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New Patterns Emerging for Cascadia Paleearthquakes: Clues from the Turbidite Record

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Abstract

New stratigraphic evidence from the Cascadia margin demonstrates that 13 earthquakes ruptured the margin from Vancouver Island to at least the California border following the catastrophic eruption of Mount Mazama. These 13 events have occurred with an average repeat time of ~600 years since the first post-Mazama (MA) event ~ 7500 years ago, and the youngest event ~300 years ago coincides with widespread evidence of coastal subsidence and tsunami inundation in buried marshes along the Cascadia coast. We can extend the Holocene record to at least 9800 years, during which 18 events correlate along the same region. The pattern of repeat times is consistent with the pattern observed at most (but not all) localities onshore, strengthening the contention that both were produced by plate-wide earthquakes. We also observe that the sequence of Holocene events in Cascadia may contain a repeating pattern, a tantalizing look at what may be the long-term behavior of a major fault system. Looking at a recurrence period versus time plot has some strengths, the principal one being that comparing cores uses the pattern of recurrence rather than the raw ages, which have not been corrected for sedimentation rate, possible basal erosion, and tuning of the ^{14}C reservoir correction. While these corrections are important, robust patterns will probably be evident without

them. The average post-Mazama recurrence time is ~ 580 years, with the shortest interval being 215 years, the longest 1488 years. The mean recurrence time based on all available intervals is ~630 years, which is the Holocene average. This average is based on the average of three AMS ages for event T18 from our Key cores in Juan de Fuca, Rogue, and Cascadia channels. These ages are 9849 (10287-9784), 9851 (10290-9583), and 9824 (10274-9540) for Cascadia, Juan de Fuca, and Rogue Channels respectively. With a single complete, but uncorrected record, the patterns may (or may not) be robust, but there does seem to be a repeating pattern of a long interval ending in an earthquake, followed by a moderately long interval, then 1 or 2 shorter intervals. Over the last ~7500 years, the pattern appears to have repeated three times, with the most recent AD 1700 event being the third of three events following a long interval of 845 years between events T4 and T5. This long interval is one that is also recognized in many of the coastal records, and may serve as an anchor point between the offshore and onshore records.

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