Large and fragmented lithospheric velocity variations in the Northern Canadian Cordillera imaged by ambient noise tomography.

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Global scale seismic velocity models of the Northern Canadian Cordillera tend to show high velocities to the east of the Cordilleran deformation front and low velocities to the west. This contrast in velocities is consistent with other geophysical observables that suggest a weak and thin lithosphere to the west that transitions quickly to a strong thick craton-like lithosphere at the deformation front. We present new results focused around data collected by the Mackenzie Mountains Earthscope Project, which included a line of broadband seismographs across the Cordillera and into the craton extending from roughly Skagway, Alaska to Great Bear Lake in the Northwest Territories. The overlap of this deployment with other arrays in the region, most notably the Earthscope Transportable Array and the Yukon Northwest Seismic Network, has allowed for detailed ambient noise imaging of the upper lithosphere. Initial results show large velocity variations west of the Cordilleran deformation front. If the lithosphere here is thermally homogenous, then the velocity variations suggest a compositionally variable lower crust fragmented by significant dextral slip between ~150 – 37 Ma. Alternatively, or in addition, changes in lithospheric temperatures may be indicated. In either case, these variations suggest that the mechanical strength of the Cordilleran lithosphere is heterogeneous, influences the Cordilleran geometry, particularly in the unusually eastward location of the Mackenzie Mountains, and that 2-D models of past and present deformation can be refined to reflect strain localization due to lateral strength variations.