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Structural vergence variation and clockwise block rotation in the Cascadia accretionary wedge, offshore central Oregon

Details

Meeting	2004 Fall Meeting
Section	Tectonophysics
Session	Rapid, Along-Strike Kinematic, Tectonic, and Thermochronologic Variations Within Obliquely Convergent Circum-Pacific Plate Boundary Zones Posters
Identifier	T41C-1235
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Abstract

Along the Cascadia margin offshore Oregon, the structural vergence at the toe of the accretionary wedge varies from landward vergent offshore northern Oregon to seaward vergent across the southern Oregon margin. A transition zone between these vergence domains occurs along the central Oregon portion of the wedge, centered on the Hydrate Ridge region. We examine the past variability in structural vergence across the Hydrate Ridge region through detailed structural mapping using multichannel seismic reflection data and gridded bathymetry. These data are coupled to biostratigraphic age constraints obtained from ODP drilling to constrain the timing of accretionary wedge growth since the early Pleistocene (<1.7 Ma). Our results indicate that the wedge in the Hydrate Ridge region was accreted in three structural phases: an early Pleistocene seaward vergent phase (~1.7-1.2 Ma), an early to middle Pleistocene (~1.2-0.3 Ma) landward vergent phase, and a late Pleistocene-Holocene (~0.3-0.25 Ma to present) seaward vergent phase. Age constraints on the timing of landward vergent deformation suggest coincidence with the timing of the deposition of the Astoria fan. High pore fluid pressures due to rapid fan deposition have been suggested as the likely cause of landward vergence for the northern Oregon and Washington margins. The large bathymetric expression of northern Hydrate Ridge is likely due to its history of continued seaward vergence, which permitted some sediment subduction, likely underplating and observed thrust duplexing, all resulting in an increase in the thickness of the accretionary wedge (more uplift) beneath this region. Superimposed on the accretionary wedge growth in the Hydrate Ridge region, two basement involved transverse strike-slip faults have affected the wedge development. Evidence of clockwise block rotation of the Hydrate Ridge tectonic block between the two transverse strike-slip faults appears most pronounced in the older portion of the wedge, and decreases toward the west. Constraints on the timing of propagation of the basement strike-slip faults into the abyssal plain section near the deformation front indicate that the early-middle Pleistocene landward vergent phase (~1.2-0.3 Ma) may have been terminated by this faulting. We speculate that the propagation of the strike-slip faults into the upper plate may have reduced pore fluid pressures and increased coupling along the decollement, triggering the change from landward to seaward vergence at the deformation front.

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