Compilation and assessment of data quality for onshore and offshore paleoseismic proxies of great Cascadia megathrust rupture

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SUMMARY

The USGS Powell Center Cascadia earthquake hazards working group has spent the past several years compiling the abundant paleoseismic data gathered over the past several decades along the Cascadia subduction zone. In this poster, we present our compilation progress to date, as well as a semi-qualitative ranking scheme to assess the quality of age control and evidence for great megathrust rupture. The age ranking scheme essentially asks: **"How well is a proposed paleoseismic event dated?"** based on the materials and methods used. The evidence ranking scheme essentially asks **"How confident are we that a proposed event is, in fact, the result of a Cascadia megathrust rupture?"** based on the sedimentological characteristics, correlation, and mapping.

OUR VISION

The compilation is planned to be a one-stop-shop for paleoseismic data in Cascadia that is put together by a diverse group of experts, but designed to be useful for a wider audience. For example, explicitly detailed values of coastal subsidence or inland extent of tsunami inundation may be used by rupture modeling colleagues to address probable and possible paleoseismic rupture characteristics.

The compilation is divided into three sections:

- Land-level change
- Tsunami
- Shaking proxies (which are further divided)
  - Onshore
  - Offshore

These data compilations will be published following peer review, likely as a USGS ScienceBase Data release and companion journal article.

DATA QUALITY

Paleoseismic data has been collected over several decades, and over that time the analytical capabilities and methodologies of data collection have changed. Our Powell Center group has focused considerable time on designing a series of ranking schemes to quasi-quantitatively assess quality of age control and strength of evidence for megathrust rupture, spanning sites from Vancouver, BC to the Mendocino triple junction (Fig. 1). The details of each numerical rank are shown as flow charts (Fig. 2).

These ranking schemes have been applied to each identified possible megathrust event at each site with published information. Fig. 3 shows the ranking scheme results applied to age probabilities for subsidence, tsunami, and marine turbidite datasets. Age probabilities shown here are preliminary results from new (in progress) geochronologic modeling, but do not yet include onshore shaking proxy datasets.

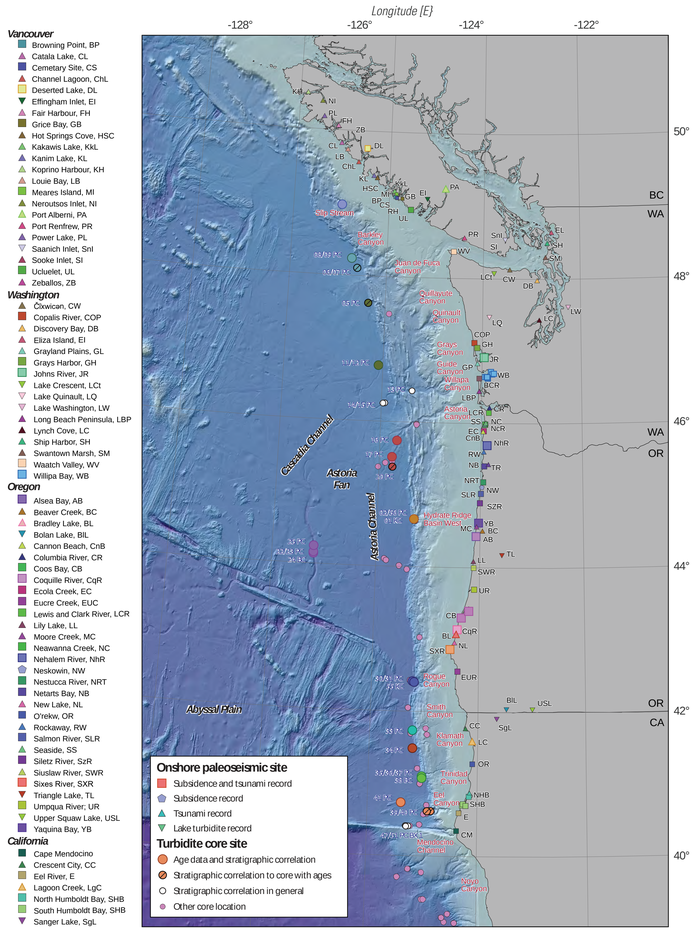

Figure 1. Onshore and offshore paleoseismic sites along the Cascadia margin. Site name acronyms are defined in the legend. Marine core identification numbers are shown beside core locations used in the interpretation of offshore coseismic turbidites by Goldfinger et al. (2012).

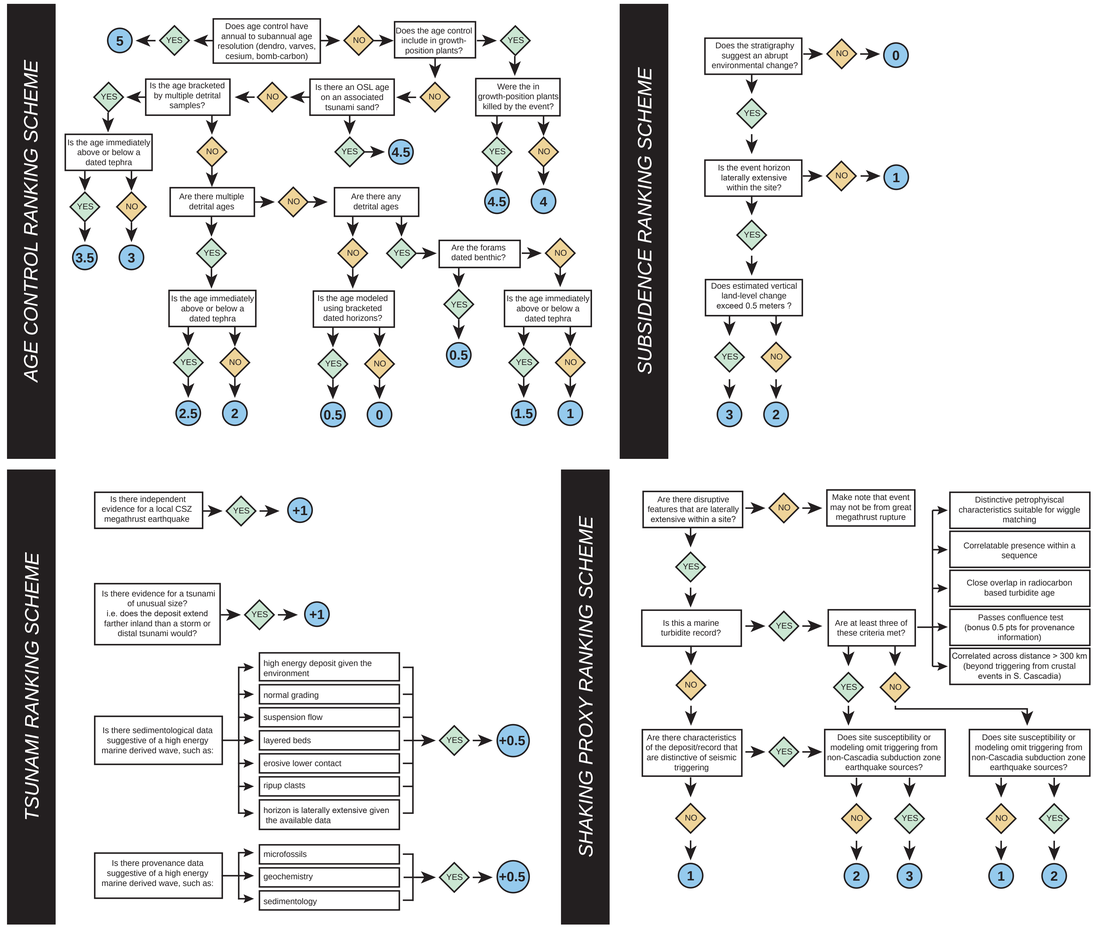

Figure 2. Flow charts graphically depict the ranking schemes designed to assess paleoseismic data quality. The age control ranks are on a scale of 0-5, with high ranks given to highly precise and accurate age control methods. The three evidence ranking schemes were developed for each category of data by a panel of experts and end-users. It is on a scale of 0-3, with high ranks given to strong evidence for local megathrust rupture.

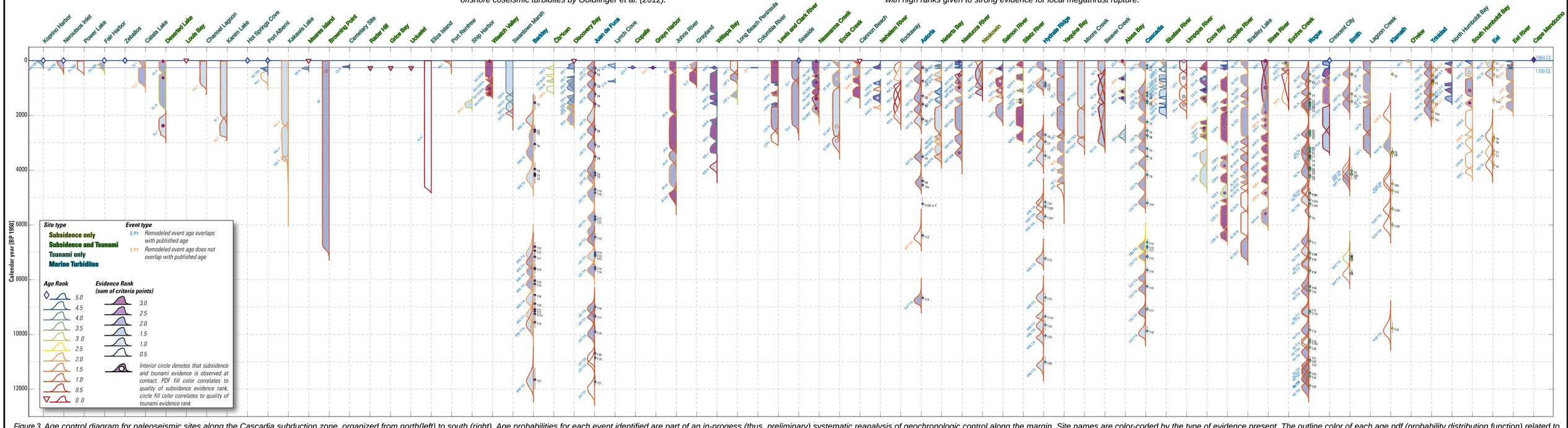

Figure 3. Age control diagram for paleoseismic sites along the Cascadia subduction zone, organized from north(left) to south (right). Age probabilities for each event identified are part of an in-progess (thus, preliminary) systematic reanalysis of geochronologic control along the margin. Site names are color-coded by the type of evidence present. The outline color of each age pdf (probability distribution function) related to the age control ranking scheme. The interior fill of each pdf relates to the quality of evidence for megathrust rupture. Since age pdfs are preliminary and may differ from published age information, the labels are color coded to show which overlap with published estimates (blue) and which do not overlap (orange). For historical evidence of megathrust rupture (i.e. 1964 Great Alaska Earthquake) diamonds denote know timing. These are included to show which sites are susceptible to distal earthquake generated tsunami inundation. Red triangles denote events with no age control, but suggestion of event timing. For marine turbidites, published ages from Goldfinger et al., 2012 are shown next to probability density functions and labeled in black.