Cordilleran granitoids and restite entrainment: A thermodynamic modelling

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The recent paradigm of formation of Cordilleran batholiths imply ascension of diapirs of melted sediments and basaltic crust, their relamination to the continental crust and segregation of melts/magmas from the relaminated body into the crust [1]. In this scenario, new diapirs may heat and melt previously relaminated ones and the segregated magmas may entrain variable amounts of a peritectic-rich restite [2], contributing, together with fractional crystallization, to the compositional variability of the batholiths.

Thermodynamic calculations on the partial melting of several source rocks at 1.0 GPa have been made with the software Perple_X [3] to evaluate this possibility. The starting compositions ranged from basaltic andesite to andesite, high-Mg andesite and dacite, to cover a wide range of sediment-basalt proportions in the diapirs. The modelled melting process included the pulsed segregation of melt every time melt amount reached 7 wt.%. The modeled magmas contained variable proportions of melt and minerals (from 100:0 to 60:40, respectively) and of peritectic and reactant minerals (from 100:0 to 0:100) at the temperatures of segregation. The trends of several elements and element ratios of the modelled magmas formed by increasing entrained mineral amounts, versus maficity (FeO+MgO), were compared to those of Cordilleran granitoids to determine the source composition and peritectic:reactant proportions that produce the best match.

The results indicate that the magmas with ~80% peritectic minerals in the entrained mineral assemblage, generated at T < 875 ºC from the andesite and basaltic andesite source compositions have the best fit with the trends of the granites except for K_2O and Al_2O_3. Magmas from the dacite source have slightly positive A/CNK trends and magmas from high-Mg andesites have a too high Mg#.

The results of this work support the hypothesis that restite entrainment may contribute to the compositional variability of the Cordilleran granitoids, but more rigorous calculations

[1] Castro (2014) *Geosci. Front.* **5**, 63-75. [2] Clemens *et al.* (2011) *Lithos* **126**, 174-181. [3] Connolly (2009) *G-cubed* **10**, Q10014.