Investigating the Turbidite Paleoseismologic Record of Holocene Great Earthquakes on the Cascadia Margin

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Turbidite paleoseismology has the potential to address long-term recurrence history of great earthquakes directly using precise dating techniques. We are investigating the turbidite event record along the length of the Cascadia margin in an effort to understand the spatial and temporal earthquake signal represented by repeated turbidite deposition in channels systems draining the Cascadia margin. Adams (1990) established a recurrence interval of about 590+/- 170 years for late Holocene turbidite events in selected basin-floor channels of the Washington and Oregon segments of the Juan de Fuca plate. These events are probably triggered by earthquakes rather than other possible mechanisms. In order to understand and utilize the turbidite record we must first understand the distributary channel systems that deliver the turbidites, then fill in the record with additional core data and precise dating. To address the first issue, we are mapping channel systems in Cascadia basin in investigating their late Quaternary history, primarily to determine of channel pathways have been open during the Holocene, or blocked, captured, or otherwise diverted thus biasing the turbidite record. Astoria Channel, one of the two main distributary systems, was been buried by slumping at about 12 Ka, at 44° N. Prior to that, the channel has been buried between 42°N and 44°N at least three times in the late Quaternary. Off northern California, numerous turbidity current events in channels active in the Holocene suggest an order of magnitude increase in paleoseismic activity relative to the Oregon-Washington margin. Analysis of new SeaBeam bathymetry and backscatter data show that Trinidad and Eel channels traverse annular bedform fields at their respective canyon mouths before emerging on the abyssal plain, possibly complicating the turbidite record.

To address the second issue, we will collect new large-diameter cores in Cascadia channel systems during an upcoming cruise. Using AMS ages, we will attempt to extend the turbidite record in space and time to establish a margin-wide Holocene event stratigraphy. If the same sequence and timing of events can be correlated in all major turbidite channel pathways, a one-to-one correspondence can be established between turbidites and great megathrust earthquakes involving much or all of the subduction zone. Alternatively, a lack of correlation may demonstrate segmentation of the margin.