Landward vergent thrust faults in marine accretionary prisms off Cascadia, Sumatra, and Southern Chile: Where do they occur and what may control them?

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Abstract

Over the last decades seismic investigations have identified a number of places where landward vergent thrust faults occur in active accretionary prisms. These unusual deformation structures, that differ from the common fold-and-thrust belt model in the dip direction of the thrust sheets, have been found at the Cascadia,

Sumatra and Southern Chile margins. Parameters that have been suggested to control their formation include strength, position and dip of the décollement, pore-fluid pressure, heat-flow, formation and dip direction of a backstop, strength of the wedge, and subduction of topographic features. However, the ultimate causes for their development are not adequately understood. To test the impact of the above mentioned parameters and to further shed light on the question of what drives these fault structures we investigate reflection seismic and bathymetric data from Cascadia, Sumatra, and Southern Chile. We map the detailed spatial distribution of landward vergence and investigate along and across-strike variations in fault structure, spacing, and fault initiation and development along the three margins. We further compile a synthesis of input parameters (e.g. pre-subduction deformation of the oceanic plate, convergence rate and direction, subducting plate dip, sediment thickness and composition, position of the décollement, oceanic plate roughness) for all regions that host landward vergent faults. This provides the base to identify key parameters that control the development of such fault structures on a local and potentially global scale.

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