INTER- AND INTRA-SITE VARIABILITY OF COSEISMIC SUBSIDENCE ESTIMATES FROM NORTHERN HUMBOLDT BAY, CALIFORNIA

(taken by G. Todoroff)

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Motivation

(taken by A. Nelson 2015)
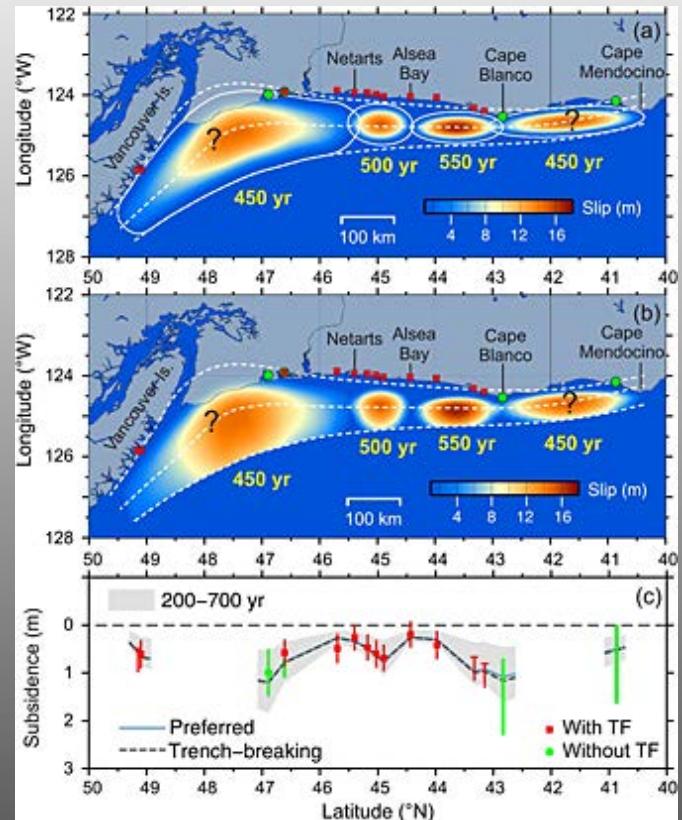
(Wang et. al., 2013)

Motivation

(taken by A. Nelson 2015)
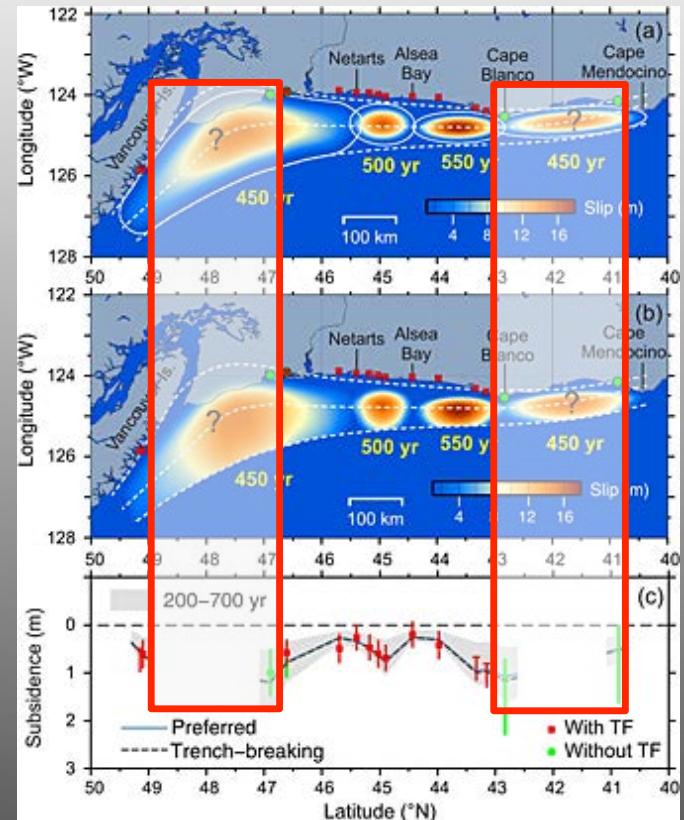
(Wang et. al., 2013)

Research Approach
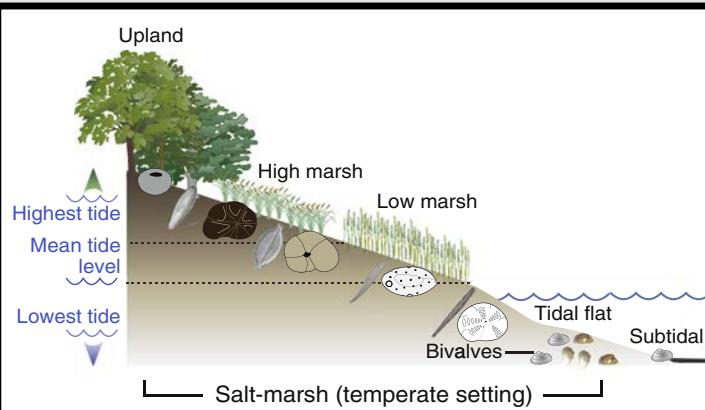
Pilarczyk et al., 2014
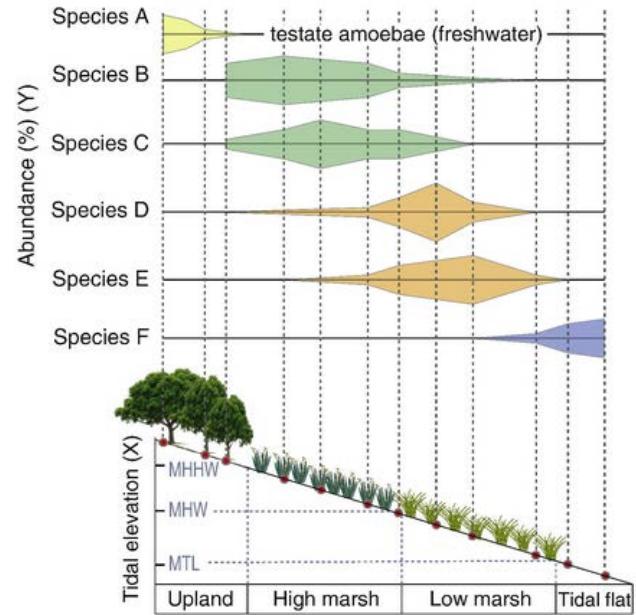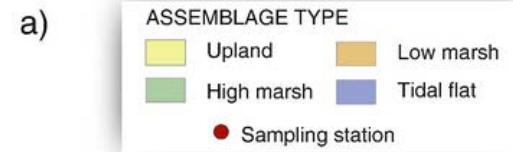
Northern Humboldt Bay Research

Previous investigations: Vick, 1988; Clarke and Carver, 1992: Pritchard, 2004; & Valentine et al., 2012
- How many large EQ's over the past 2000yrs?

1. **Refine the paleoseismic chronology**

   - 21 new AMS ^{14}C dates and Bayesian age models

2. **Assess spatial variability**

   - South Slough, Oregon <45m (Milker et al., 2016)

   Validated transfer function
   - Transplant experiment (Engelhart et al., 2013)
   - Bandon Marsh (poster session tomorrow, Milker et. al., 2017)

Location Maps

A. Cascadia margin
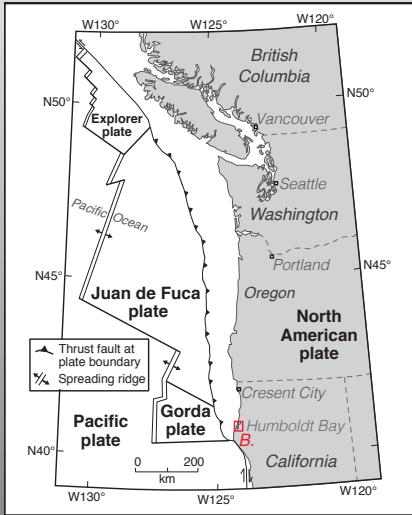

B. Humboldt Bay
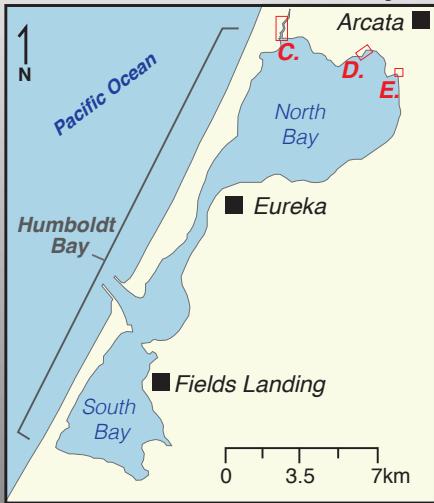
C. Mad River
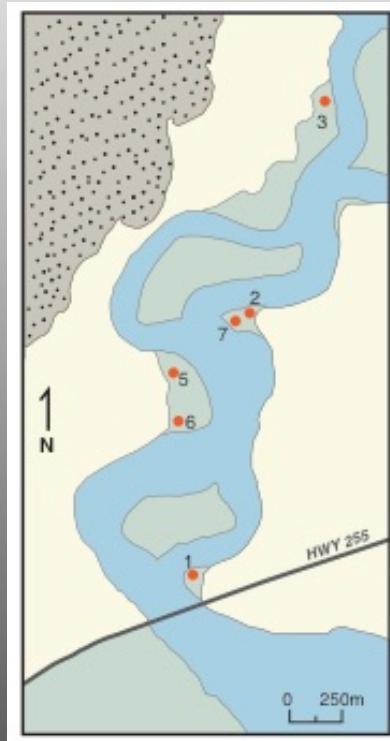
D. McDaniel Creek
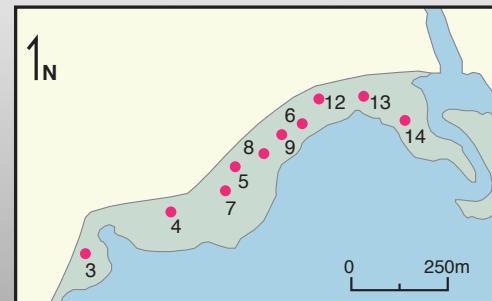
E. Jacoby Creek
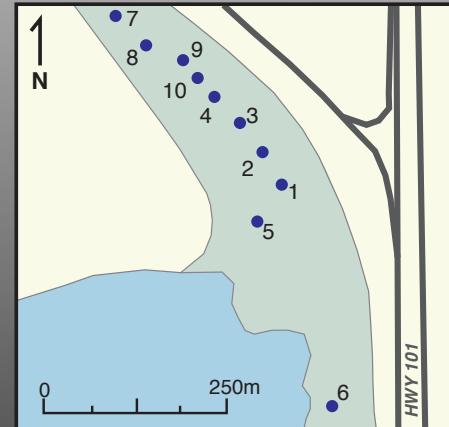
Mad River Stratigraphy
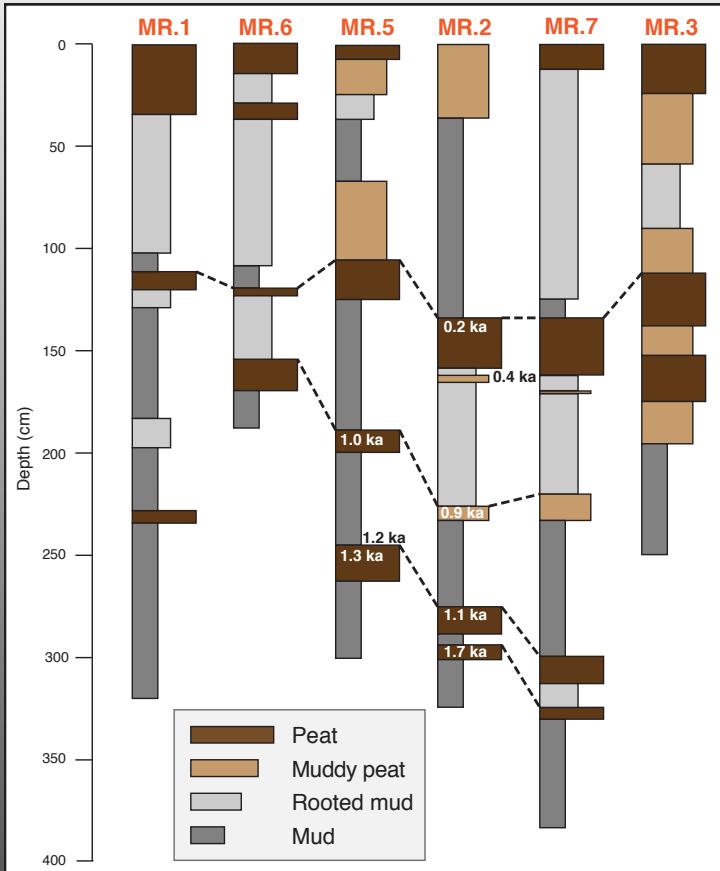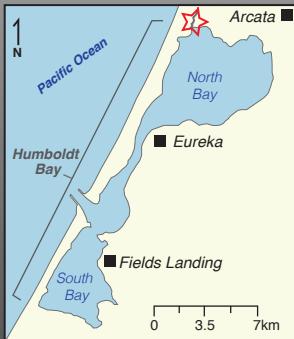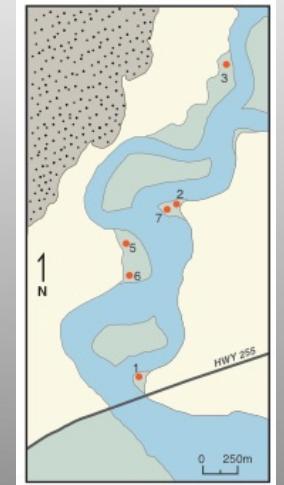
- Four peat-to-mud sequences

- Tight max. & min. AMS ^{14}C dates for contact 3

- Limited extent of subsidence contact 4

- Relatively complicated stratigraphy

McDaniel Creek Stratigraphy
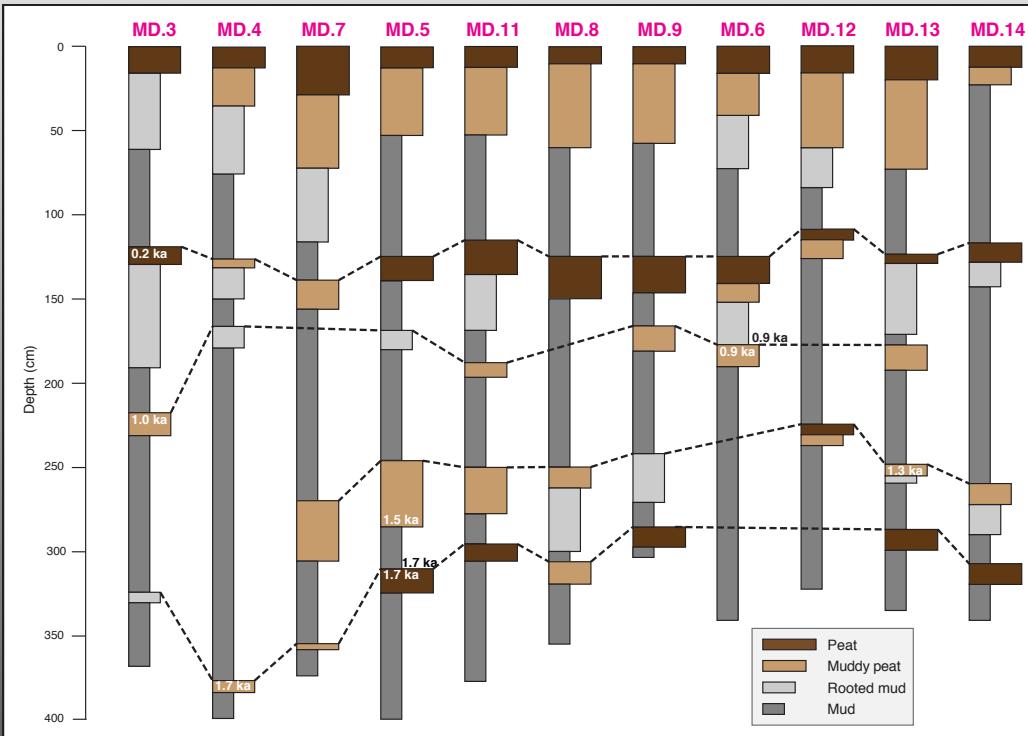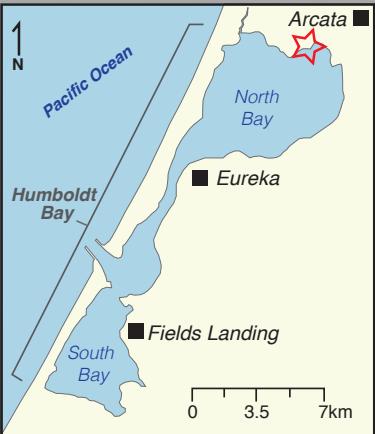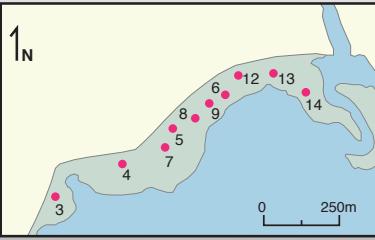
- Four subsidence contacts

- Soils for contacts 2&3 have weak expressions

- Tight min. & max AMS ^{14}C dates for contacts 2&4

Jacoby Creek Stratigraphy
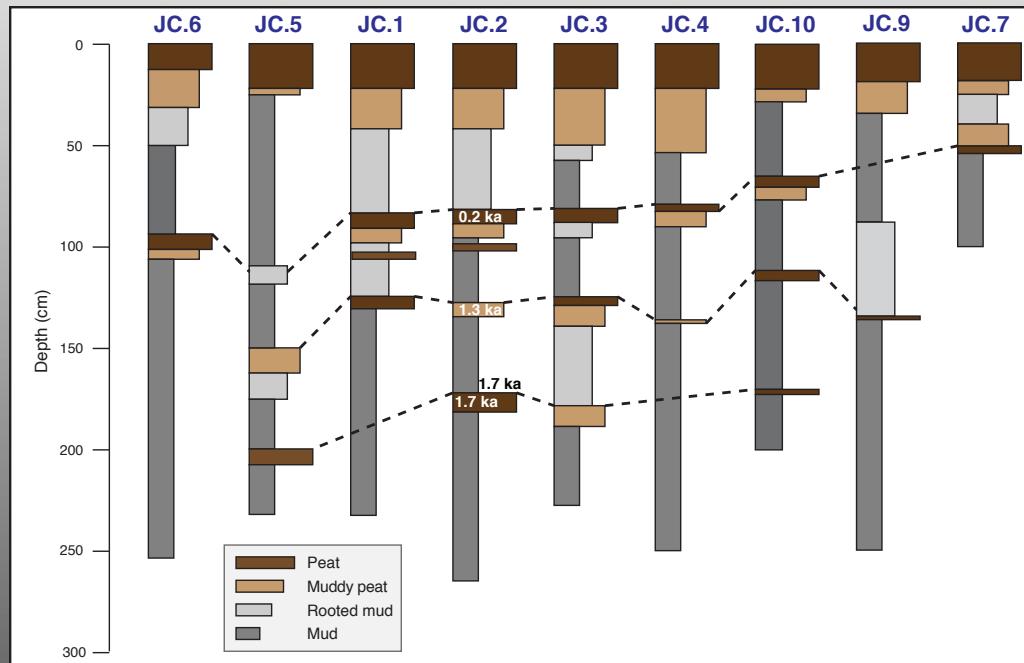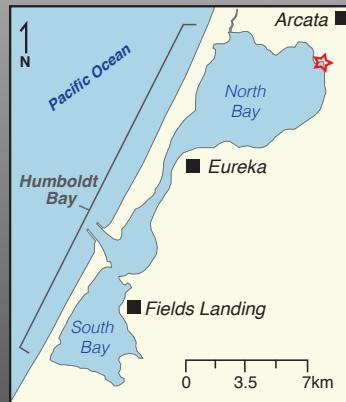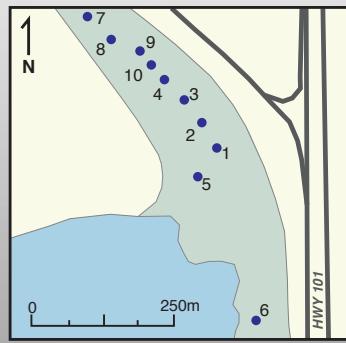
- Three subsidence contacts

- No contact 2

- Relatively smaller site location

- Tight max. & min. dates for contact 4

Paleoseismic Chronology

Bayesian Age Models:

- Oxcal phase
  - uses sample relative positions

- Bchron
 - uses sample actual depth and models a sedimentation rate
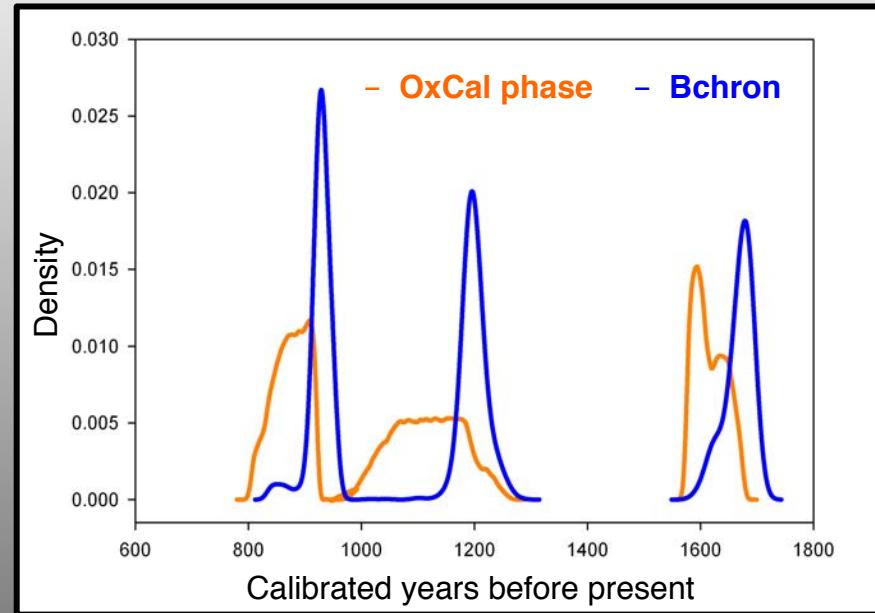
EQ 1

250 yr BP

EQ 2

870 +/- 56yr BP

EQ 3

1125 +/- 82yr BP

EQ 4

1600 +/- 51 yr BP

Synchronicity

- Each location has evidence for the CSZ AD 1700 earthquake

- Tighter age control on the northern Humboldt Bay subsidence contacts

- Timing corresponds with **single** turbidite chronologies

(format after Milker et. al., 2016)
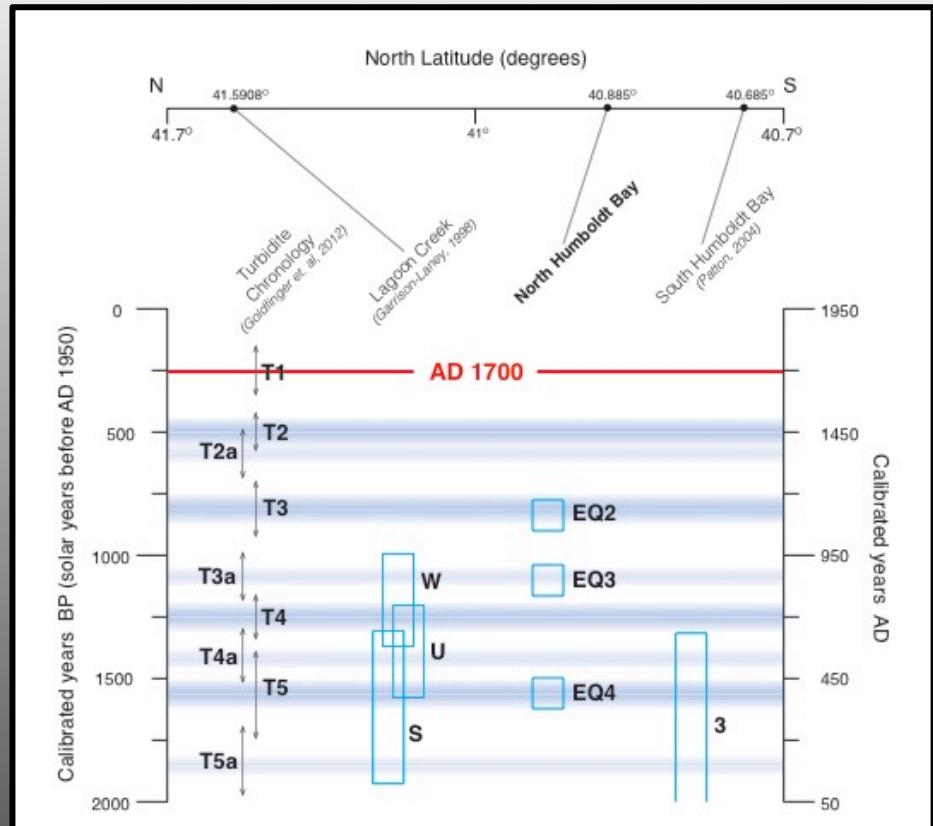
Lanphere Dunes

EQ1 Subsidence McDaniel Creek
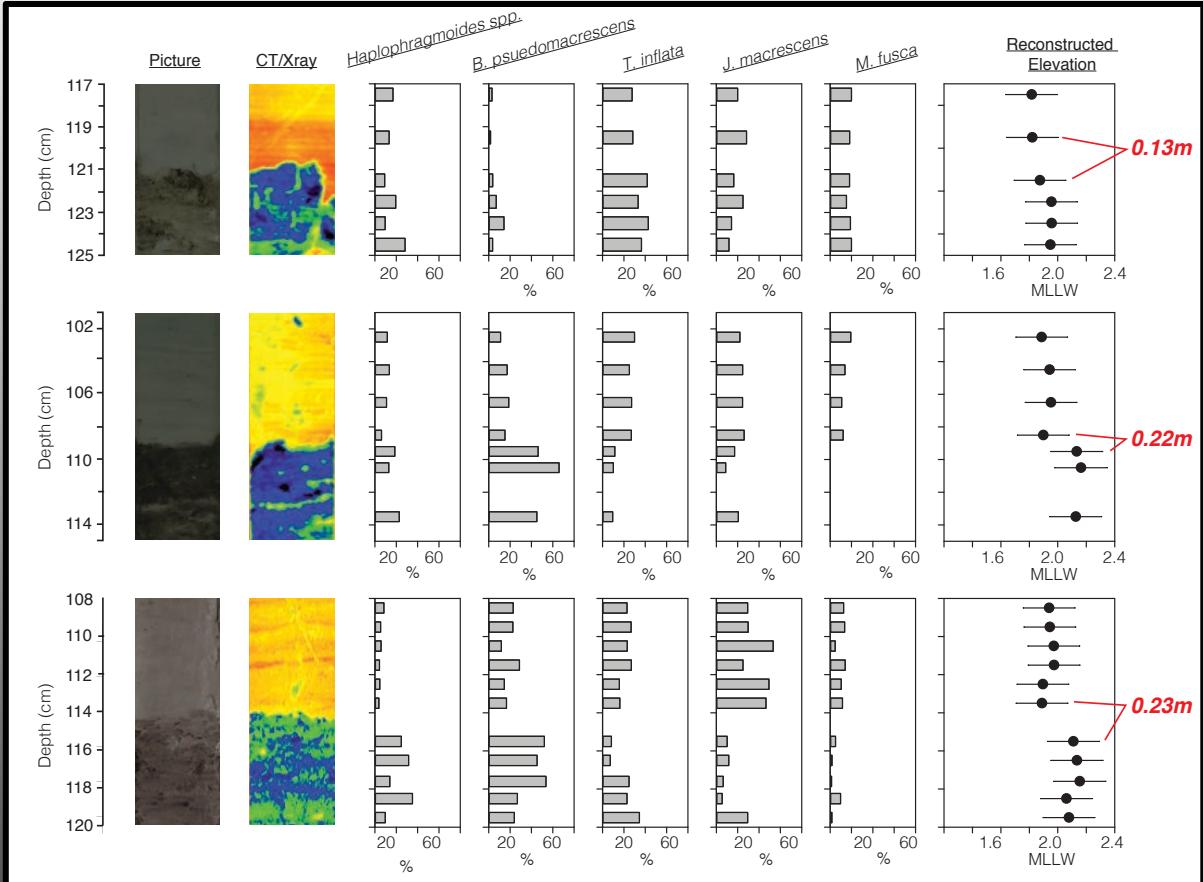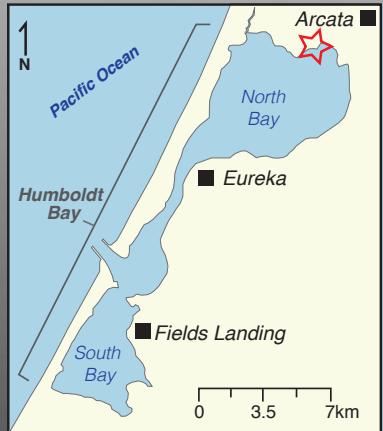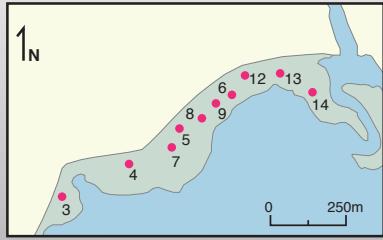
EQ1 Subsidence Mad River
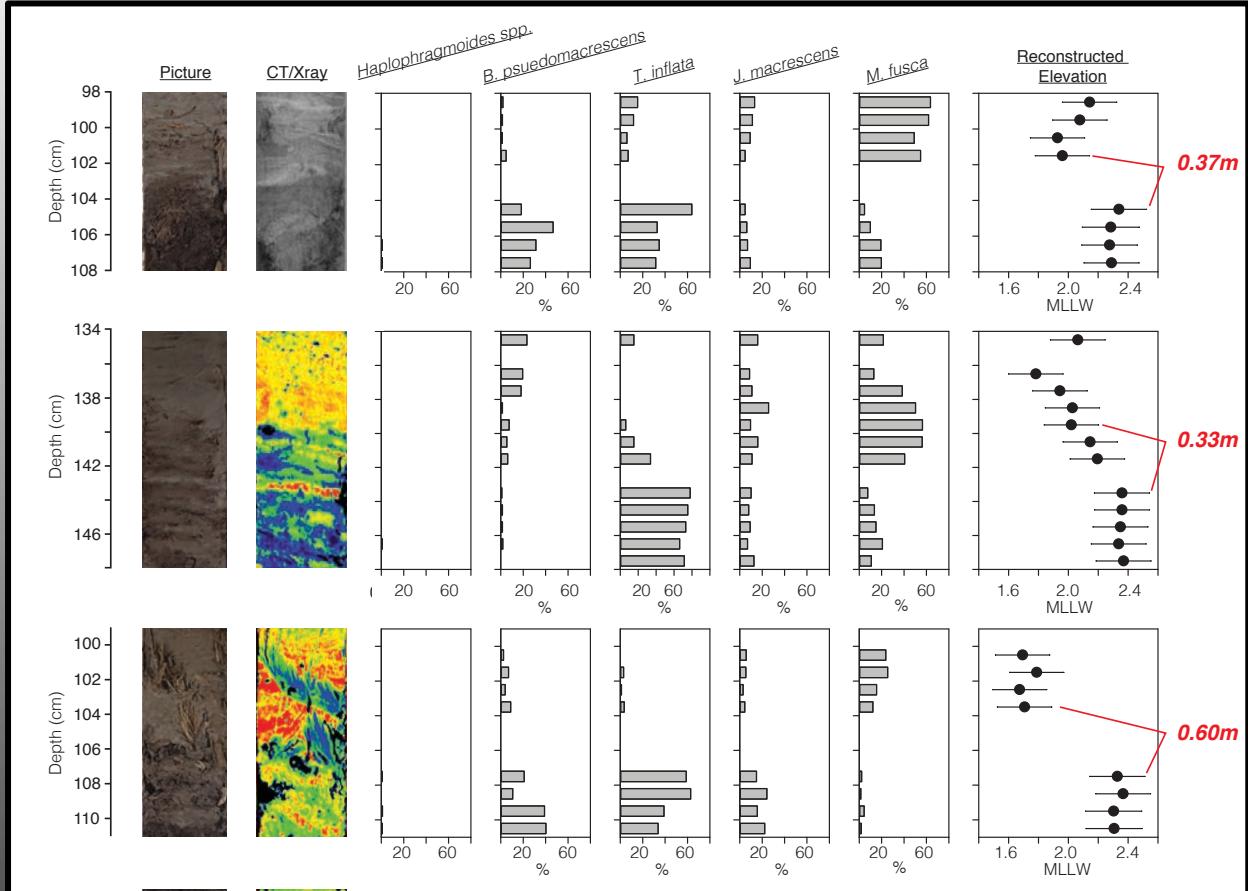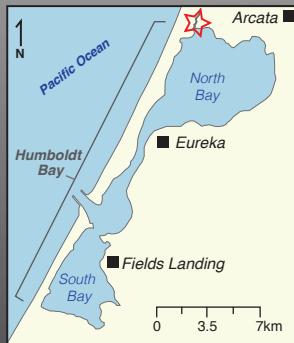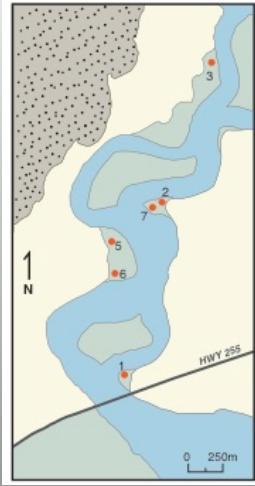
EQ4 Subsidence McDaniel Creek

Subsidence Estimates

EQ 1

250 yr BP

0.29 +/- 0.24m
0.48 +/- 0.24m
0.22 +/- 0.24m
0.23 +/- 0.24m
0.13 +/- 0.24m
0.37 +/- 0.24m
0.33 +/- 0.24m
0.62 +/- 0.24m

0.33m Average
0.13 to 0.62

EQ 2

870 yr BP

0.38 +/- 0.24m
0.30 +/- 0.24m
0.50 +/- 0.24m
0.09 +/- 0.24m
0.38 +/- 0.24m

0.33m Average
0.09 to .50

EQ 3

1125 yr BP

0.35 +/- 0.24m
0.30 +/- 0.24m
0.33 +/- 0.24m
0.50 +/- 0.24m
0.40 +/- 0.24m

0.37m Average
0.30 to 0.50

EQ 4

1600 yr BP

≥ 0.39 +/- 0.18m
≥ 0.82 +/- 0.18m
≥ 0.57 +/- 0.18m
≥ 0.48 +/- 0.18m

≥0.64m

Conclusions

Four subsidence events:

250 yr BP	**0.33m +/- 0.24m**
870 yr BP	**0.33m +/- 0.24m**
1125 yr BP	**0.37m +/- 0.24m**
1600 yr BP	**≥0.64m**

Inter-site variability:

Min - 0.22 m for the 1125 cal yr BP contact
Max - 0.49 m for the AD 1700 contact.

Intra-site variability:

Min - 0.01 m - AD 1700 contact at McDaniel Creek.
Max - 0.41 m - 870 yr BP contact at Mad River.

Acknowledgements

This research was supported by:
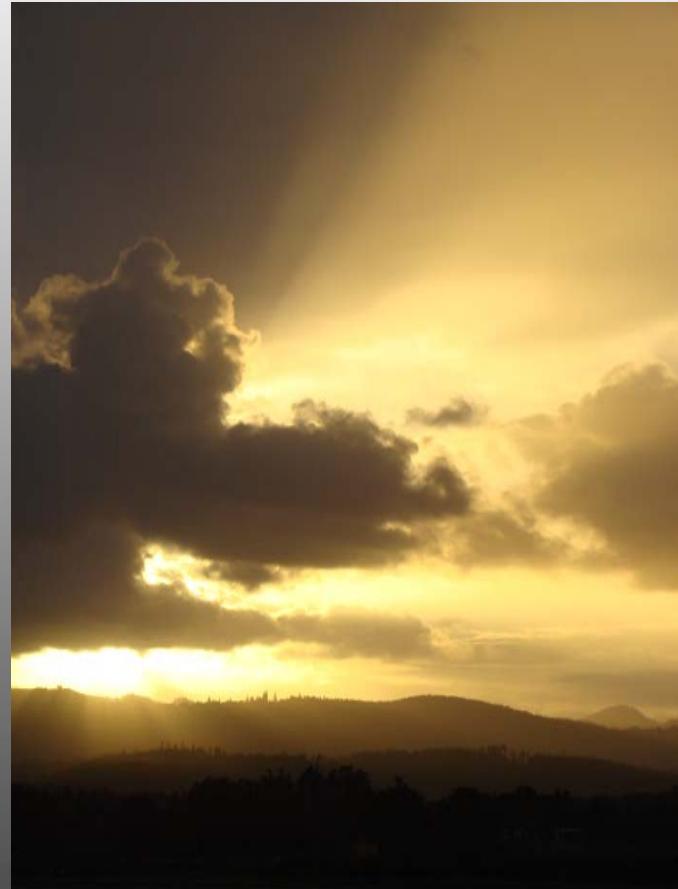
EQ1 Subsidence Jacoby Creek
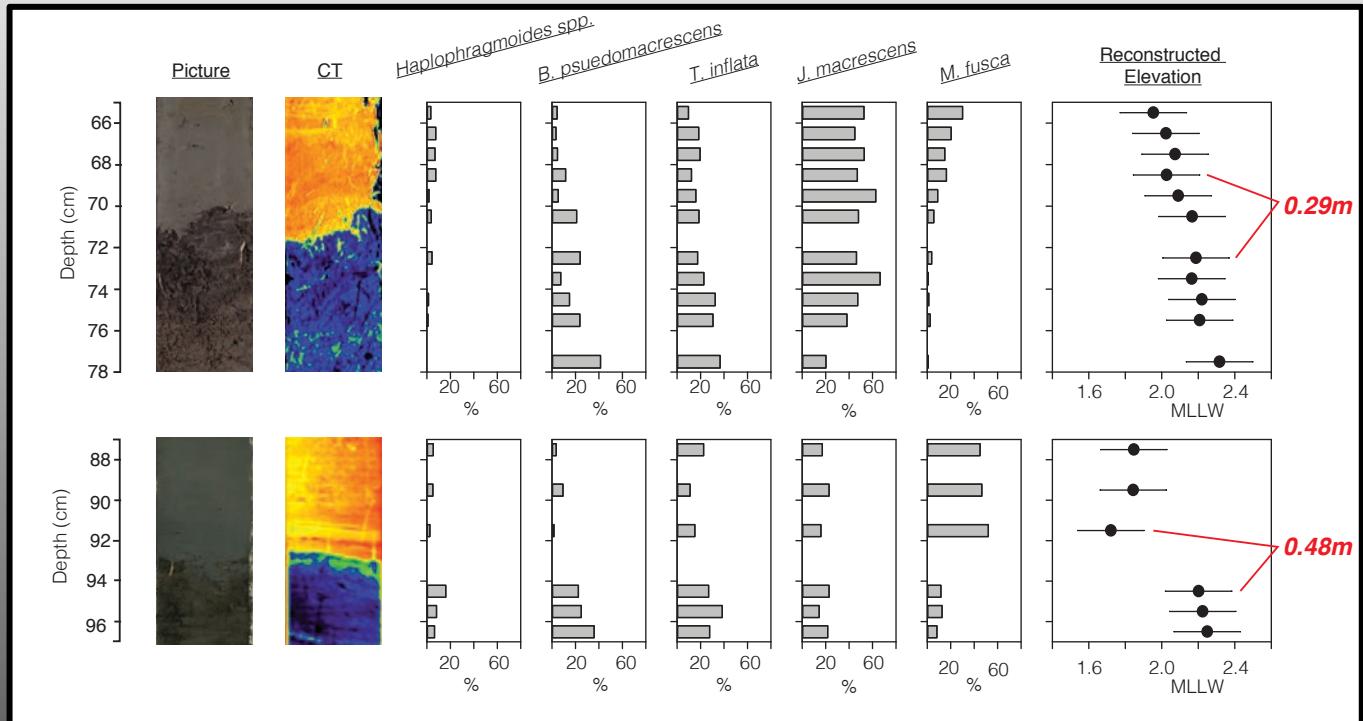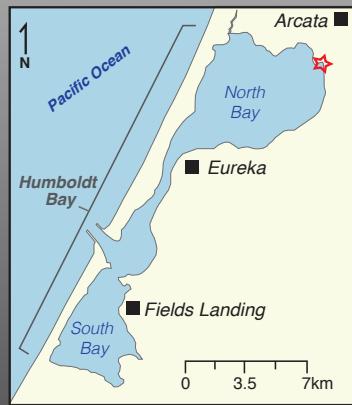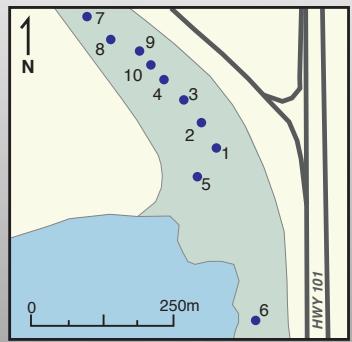
Subsidence Contact Context
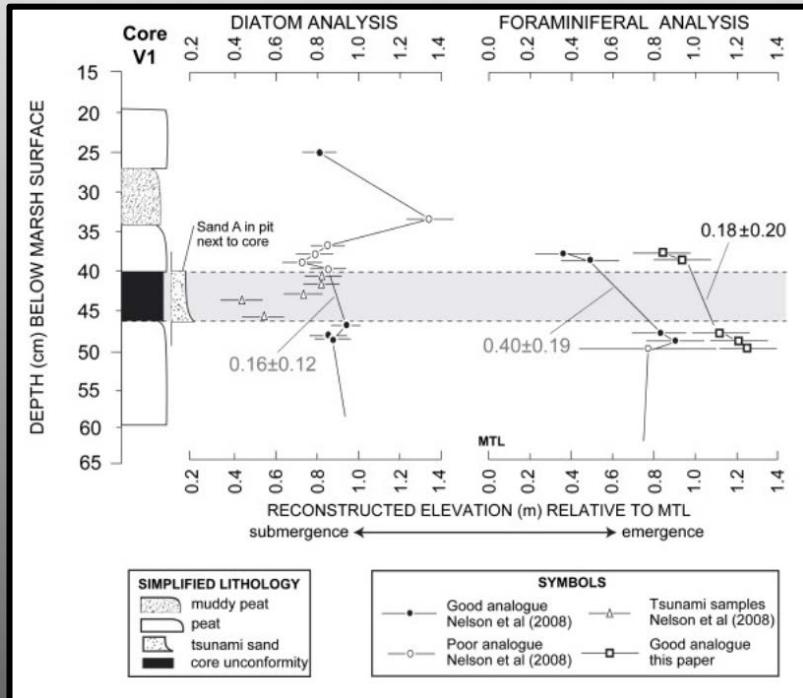
Hawkes et al., 2010

Subsidence Estimate Derivation

- above and below contact
- tsunami deposit
- mixing
- delayed response

Traditionally one estimate has been considered acceptable for an area of interest