# Deep Structure of the Northern Cascadia Subduction Zone From Reflection, Tomography and Seismicity Studies

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To study the structure of southwestern British Columbia and northwestern Washington State, a multidisciplinary seismic survey named SHIPS (Seismic Hazards Investigation in Puget Sound) was carried out in 1998. The main objective was to map active crustal faults in the high seismicity region of Strait of Juan de Fuca, Georgia Strait and Puget Sound, and to gather information about other earthquake controlling structures such as are the position and nature of the subducted Juan de Fuca oceanic plate. We carried out a comparative analysis of the reflection, tomography and seismicity results for the Strait of Juan de Fuca region. Shallow forearc sedimentary basins of glacial and tectonic origin are well outlined on reflection sections. Leech River Fault and southern Whidbey Island Fault are imaged directly. Devils Mountain Fault is indirectly imaged on several profiles by an offset in the basement structure. At greater depth, a thick group of gently landward dipping events is present in the reflection images: The "E" reflection zone previously detected on Lithoprobe data. We believe that this reflection band, earlier interpreted as a shear zone, is situated just above the subducted slab. We use it to map the topography of the subducted oceanic crust. Because oceanic Moho is visible on reflection profiles only within the western edge of the survey area, we also use tomography and seismicity results to delineate it. The reflection, tomography and seismicity results are in good agreement and confirm the existence of an upward bulge in the subducting oceanic crust beneath northwestern Washington. By integrating our results with previous reflection profiles across the accreted wedge and Vancouver Island, we study the structure of the subducted Juan de Fuca oceanic slab and the nature of its contact with the overriding North America plate, from the deformation front to the forearc Moho.