

2009 Portland GSA Annual Meeting (18-21 October 2009)
Paper No. 202-5
Presentation Time: 2:40 PM-3:00 PM

PALEOSEISMICALLY DERIVED PROBABILITIES FOR CASCADIA GREAT EARTHQUAKES

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Turbidite systems located on the continental margin of Cascadia Basin from Vancouver Island, Canada to Cape Mendocino California contain an extensive paleoseismic turbidite record. This record passes several tests for synchronous triggering, and correlates well with the shorter onshore paleoseismic record.

The northern series of events define a Holocene great earthquake recurrence of ~ 500 years. The recurrence times and averages are also supported by the thickness of hemipelagic sediment deposited between turbidite beds. The southern Oregon and northern California margins represent at least three segments that include all of the northern ruptures, as well as ~ 20 thinner turbidites of restricted latitude range that are correlated between multiple sites. At least two Northern California sites, Trinidad and Eel Canyons, probably also record numerous small sedimentologically or storm triggered turbidites, particularly during the early Holocene when a close connection existed between these canyons and associated river systems.

The combined stratigraphic correlations, hemipelagic analysis, and 14C framework suggest that the Cascadia margin effectively has three rupture modes: 19 full or nearly full -length ruptures; 1 or 2 ruptures comprising the southern 50-70% of the margin, and 20 smaller southern margin ruptures during the Holocene. The shorter rupture extents and thinner turbidites of the southern margin correspond well with spatial extents interpreted from the onshore paleoseismic record, supporting margin segmentation of southern Cascadia. The total of 40 events define a Holocene recurrence for the southern Cascadia margin of ~240 years. Time-independent probabilities for segmented ruptures range from 7-9% in 50 years for full margin ruptures, to ~18% in 50 years for a southern segment rupture. Time dependent failure analysis indicates probabilities rise to 25% in 50 years for the northern margin, to 80% in 50 years for the southern margin. The long paleoseismic record also indicates a repeating pattern of clustered earthquakes that includes three and possibly four Holocene cycles of 5 earthquakes followed by an unusually long interval.

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General Information for this Meeting

Session No. 202
Reducing Risk from Geologic Hazards in the Dynamic Landscape of Oregon and Washington
Oregon Convention Center: E141/142

1:30 PM-5:30 PM, Tuesday, 20 October 2009

Geological Society of America Abstracts with Programs, Vol. 41, No. 7, p. 520

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