Climatic and Tectonic Signals in Turbidite Systems off Western North America

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Abstract

Turbidite systems (deep-sea channels, submarine fans, base-of-slope aprons) in the northern Cascadia Basin contain a synchronous Holocene (past 10,000 cal. yr. BP.) record of ~18 turbidites. These turbidites were triggered with an average frequency of 550 yr by great earthquakes (8-9 Mw) on the Cascadia Subduction Zone. Greater magnitude of events is shown by thicker turbidites. Similarly, along the northern California continental margin, Holocene turbidites have been triggered every 200 yr on average by great earthquakes (ca. 8 Mw) associated with the San Andreas Fault. The paleoseismic turbidite record on both margins proves the dominant tectonic control for triggering turbidity currents on these active margins. In contrast, the control of turbidite system growth by climatic change and lower sea level during the late Pleistocene is shown in Cascadia Basin by 1) the order of magnitude greater average sedimentation rates (100 plus cm/ka Pleistocene, 2) bypassing of sediment to outer fan unconfined depocenters, 3) high sand:shale ratios (1:1 to 3:1 Pleistocene), and thick sand turbidites (ca. 10-40 cm Pleistocene). After a rapid deglaciation and sea level rise from ca.13-14,000 yr B.P., turbidites became finer-grained silt and mud beds that were mainly confined to channels, whereas other Cascadia Basin interchannel areas were covered by a hemipelagic sediment drape

with a basal age of 12,750 cal yr BP.

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