Physical Property Correlations and Radiocarbon Ages Illuminate Cascadia Earthquake Recurrence Patterns

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Abstract

We have been investigating the recurrence pattern of Great Earthquakes along the Cascadia margin using the record of turbidites deposited after margin-wide shaking during great earthquakes. We have previously suggested that virtually all the turbidite record is the result of great earthquakes, based on identical numbers of events in widely separated cores, and relative dating techniques that demonstrate synchroneity of the triggering mechanism. We are now testing this correlation with radiocarbon ages and physical properties of the core sediments. We observe a systematic variation of turbidite ages as a spread of ages that is greatest in the mid-Holocene, tapering off toward both the early and late Holocene. The pattern could represent either systematic earthquake behavior, or a systematic variation of the "reservoir age" of the ocean water in which the microfossils we are dating live. We suspect the latter, as the dated events pass other correlative tests that strongly suggest synchronous triggering. We also are testing the correlation of events using physical property measurements of the cores containing the turbidite record. We find that a reasonably good stratigraphic

correlation can be made between three key core sites at Juan de Fuca, Cascadia, and Rogue Channels using Gamma density and high-resolution magnetic susceptibility records of these cores. This correlation is independent of other correlation methods including the Mazama ash datum, event number comparisons, the "confluence test" of synchronous triggering, and radiocarbon ages, but is consistent with them. That we are able to correlate physical property "wiggle" plots between turbidite channels that are not connected, implies that something of the earthquake shaking signal may be contained in these records. With strengthened correlations, and improved estimates of the reservoir correction, we infer that the pattern of Cascadia Great Earthquakes appears to include 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 ~9000 years, the pattern appears to have repeated four times, with the most recent AD 1700 event being the third of three events following a long interval 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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