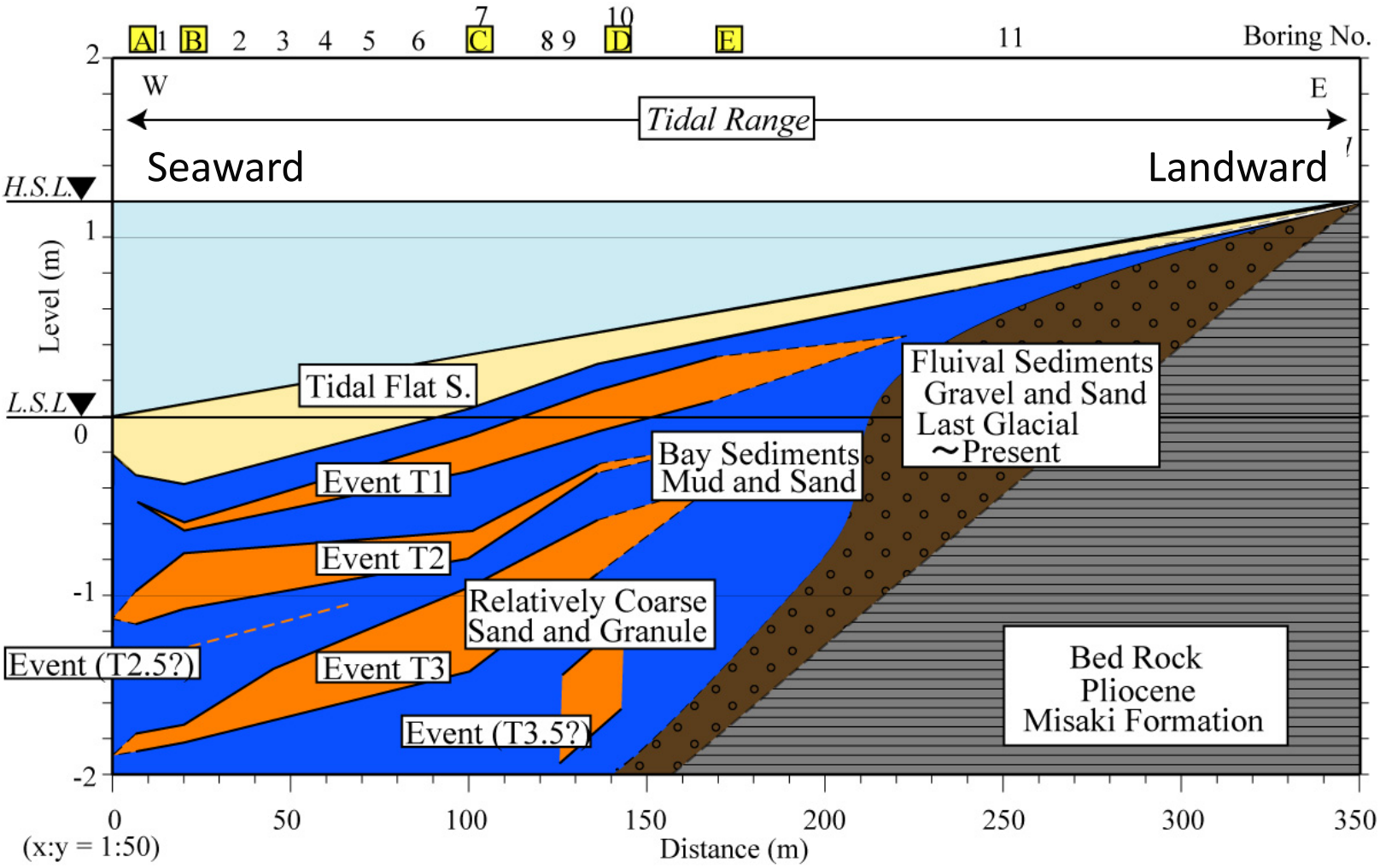
Study Site: Koaijiro Bay

Array Coring using Geoslicer at Tidal Flat

Array Coring using Geoslicer at Tidal Flat



Sequence of Stratigraphy



Three event deposits in the bay sediment beneath tidal flat sediment

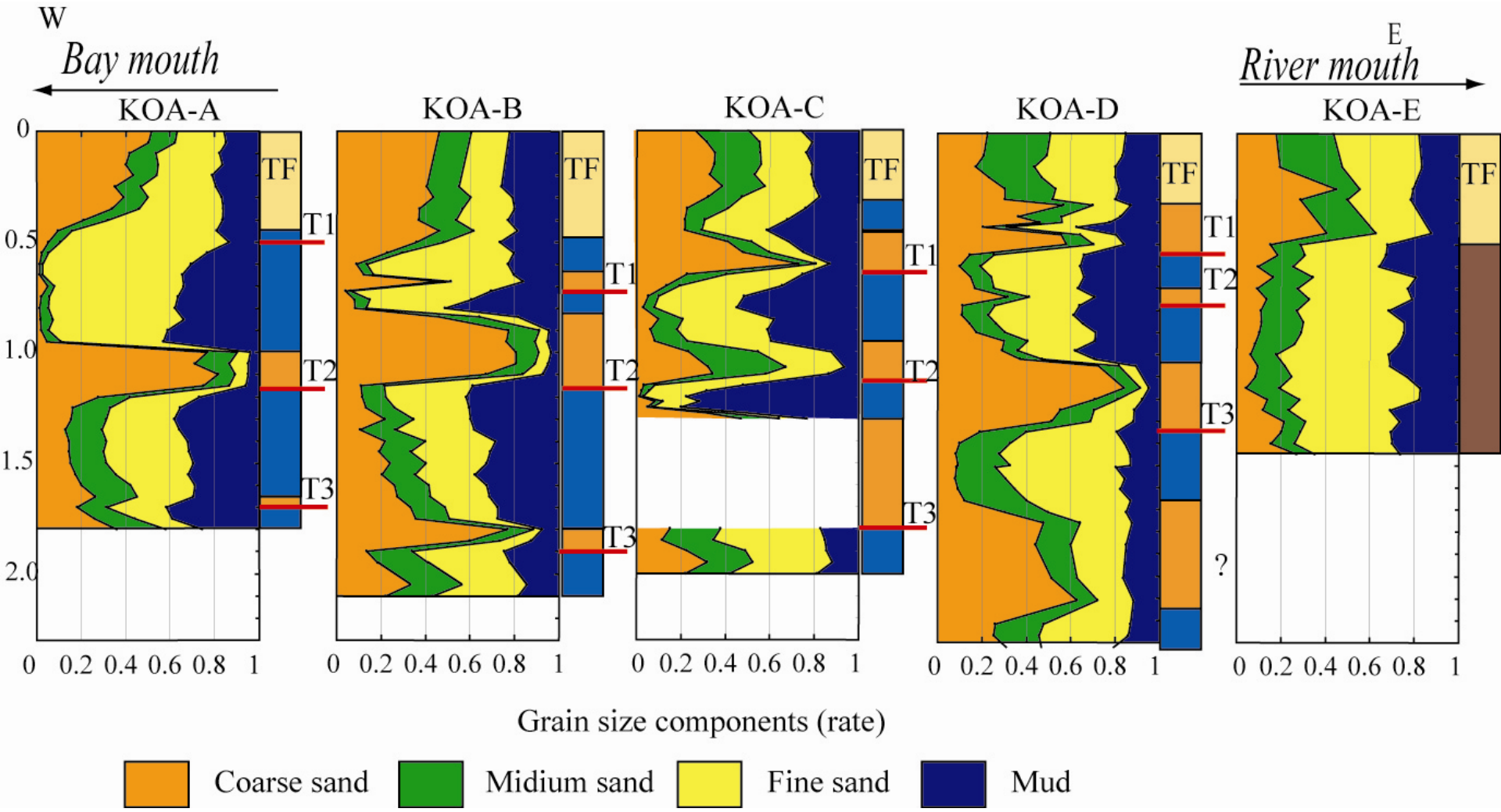
Tsunami Deposits

T1
1923 Kanto Eq.

T2
1703 Kanto Eq.

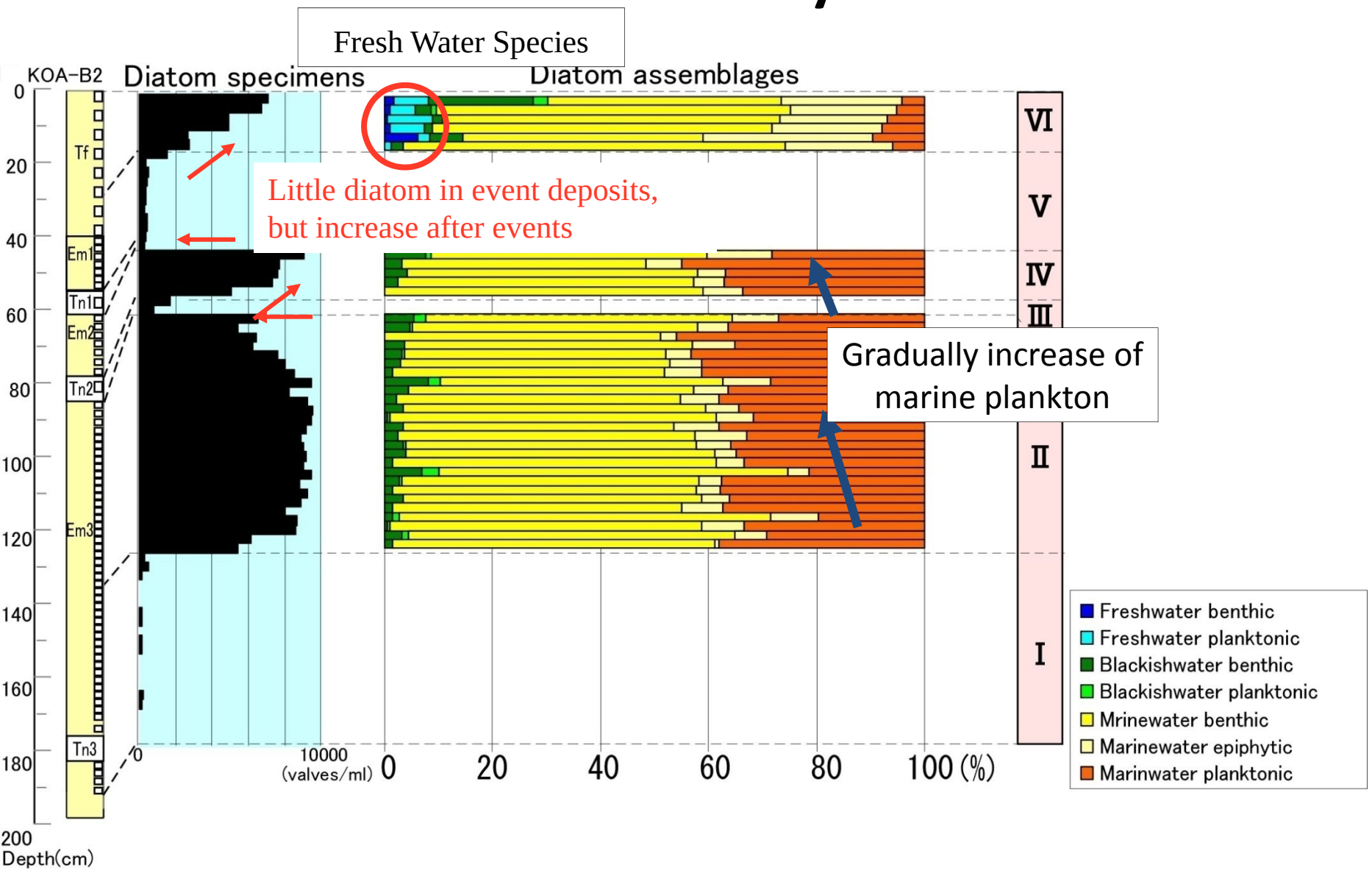
T3
older Eq.

Grain Size Analysis



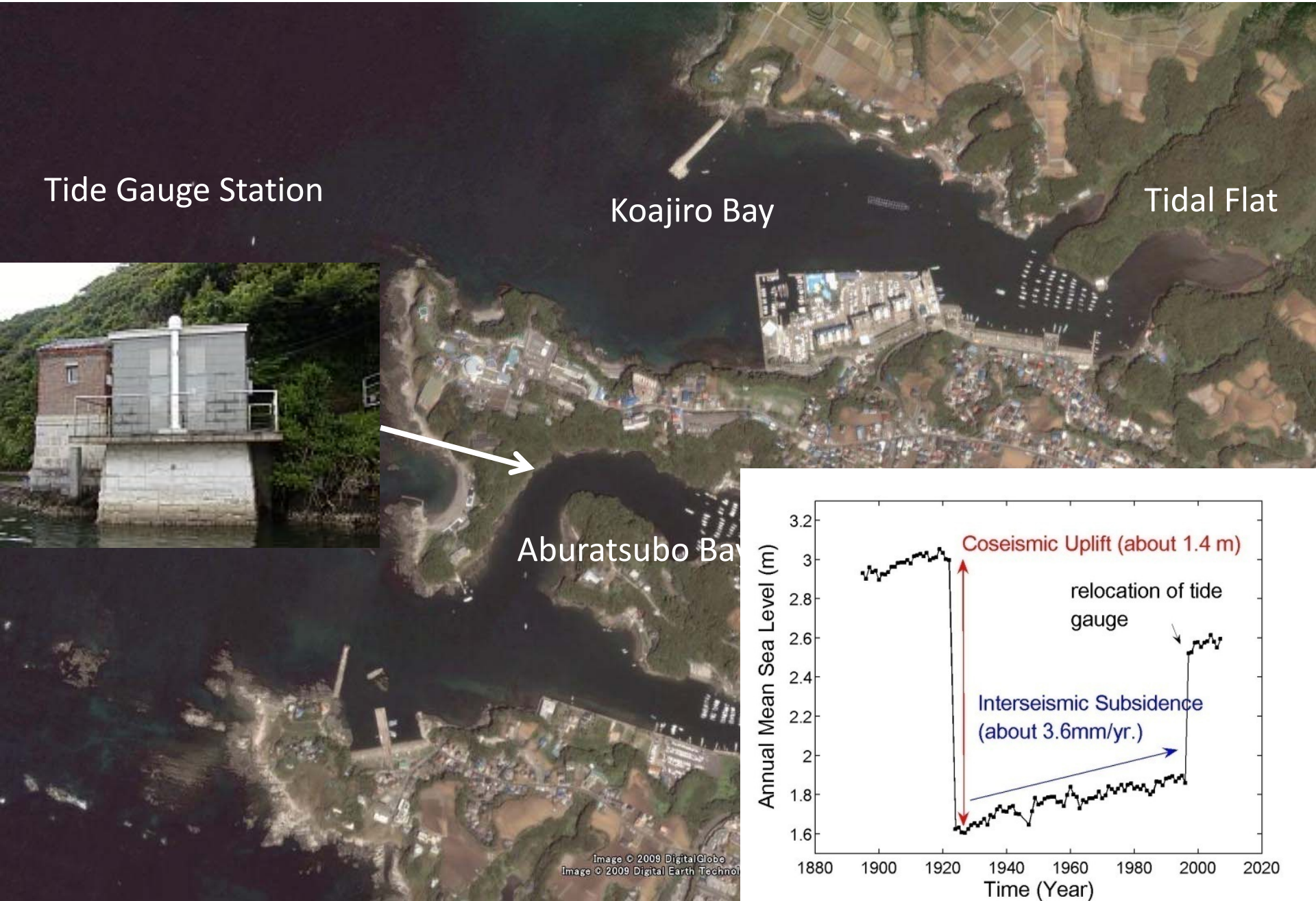
- Event Units composed of the coarse materials.

Diatom analysis

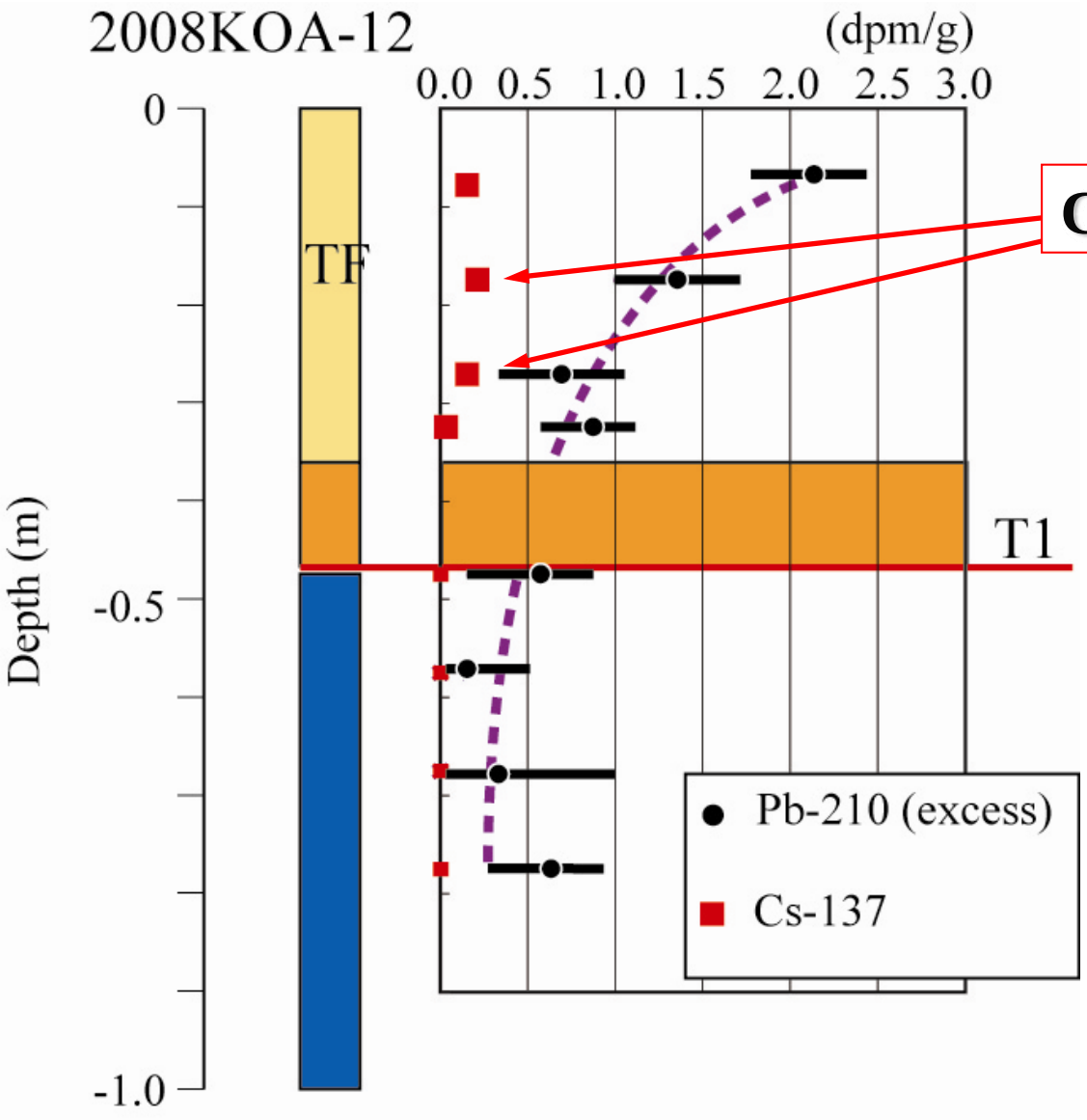


Gradual (interseismic) subsidence and Sudden (coseismic) uplift

Study Site: Koaijiro Bay



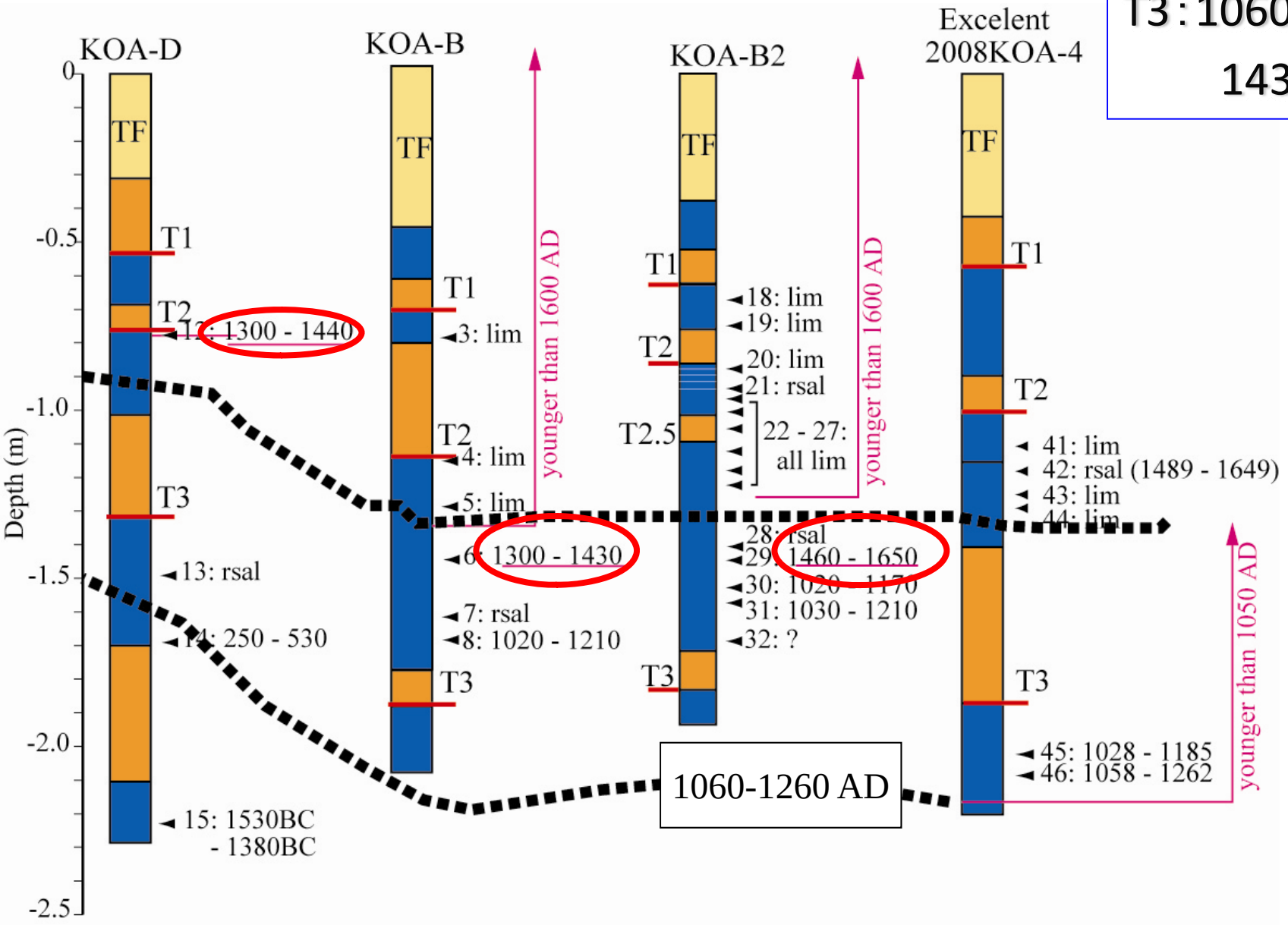
Dating of most recent event (Cs, Pb)



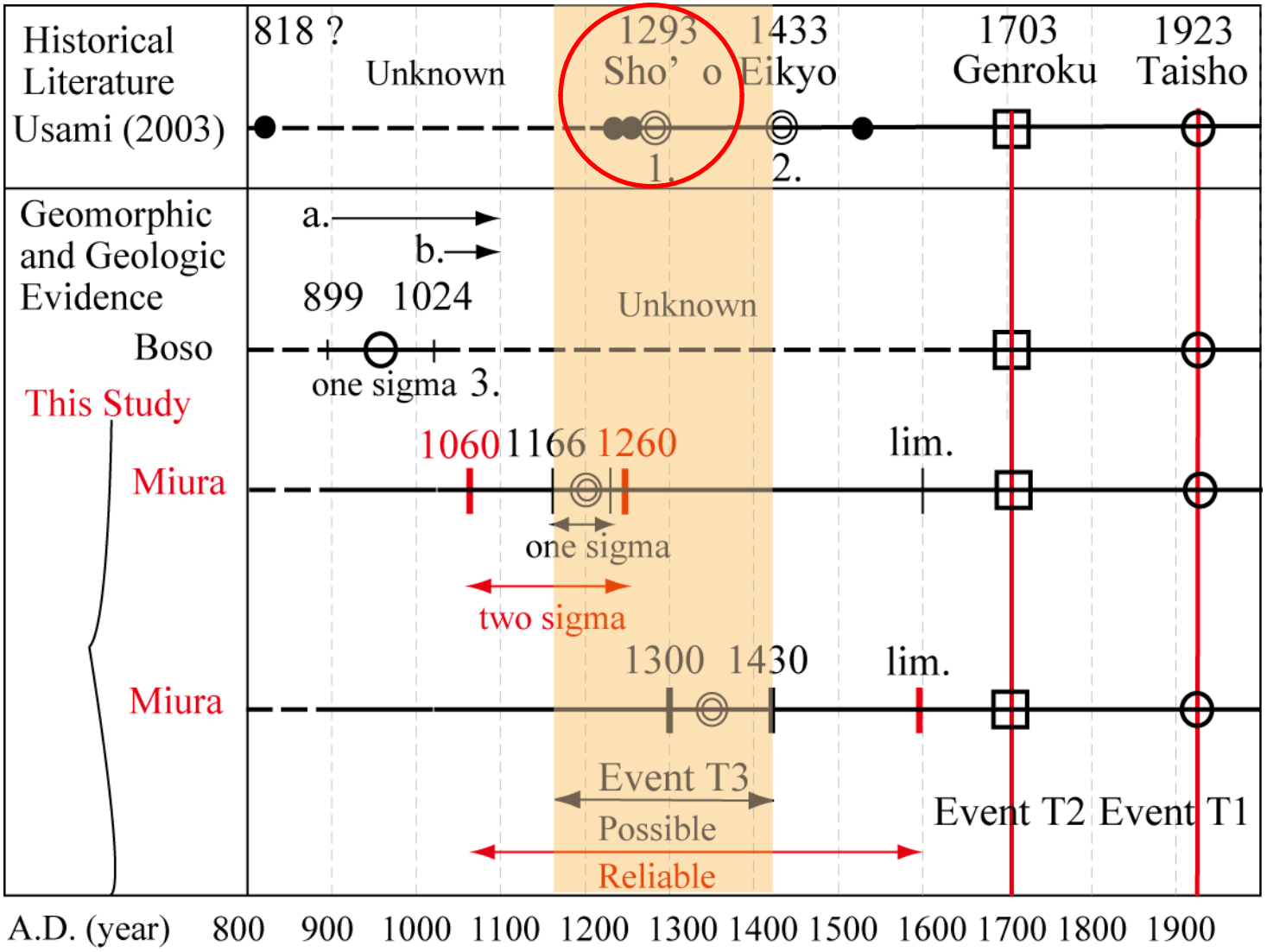
Cs-137 and Pb-210 indicate that T1 sand layer is brought by the 1923 Kanto earthquake

Radiocarbon Dating

T1 : 1600AD～
T2 : 1600AD～
T3 : 1060AD～
1430AD



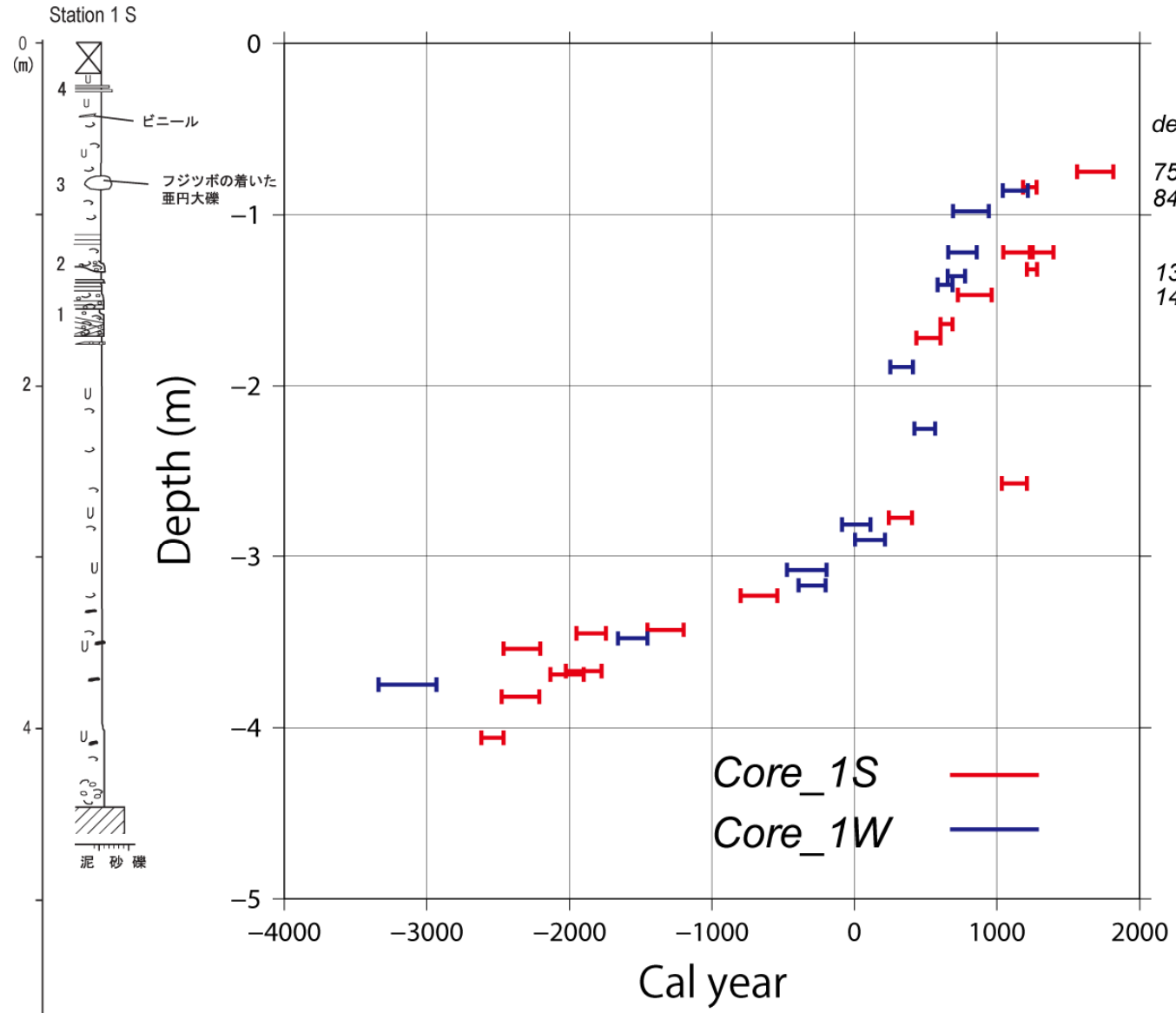
Older earthquake



T3 may correlate with 1293 Sho'o earthquake

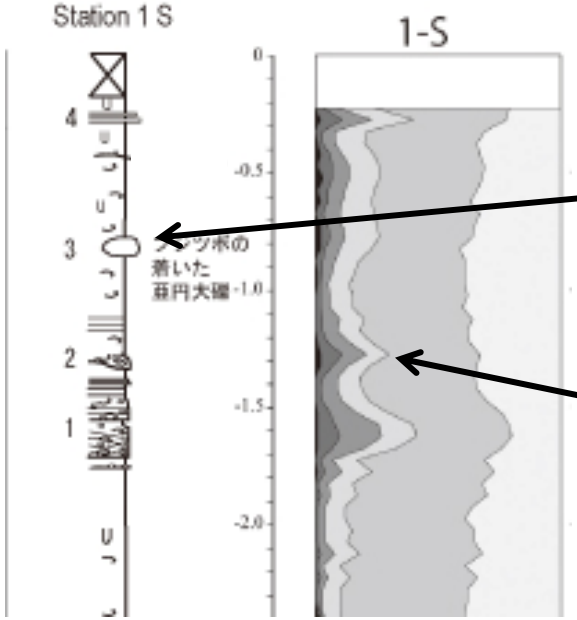
Long Geoslicer Survey

Long Geoslicer Survey



depth	sample	2σ range
75-80	acorn barnacle	(1561-1816AD)
84	wood	(1171-1275AD)
132	wood	(1210-1279AD)
147	wood	(724-961AD)

Long Geoslicer Survey



Balanus 710+-30yBP (1560-1820 AD)

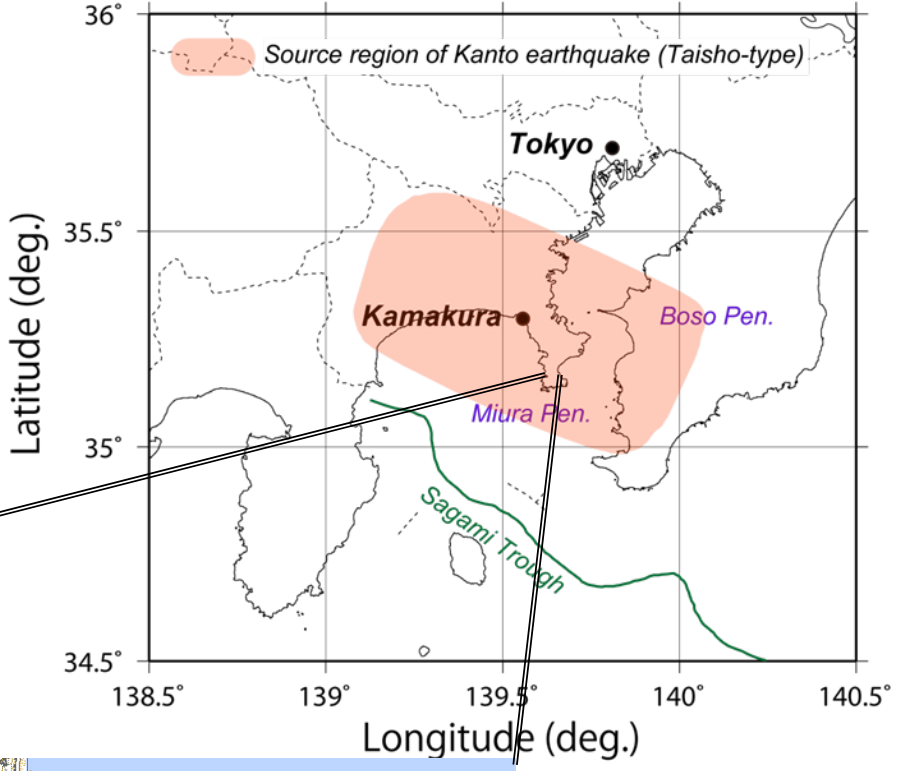
~ 1703 (Genroku) Kanto Eq.

Shell in sand layer

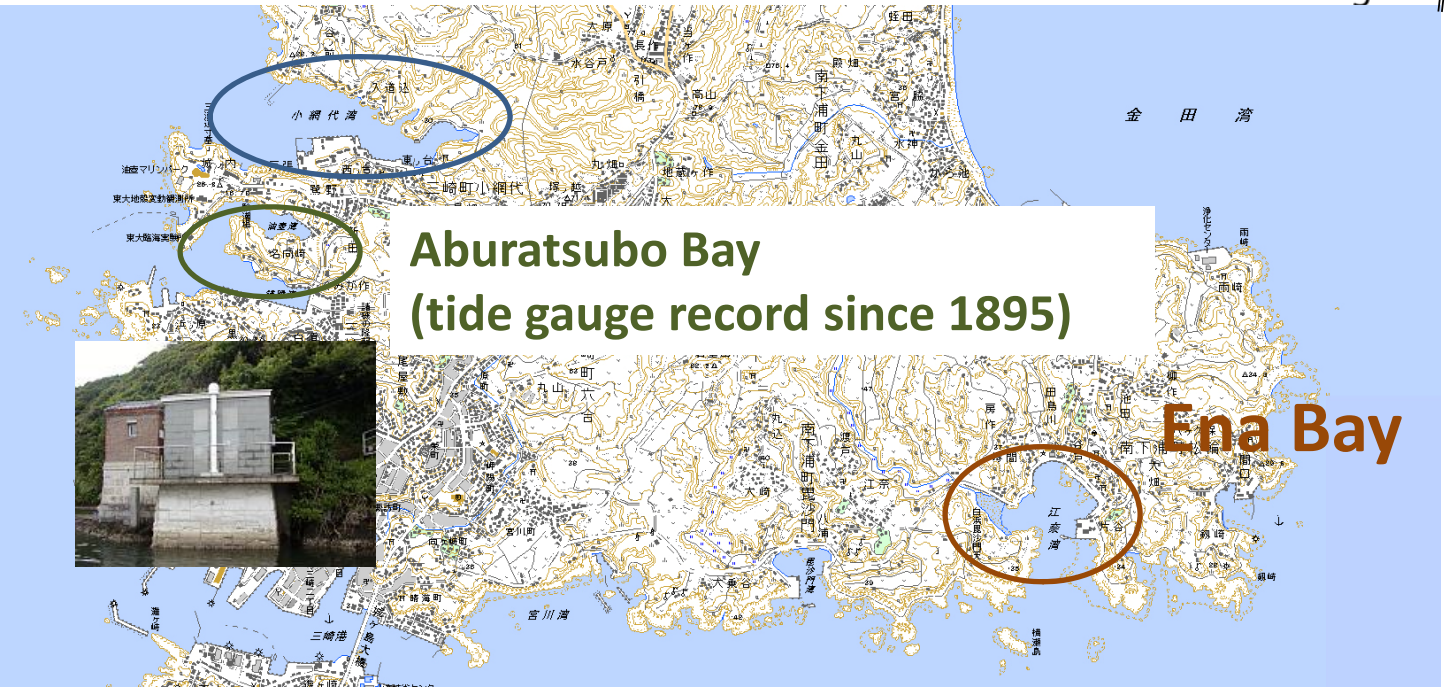
1230-1400AD（Marine Reservoir correction applied）

~ 1293 Kanto Eq.

Miura Peninsula



Koajiro Bay

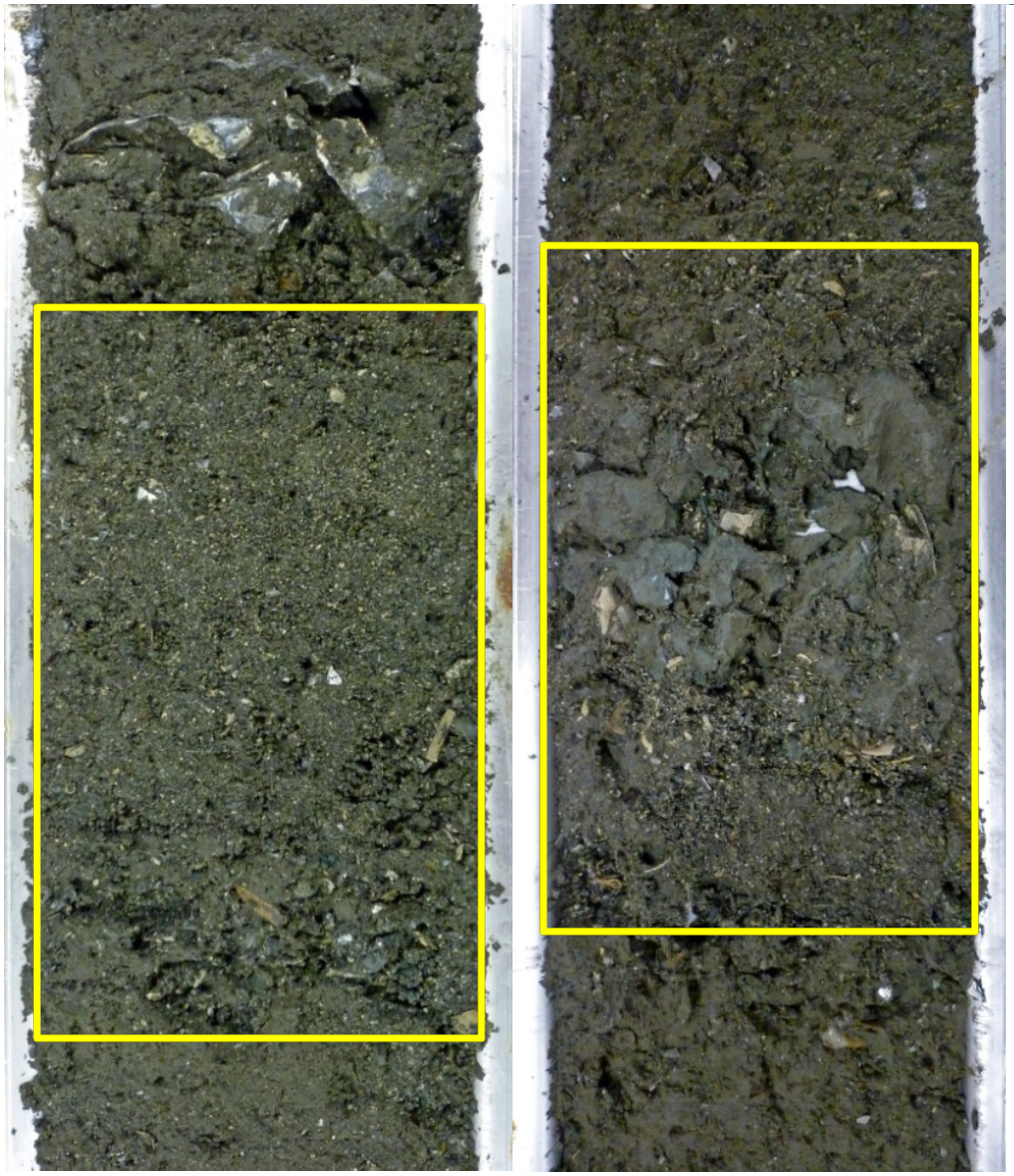


Aburatsubo Bay
(tide gauge record since 1895)

Ena Bay

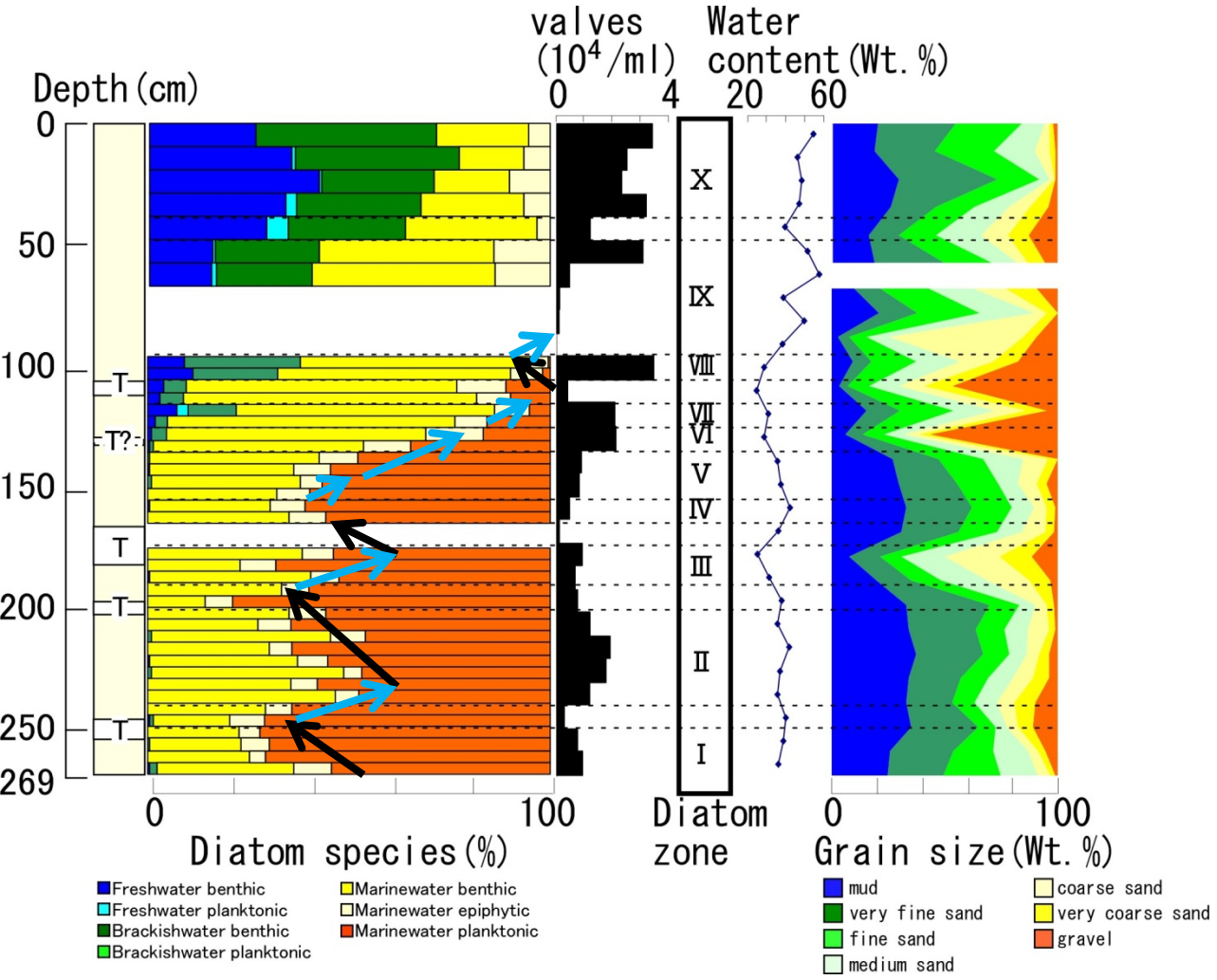
Geoslicer survey in Ena Bay

Characteristics of Tsunami deposits in Ena Bay

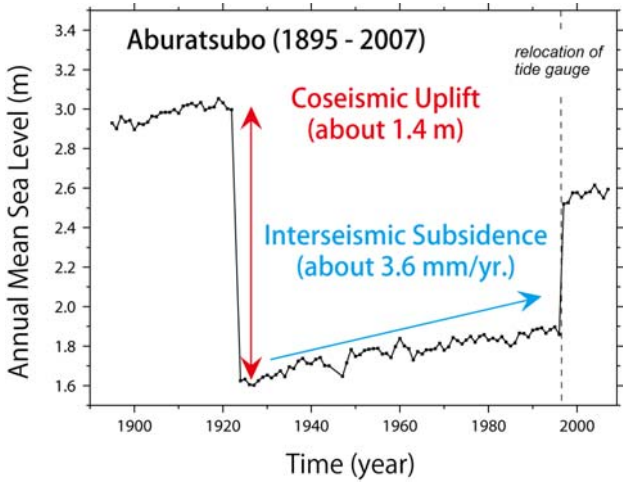


- Three or four coarse layers including shell fragments, gravels, and coarse sand were identified in the inner bay fine sediments.
- These tsunami deposits erode layers below, indicating a strong current.
- Sedimentation environment clearly changes between below and above the tsunami deposits.

Diatom and grain size analyses



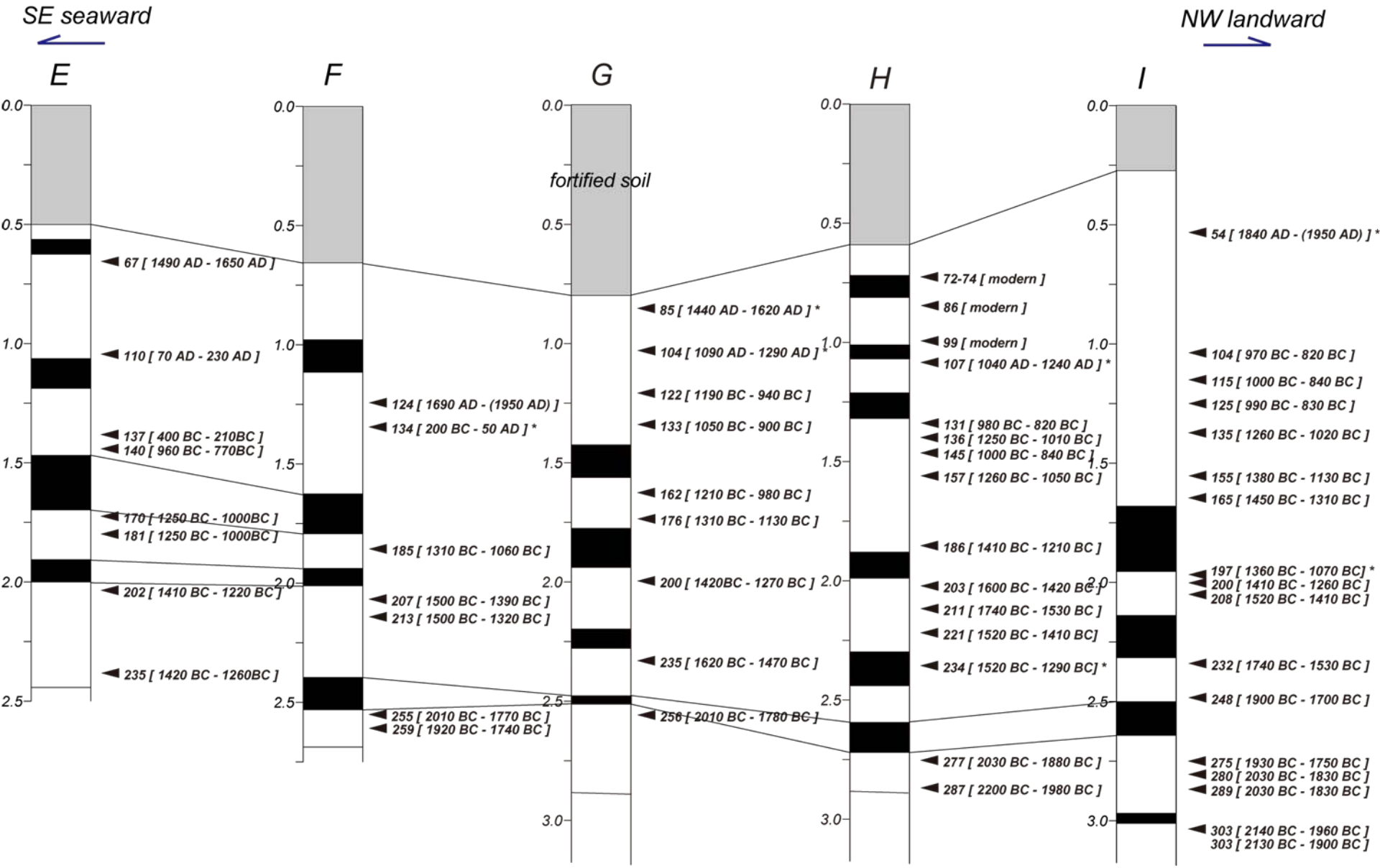
Tide gauge record at Aburatsubo



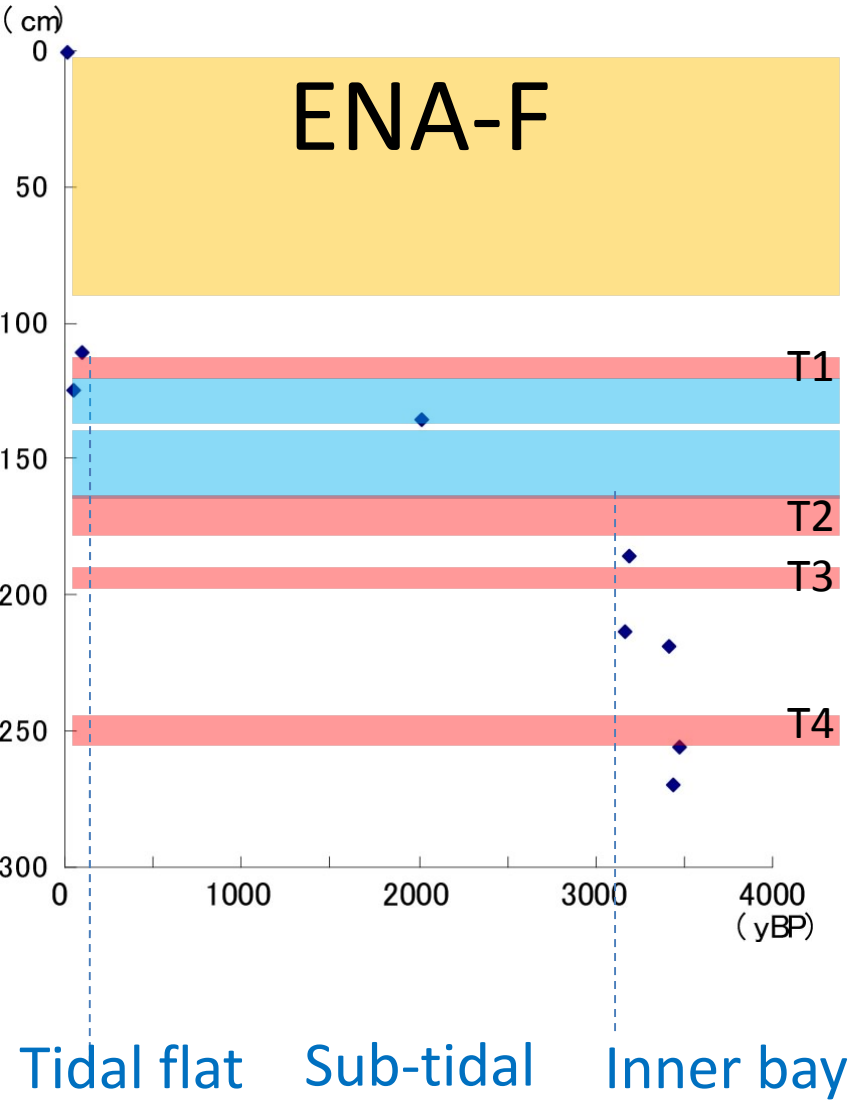
Planktonic > Benthic diatom : interseismic subsidence

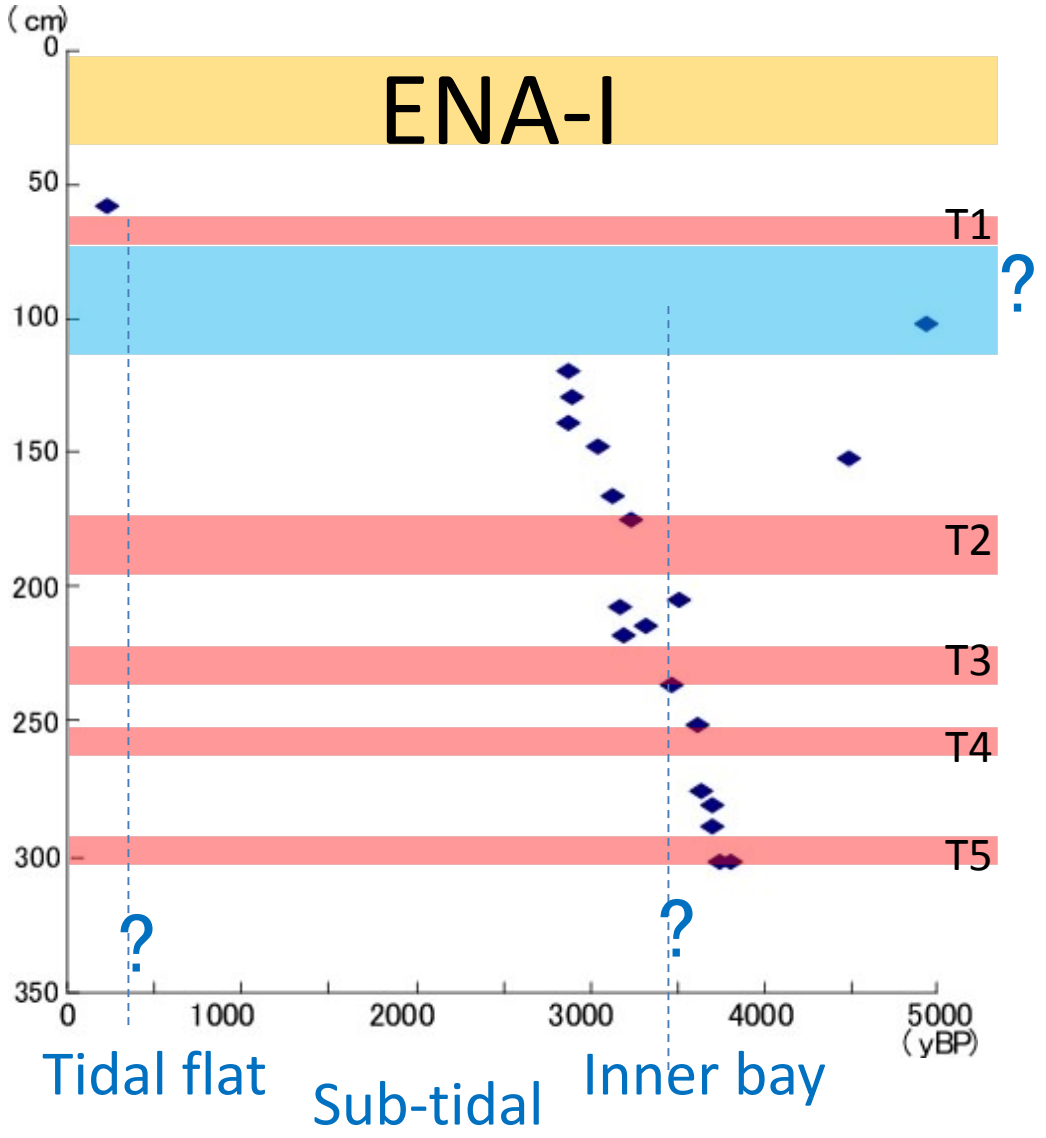
Planktonic < Benthic diatom : coseismic uplift

Radiocarbon Dating

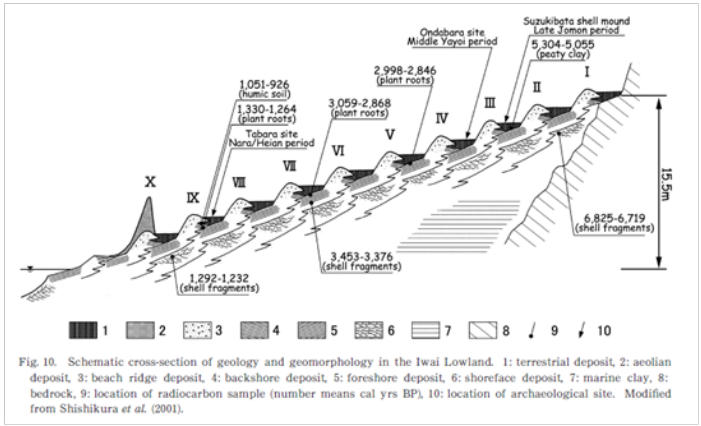


Radiocarbon Dating and Sedimentation Rate





Comparison with Geomorphological study



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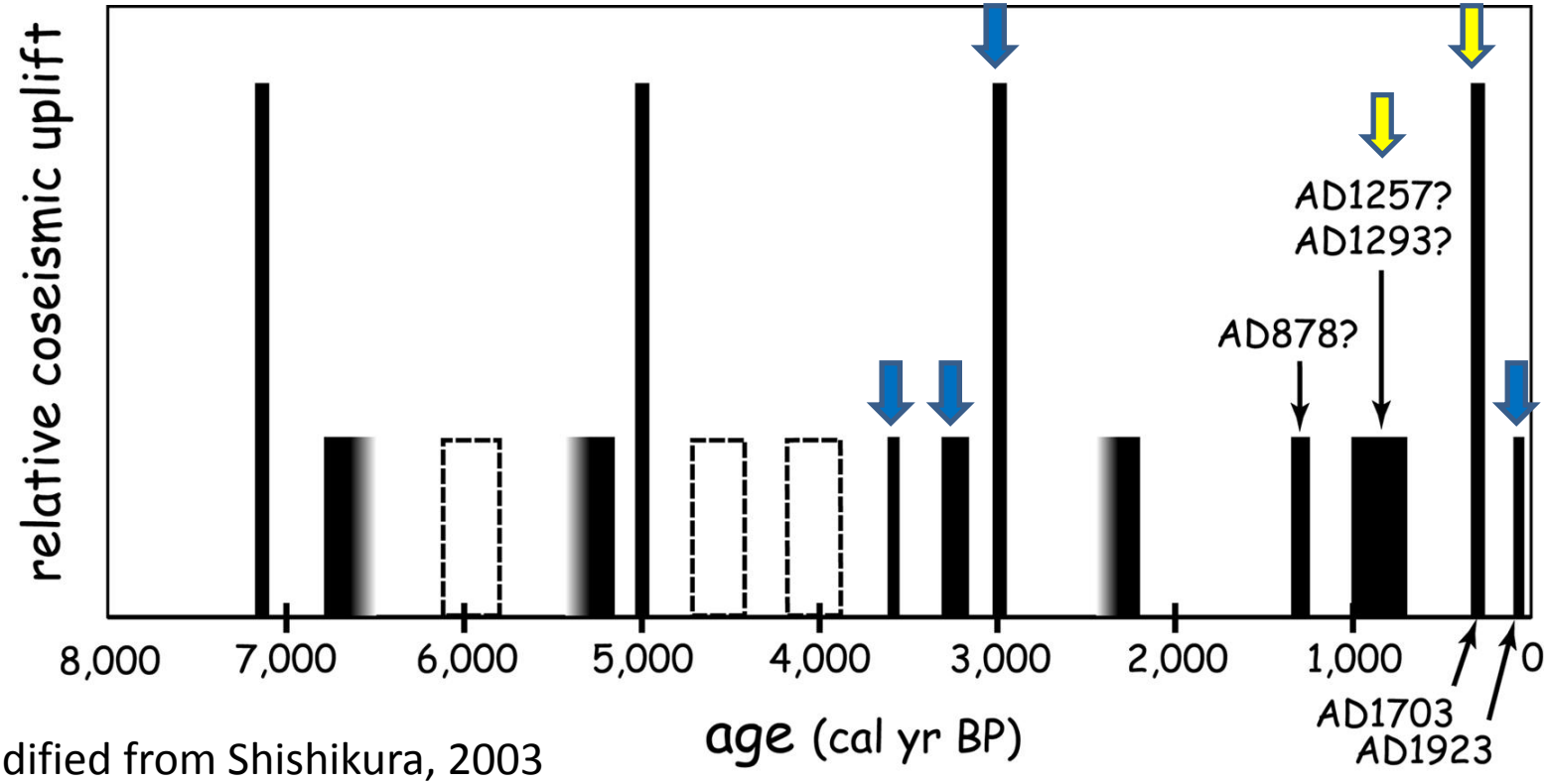

modified from Shishikura, 2003

Summary

- Three or four tsunami deposits are obtained in the inner bay fine sediment.
- In Koajiro Bay, the top and second tsunami deposits are correlated to the 1923 and 1703 Kanto earthquake. The third one may be 1293 earthquake recorded in historical literature.
- In Ena Bay, the topmost deposit is the 1923 Kanto earthquake. The second through fourth unit deposited about 3000, 3300 and 3700 year BP, respectively.
- In addition to tsunami deposits, diatom analysis provide coseismic and interseismic sea level changes.