

## Large Lithospheric Velocity Variations Across the Northern Canadian Cordillera Imaged by Ambient Noise Tomography

Global-scale seismic velocity models of the Northern Canadian Cordillera show high velocities to the east of the Cordilleran deformation front and low velocities to the west. This velocity contrast is consistent with other geophysical observables, such as regional seismological studies, that suggest a weak and thin lithosphere to the west that transitions quickly to a strong and thick craton-like lithosphere at the deformation front. We present new results using data collected by the Mackenzie Mountains EarthScope Project, which included an ~875 km-long line of 40 broadband seismographs across the Cordillera and into the craton that extended 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 Seismograph Network, has allowed for detailed ambient noise imaging of the upper lithosphere across the region. Initial results show large velocity variations and low velocity structure west of the deformation front. If the lithosphere is thermally homogenous, then the velocity variations suggest a compositionally variable lower crust that was fragmented and mechanically weakened by dextral transpression (subsequently on the Teslin-Thibert, Tintina, and Denali faults) between ~150 – 37 Ma. Alternatively, or in addition, changes in lithospheric temperatures and or hydration may be indicated as additional weakening mechanisms. In either case, these variations suggest that the lithosphere-scale mechanical strength of the Cordilleran crust is highly heterogeneous and strongly influences Cordilleran deformational geometry, particularly in the unusually eastward location of the Mackenzie Mountains, and that models of past and present deformation can be refined to reflect strain localization due to lateral strength variations. Furthermore, a westward dipping feature of distinctly low velocities exists from the crust to asthenospheric depths beneath the Mackenzie Mountains and may play a role in current dynamics and uplift.

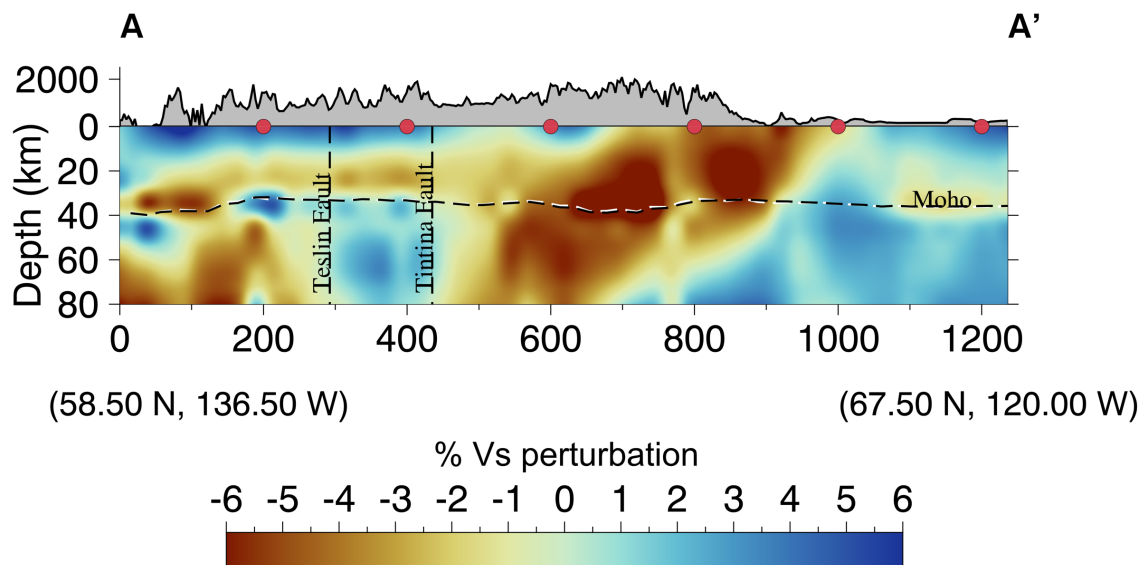


Figure 1: A plume-like structure of low velocities rises below the Mackenzie Mountains.