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Along arc variations in the magma source beneath the Garibaldi Volcanic Belt.

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The Garibaldi Volcanic Belt extends northwards from the Cascades Volcanic Arc, between northern Washington and British Columbia in western Canada. This Quaternary-aged glaciovolcanic belt is formed by the subduction of the young (<11 Ma) Juan de Fuca plate beneath the North American plate. The only arc-parallel geochemical variation recognized in the literature is situated at the north end of the arc and is ascribed to the presence of a slab window.

Here we present major, volatile and trace element data for olivine-hosted melt inclusions from volcanic rocks sampled along the Canadian arc segment. This dataset reveals a systematic and continuous northward decrease in subducting slab influence (decreasing LILE, Zr/Nb=80 at Glacier Peak, WA and Zr/Nb= 16 at the Mount Meager Volcanic Complex, BC). The slab-influenced geochemical characteristics abruptly terminate at the edge of the slab and against the slab window where the magma source is dominantly OIB (Zr/Nb=5-9). Importantly, this trend also coincides with the age of the subducting slab as it youngs along-arc from 10 Ma to 5 Ma, suggesting that the degree of slab fluid exsolution is a function of age. Our work shows that magma bodies beneath the Garibaldi Volcanic Belt are unique, independent of each other and have compositions that are distinctly controlled by the subducting slab. As a result, the eruptive compositions are dominantly felsic and evolved in the southern segment and become progressively more mafic and primitive towards the northern end of arc. This is an important parameter when considering future hazard assessments since the eruptive compositions imply specific risks to nearby populations.