Adakitic Volcanism during the Early Eocene in Souther BC: Isotopic and Geochemical Constraints from the Princeton Group

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The Princeton Group is an assemblage of terrestrial volcanic and clastic sedimentary rocks in south-central British Columbia, and is part of the Challis-Kamloops belt that stretches from central British Columbia to the northwestern United States. The volcanic rocks were largely deposited as cinder cones and composite volcanoes, and are composed of basaltic andesite (olivine + clinopyroxene), andesite and dacite (hornblende + plagioclase + clinopyroxene), and rhyolite (biotite + quartz + K-feldspar), with calc-alkaline affinity. New $^{40}$Ar/$^{39}$Ar dates indicate that magmatism took place during the Early to Middle Eocene, from 53-47 Ma. New $^{143}$Nd/$^{144}$Nd measurements, in conjunction with previously published data, indicate that the Princeton Group represents primarily juvenile additions to the continental crust with $\varepsilon$Nd$_{50}$ = 1.2-6.4.

Major and trace element abundances of Princeton Group rocks resemble those of many modern continental arcs. The compositions are notable, however, because they have an “adakitic” signature that extends throughout their entire compositional range, including high-Mg# basaltic andesite. Trace element modelling indicates that the signature is not derived from anatexis of normal oceanic crust, but from an already enriched “arc-like” source. This source may have been basaltic dykes that were emplaced into the lithospheric mantle during Mesozoic arc magmatism and subsequently partially melted during an event of lithospheric heating in the Eocene. The heating may have been caused by upwelling asthenosphere related to a slab window or slab tear.