Temporal Patterns of Turbidites Offshore the Northern San Andreas Fault and Correlation to Paleoseismic Events Onshore

Details

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Abstract

Two piston cores and one box core from Noyo Channel, adjacent to the northern San Andreas Fault, show a cyclic record of turbidite beds, with thirty-one turbidite beds above a Holocene/Pleistocene faunal "datum". Thus far, we have determined ages for 20 events including the uppermost 5 events from cores 49PC/TC and adjacent box core 50BC using AMS radiocarbon methods. The uppermost event returns a "modern" age, which we interpret is likely the 1906 San Andreas earthquake. The penultimate event returns an intercept age of AD 1663 (2 sigma range 1505 - 1822). The third event and fourth event are lumped together, as there is no hemipelagic sediment between them. The age of this event is AD 1524 (1445-1664), though we are not certain whether this event represents one event or two. The fifth event age is AD 1304 (1057 - 1319), and the sixth event age is AD 1049 (981-1188). These results are in relatively good agreement with the onshore work to date, which indicates an age for the penultimate event in the mid-1600's the most likely age for the third event of ${\sim}$ 1500-1600, and a fourth event ${\sim}$ 1300. We presently do not have the spatial sampling needed to test for synchroneity of events along the northern San Andreas, and thus cannot determine with confidence that the observed turbidite record is entirely earthquake generated. However, the good agreement in number of events between the onshore and offshore records suggests that, as in Cascadia,

turbidite triggers other than earthquakes appear not to have added significantly to the turbidite record along the northernmost San Andreas margin during the last ${\sim}$ 2000 years. With 20 event ages (and no reversals), we can begin to make some observations about the turbidite event history. It is apparent that both sedimentation rate and turbidite event frequency have not been constant through the Holocene. This may be due to: 1) The behavior of the fault has changed, for example more slip shifting from other parts of the plate boundary system to the main San Andreas in the late Holocene; 2) The record includes a non-earthquake climatic or sedimentation record that has changed through the Holocene. Climatic and sedimentation changes would tend to favor a reduction in sedimentation during the Holocene as sea level rose and separated canyons from their river sources, and terrestrial erosion rates fell. We observe just the opposite, with an increase in sedimentation rate that parallels the increase in turbidite frequency with time. This observation tends to support a change in fault behavior, however this issue cannot be resolved with our single site. We observe three relatively constant periods in event frequency. The youngest period, from ${\sim}$ 5000 years BP to the present has an average event recurrence interval of 216-234 years (depending on whether events 3 and 4 represent one or two events. These data are quite consistent with estimates of time intervals between recurrent northern San Andreas earthquakes at Pt. Arena and Olema. At Pt Arena, Prentice (1989) estimated a 200-400 year recurrence time, and the interval was estimated to be 221 years at Olema. We are encouraged at the close agreement with these preliminary data, and believe that this also supports our conclusion that the San Andreas is the principal, and perhaps only trigger for turbidites along this segment of the margin. The planned systematic coring in 2002 may be able to resolve the origins and event patterns through spatial and temporal correlations as it has in Cascadia.

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