

Mapping, dating, and modeling of prehistoric tsunami inundation and frequency at Cascadia

USGS

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(pre-tsunami view looking west from
Craig Weaver's cabin at Long Beach, WA

*Village along the Sumatra
coast following the 2004
tsunami - U.S. Navy photo*



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BIG SCIENCE QUESTIONS THAT NEED ANSWERING

- **How high and far inland have tsunamis from the greatest (>M8.6) Cascadia earthquakes extended, how often have they occurred, and have the frequency of such events changed over time?**
- **What are the characteristics and probabilities of tsunamis accompanying smaller great earthquakes (<M8.6)?**
- **How does local coastal bathymetry, as well as different models of megathrust rupture, affect tsunami inundation at different kinds of sites?**
- **How do locations and characteristics of source earthquakes for prehistoric tsunamis, obtained through inverse simulation modeling, compare with paleogeodetically determined models for the same earthquakes?**



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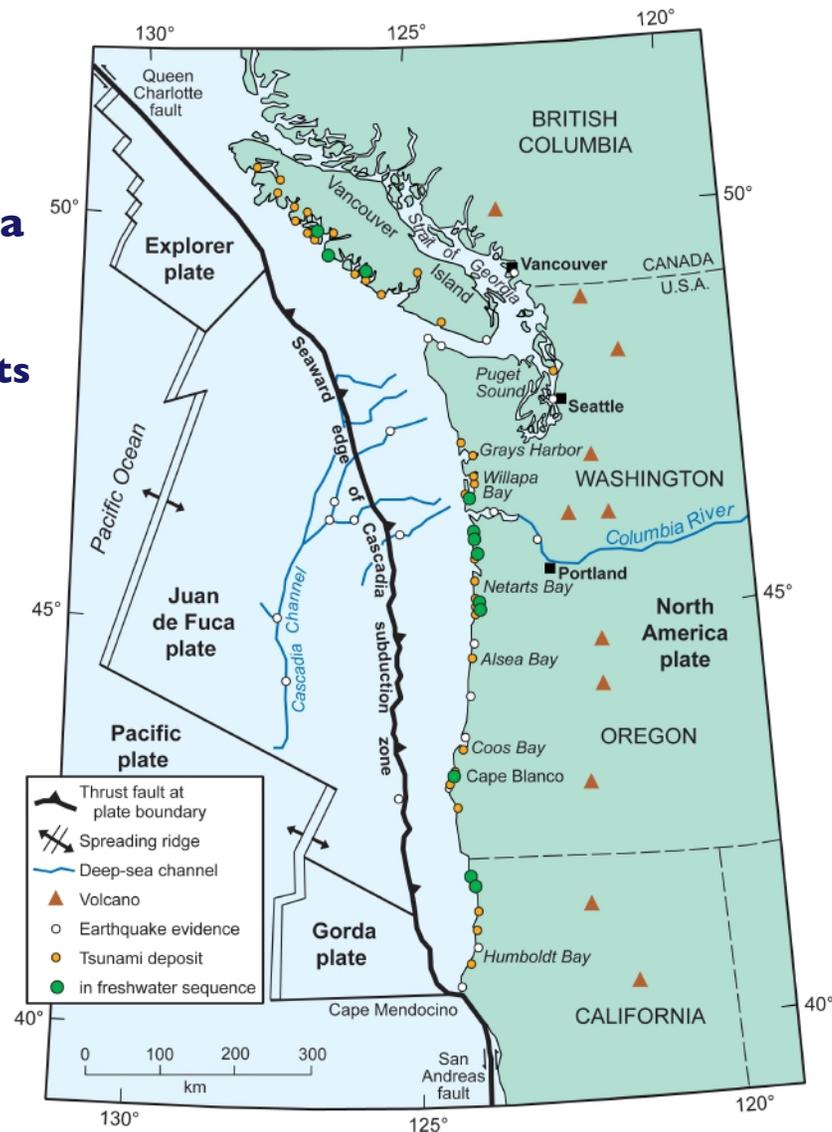
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Mapping

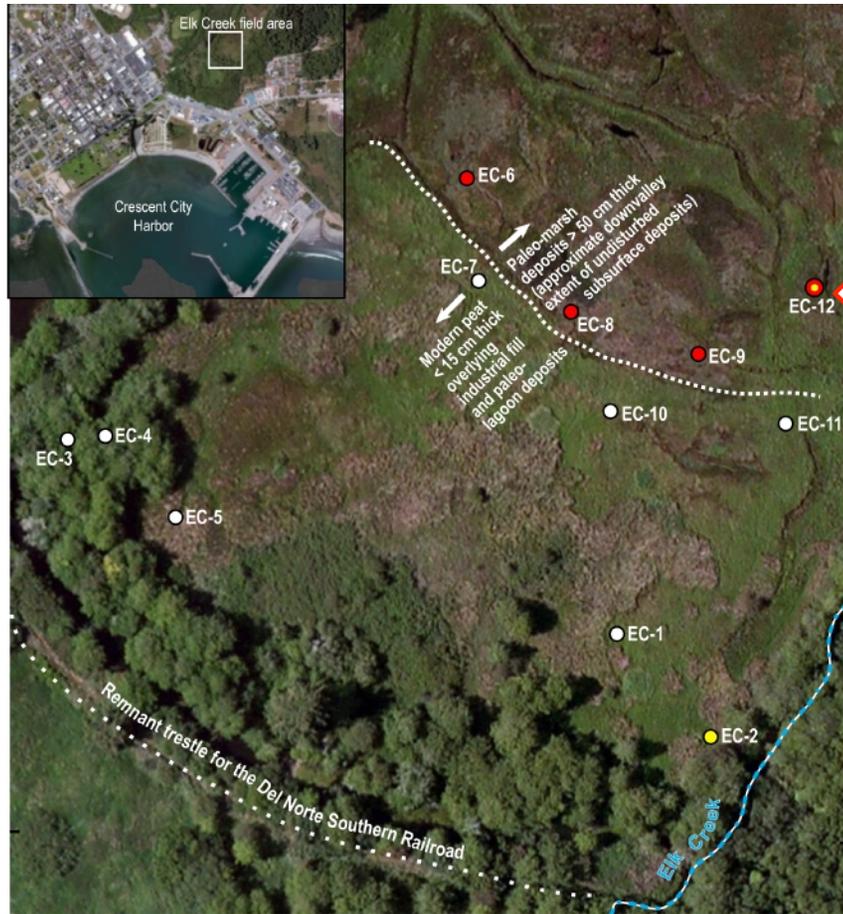
Tsunami deposits in Cascadia freshwater sequences

- better preservation of deposits
- deposits nearer limit of inundation
- host sediment has uniform rates of deposition, which improves age models

(Kelsey et al., 2005; Peterson et al., 2006; 2008; 2009; 2010; 2011; 2013; 2014; 2015)



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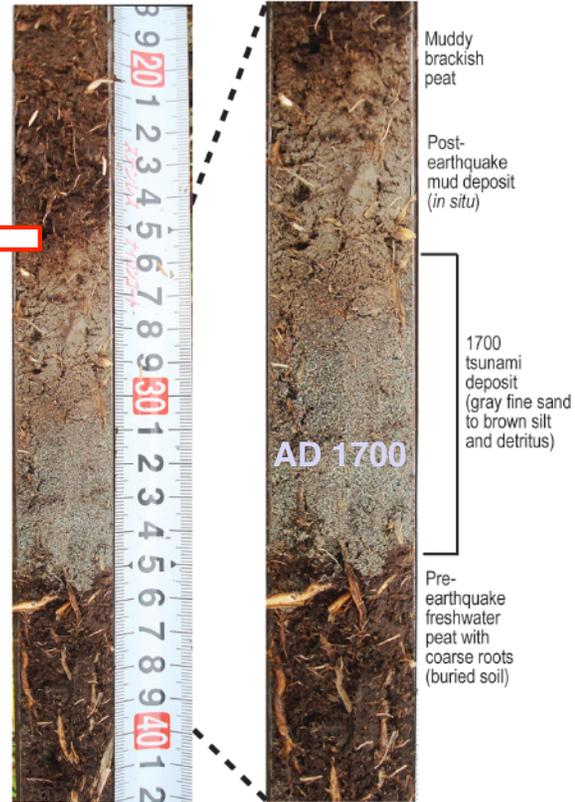


Base from USDA 2010 NAIP Imagery
UTM Zone 10N, NAD83



EXPLANATION

- Gouge cores
- 1964 tsunami deposit observed
- 1700 tsunami deposit observed
- Both 1964 and 1700 tsunami deposits observed
- No tsunami deposits observed



Tsunami deposits in freshwater peat, Crescent City (Hemphill-Haley et al., in progress)



Mapping

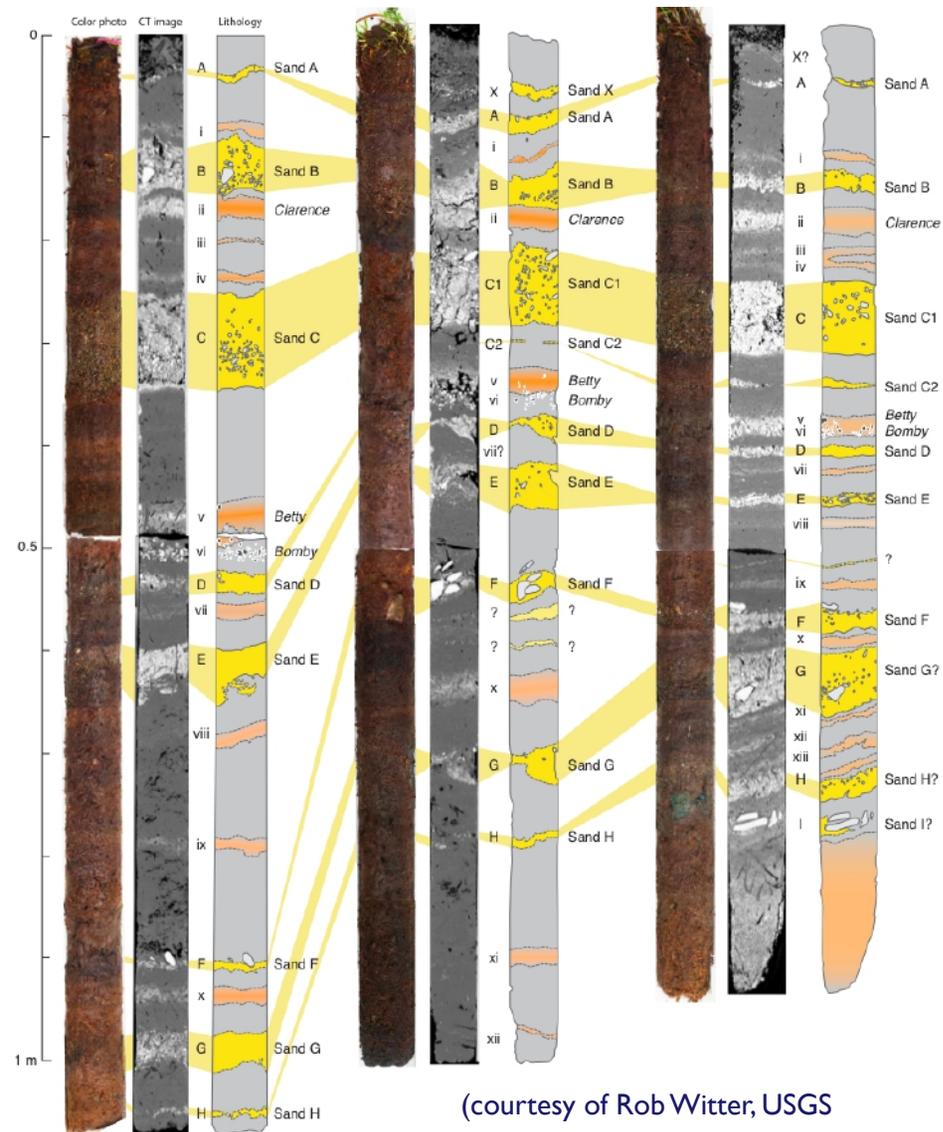
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Mapping

CT scans (gray-scale)
of tsunami deposits in
cores of freshwater
peat from Umnak
Island, Aleutians



Umnak investigators



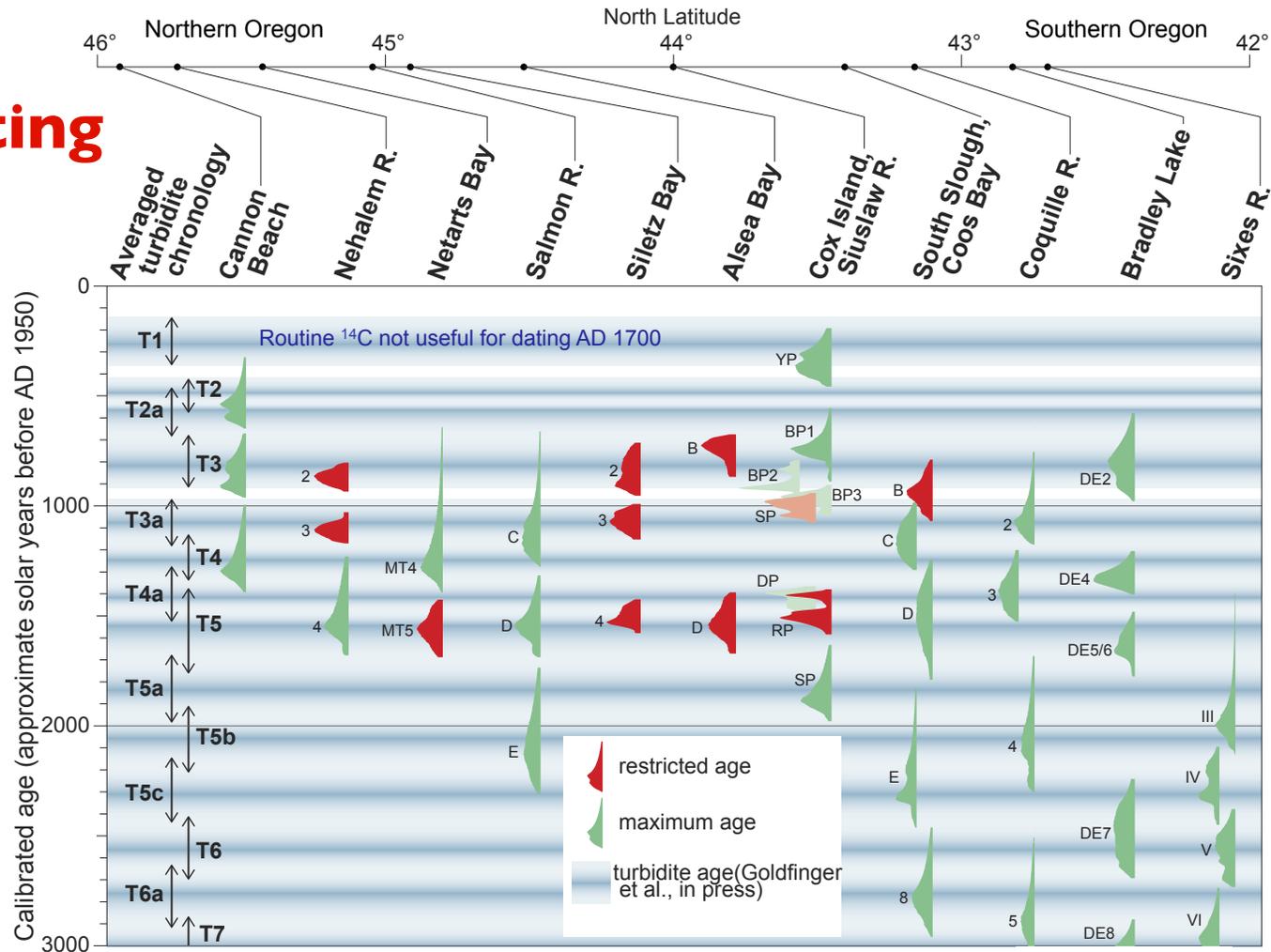
(courtesy of Rob Witter, USGS)

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Dating



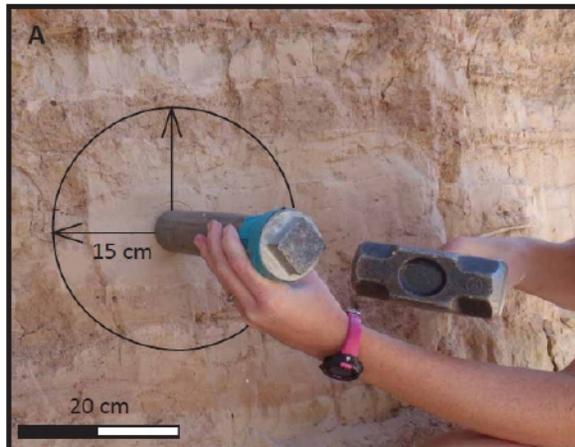
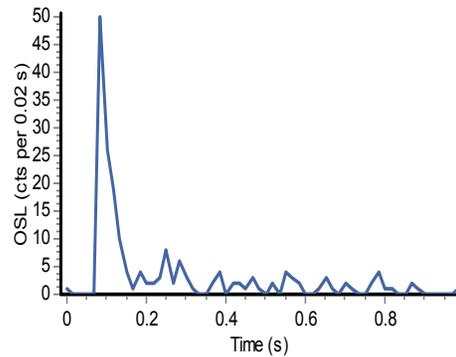
Max and min ¹⁴C ages make times of earthquakes more precise



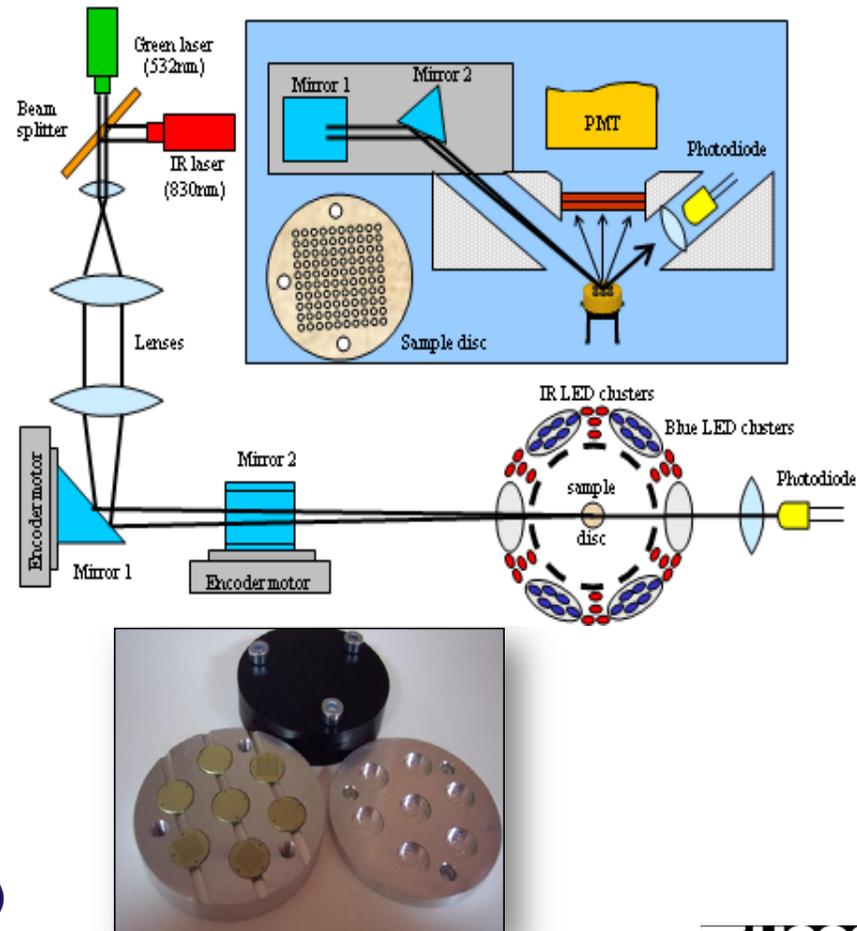
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Dating

Single-grain laser OSL dating



(courtesy Shannon Mahan, USGS)



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