Isotopic Evidence of a Near Surface History for the Source Rocks of the Central Coast Mountains Batholith, British Columbia

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ABSTRACT

Strontium and lead isotopic data, completed on 57 plutonic samples from the Coast Mountains Batholith ranging in age from 322 Ma to ~50 Ma indicate that the source regions for these rocks were relatively uniform and typical for island arcs around the Pacific. Initial whole-rock $^{87}Sr/^{86}Sr$ range from 0.7032 up to 0.7062, whereas lead isotopic data range from 19.078 to 18.028 for $^{206}Pb/^{204}Pb$, 15.634 to 15.542 for $^{207}Pb/^{204}Pb$, and 38.985 to 37.115 for $^{208}Pb/^{204}Pb$. In contrast to these relatively primitive isotopic data, $\delta^{18}O$ values for quartz separates determined for 26 of the samples range from 6.2 ‰ up to 10.4 ‰. These $\delta^{18}O$ values preclude the possibility that these melts were exclusively generated from the Mesozoic mantle wedge of this continental arc, just as the Sr and Pb data preclude significant involvement of an old (Precambrian) crustal/mantle lithospheric source. We interpret the high $\delta^{18}O$ component to represent materials that had a multi- stage crustal evolution. They were originally mafic rocks derived from a circum-Pacific juvenile mantle wedge that experienced a period of near surface residence after initial crystallization. During this interval these primitive rocks have interacted with meteoric waters at low temperatures, as indicated by the high $\delta^{18}O$ values. Subsequently, these materials were buried to lower crustal depths where they re-melted to form the high $\delta^{18}O$ component of the Coast Mountains Batholith. This component makes up at least 45% (mass) of the Jurassic-Cretaceous batholith in the studied area. The remainder of the source materials making up the Coast Mountains Batholith had to be new additions from the mantle wedge. A soft arc-continent collision is inferred to have been responsible for underthrusting the high $\delta^{18}O$ into the lower crust. We suggest that rocks of the Insular Superterrane (e.g. Alexander-Wrangellia) are of ideal composition, and were accreted to and overthrust by what would become the Coast Mountains Batholith just prior to initiation of magmatism in that region.

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