New tools for an old problem - Constraints on contact metamorphism in Halifax from RSCM thermometry and thermal models

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Intrusion of the South Mountain Batholith produced a low-pressure contact metamorphic aureole in its host rocks of the Meguma Supergroup. The effects of contact metamorphism are particularly well developed in pelitic rocks of the Cunard and Bluestone formations of the Halifax Group. Contact metamorphic isograds have recently been mapped across the Halifax Peninsula and vicinity, with P-T conditions at the contact estimated at ca. 650 °C and 2.5–3.0 kbar. However, quantitative assessment of prograde metamorphism and the overall thermal structure of the contact aureole have been hampered by uncertainties in key thermodynamic parameters and extensive retrogression of low-grade assemblages. In this study, Raman spectroscopy of carbonaceous material (RSCM) was used to obtain temperatures from graphite, which is common throughout the contact aureole. Temperature estimates range from ca. 360 °C just outside the cordierite-in isograd to ca. 640 °C in the sillimanite-K-feldspar zone near the contact, the latter consistent with the temperature estimated from the corresponding mineral assemblage. A thermal profile constructed from the RSCM data was used to constrain a 2D numerical model for heat transport associated with post-intrusion conductive cooling of the batholith along its eastern margin. For the parameters used, the model predicts that peak temperatures in country rocks within 1 km of the contact were reached within 50 ka of intrusion. Comparison of RSCM vs model thermal profiles also places constraints on the subsurface geometry of the contact in the study area. Based on this work, we infer that the area around Williams Lake is underlain by granite at shallow depth, with the contact steepening beneath the Northwest Arm; the pluton apparently does not extend beneath the Halifax Peninsula.

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