

Isotopic evidence of a near surface history for the source rocks of the central Coast Plutonic Complex, British Columbia, Canada

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Radiogenic isotopic data from intrusive suites have recently been the key to interpretations that many of the Cordilleran batholiths are the direct products of partial melting of mantle derived diorites that ponded within the lower crust. However, results from a regional study of the Coast Plutonic Complex of British Columbia, Canada, part of the BATHOLITHS Continental Dynamics project, conflict with this interpretation and indicate that a substantial portion of the source rocks resided at near surface levels at some time prior to burial and partial melting.

Radiogenic isotopic data, including Sr, and Pb, completed on more than 60 plutonic samples ranging in age from 322 Ma to 9 Ma indicate that the source regions for these melts were indeed very primitive. Initial Strontium 87/86 ratios range from 0.7032 up to 0.7062 with a mean of 0.7042. Similarly, lead isotopic data range from 19.675 to 19.520 for $^{206}\text{Pb}/^{204}\text{Pb}$, 15.550 to 15.662 for $^{207}\text{Pb}/^{204}\text{Pb}$, and 38.155 to 39.589 for $^{208}\text{Pb}/^{204}\text{Pb}$. In contrast to these relatively primitive isotopic data, oxygen data indicate a somewhat more evolved component to or characteristic of the deep crustal source regions for these melts. Delta ^{18}O values for quartz separates determined for more than 30 of the samples range from 7.1 ‰ up to 9.8 ‰. Such high oxygen values clearly preclude the possibility that these melts were generated from mantle derived diorites just as the Sr and Pb data preclude significant contamination from an evolved crustal source.

We argue that these data indicate that the rocks that formed the source region for these melts were originally derived from the mantle but experienced a period of near surface residence after initial crystallization and before they were again melted to form the igneous bodies of the Coast Plutonic Complex. During this interval these highly primitive rocks would have interacted with meteoric waters at low temperatures in order to change their oxygen isotopic composition away from their mantle signatures. Such a process of depression and remelting of once epizonal rocks is also consistent with the common Pb data which tend to plot within the Mature Primitive Arc field of Zartman and Doe (1981).