Crustal Thickness and Vp/Vs Ratios in Western Canada through H-k Stacking of P-wave Receiver Functions

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Investigating the source of intracratonic uplift is crucial in understanding the deformation mechanism between subducting oceanic crust and thick continental crust. This significance is demonstrated by the Canadian Rockies, which extend across 1600 km of British Columbia on the eastern edge of the Canadian Cordillera, serving as an example for studying the origins of elevated terrain. Seismic tomography offers an effective method for developing high-resolution images of crustal structure through estimates of crustal thickness and seismic speed ratio. This study utilizes the two-layer H-k stacking technique on p-wave receiver functions calculated from 248 seismic stations in Western Canada. Selected waveforms, with magnitudes greater than 5.5 and epicentral distances between 30 to 130 degrees, were windowed 5 seconds before and 50 seconds after the P-wave arrival time. Following bandpass filtering (0.5-1.5 Hz), high and low-frequency receiver functions were calculated using an interactive deconvolution method, with Gaussian parameters of 5.0 and 2.5, respectively. The amplitudes of selected P-wave converted phases were then stacked to produce 96 estimates for crustal thickness and Vp/Vs ratios at each station. The resulting maps demonstrate a variable and inconsistent crustal thickness map with an average Moho depth of 31.45km. The relationship between Moho depth and elevation is moderate with a correlation coefficient of 0.243 although significantly improved compared to the continental US correlation at 0.041. Given the lack of substantial correlation, it is reasonable to infer that elevation, while strongly impacted by crustal thickness, is connected to a range of variables, including crustal density, mantle density, and geothermal structure. It is worth noting that this interpretation is constrained by the lack of dense seismic stations in the study region. This study enhances comprehension of the crustal structure beneath Western Canada, serving as a foundation for deeper insights into the subsurface geodynamics in the region.

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