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Coda Q Determination Across Western Canada: From a Region of Active Subduction, through a Volcanic Belt, to the Stable Craton

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In this study we determine the variation in coda-wave attenuation (QC) across western Canada, covering a wide range of tectonic settings – from a seismically active subduction zone in the west, through a volcanic belt, to the stable craton of North America – a region of slow lithospheric deformation in the east. Our dataset is made up of more than 1000 earthquakes recorded at 85 Canadian seismic stations across the region. We employ the single back scattering approximation, and consider only high signal-to-noise ratio (SNR) traces (SNR$\geq$5.0) with a range of ellipse parameter (a2) from 30 to 110. Coda windows were selected to start at tc = 2tS (two times the travel time of the direct S wave), and were filtered at center frequencies of 2, 4, 8, 12 and 16 Hz. We find a very clear attenuation pattern across the study area. The lowest Q0 values (e.g., Q0 of 39) are in the vicinity of Nazko Cone in the Anahim volcanic Belt (AVB), the highest Q0 values (e.g., Q0 of 151) are on the stable craton, and intermediate values of Q0 are determined across the Cascadia subduction zone. Our results showing low Q0 throughout the AVB (and the lowest Q0 at Nazko Cone) provides additional support for an interpretation of magma injection into the lower crust during the 2007 Nazko earthquake swarm, fracturing of the crust, and resulting high seismic attenuation. Within the subduction zone, Q0 is lowest closest to the active faults off the coast and in the vicinity of the only known large crustal earthquakes (1918, M$\sim$7 and 1946, M$\sim$7.3) on Vancouver Island, and Q0 increases moving inland. The highest Q0 values we determine are in the regions of slow lithospheric deformation. Our results show a clear link between coda Q, tectonic setting, and seismicity rates.